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DE-RISK Project

D3.1: PESTLE Analysis and Benchmarking of LFMS Implementations with Stakeholder Mapping

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DE-RISK

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DE-RISK

ABBREVIATIONS and ACRONYMS

Abbreviation	Full text
CfD	Contracts for Difference
DER	Distributed Energy Sources
DR	Demand Response
DNO	Distribution Network Operator
DSO	Energy Communities
EC	Energy Performance Certificate
EPC	Hydrocarbons
HYD	Hydrocarbons
ICT	Information and Communication Technologies
IoT	Internet of Things
LC	Local Communities
LFM	Local Flexibility Market
LFMs	Local Flexibility Markets
P2P	Peer-to-Peer
RED	EU Renewable Energy Directive
RES	Renewable Energy Sources
ROI	Return on Investment
TSO	Transmission System Operator
VPPs	Virtual Power Plants

Contents

List of Tables

List of Figures

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EXECUTIVE SUMMARY

The current report PESTLE Analysis and Benchmarking of LFMS Implementations with Stakeholder Mapping is prepared under the DE-RISK project, within the framework of WP3: Regulatory, Policy, Financial state-of-the-art analysis which builds upon the work already undertaken by the consortium in identifying, analysing, and extracting lessons and guidelines from several promising LFMs (e.g., R2M in Italy, QUE in Greece, MIW in Spain) and worldwide (via desktop research). Benchmarks and lessons learnt are combined with a PESTLE analysis, which identifies and discusses the Political, Economic, Social, Technological, Legal and Environmental conditions that act as drivers for barriers to the opportunities required to run, replicate and upscale the LFMs and make them sustainable.

WG is the organisation in charge of this Deliverable. All comments and feedback should be addressed to WG as the Project Coordinator, to the following contacts: melike.gulluoglu@weglobal.org and kadir.ulger@weglobal.org.

1. INTRODUCTION

Local Flexibility Markets (LFMs) provide the opportunity to consumers to play a significant role in the operation of the electric grid by reducing or shifting their electricity usage in response to time-based rates or other forms of financial incentives. Demand Response (DR) programmes are currently being used by some electric system planners and operators, using mainly the flexibility provided by large industrial facilities connected to the high-voltage grid, as resource options for balancing supply and demand. The new challenge is to unlock the very high potential of the LFMs in the distribution grid where the main sources of flexibility are residential and tertiary buildings, representing 70% of the total DR potential. DE-RISK overcomes these challenges by de-risking the adoption of LFMs to unlock the full DR potential and therefore supporting the market uptake of renewable energy systems. DE-RISK aims at: Boosting the end-users active participation in the LFMs by deeply understanding their needs and requirements through an innovative behavioural analysis methodology; Deploying a low cost DE-RISK digital-twin automated platform to assess, validate and unlock the flexibility potential in 4 highly replicable case studies from different regions of EU as per geographical, climatic and regulatory conditions; Bridging the regulatory gap and road mapping the LFMs in different regulatory and policy frameworks and market maturity conditions; and Developing and validating innovative sustainable business models and financing mechanisms (crowdfunding/lending, EPC, P2P) to de-risk the upfront investment to ensure a long-term viability and sustainability of the local flexibility markets.

The Project is coordinated by WEglobal Danışmanlık Anonim Şirketi (WG, Türkiye). The project's beneficiaries are: Que Technologies Kefalaiouchiki Etaireia (QUE, Greece), Troya Genç Çevre Derneği (TRO, Türkiye), Uludağ Elektrik Dağıtım Anonim Şirketi (UE, Türkiye), National University of Ireland

Galway (NUI, Ireland), Universidade Nova De Lisboa (UNL, Portugal), My Energia Oner SL (MIW, Spain), R2M Solution Spain SL (R2M, Spain), Sofia Energy Agency Association (SOFENA, Bulgaria), Ecrowd Invest Plataforma De Financiacion Participativa SL (EC, Spain) and Gridpocket SAS (GP, France).

WG, as the Leader of Task 3.1 is in charge of delivering D3.1 – PESTLE Analysis & Benchmarking of LFMs Implementations with Stakeholder Mapping, which is the object of this document in close collaboration with the WP Leader, SOFENA.

Based on the conceptual framework and typology of local flexibility markets (LFMs), this task focuses on a PESTLE analysis (Zornow et al., 14 February 2023) at the EU level as well as the wider European level, including benchmarking markets. The authors debate the political, economic, social, technological, legal, and environmental conditions impacting the implementation of local flexibility markets for electricity.

As part of the DE-RISK project, the objective of this document is to give an overview of how the local flexibility market projects have developed in the partner countries of DE-RISK, highlighting country specific characteristics. Lessons learnt and benchmarks are supported by PESTLE analysis to pave the way for market uptake of renewable energy systems on a larger scale.

This Report covers:

- In-depth PESTLE analyses of 10 Core Countries' (Italy, Greece, Spain, Türkiye, Bulgaria, Romania, France, Portugal, Ireland, and the Netherlands).
- In-depth PESTLE analyses of 3 Additional Benchmarking Countries' (the United Kingdom, Norway, and Switzerland).
- Evaluation of 10 Core Countries' PESTLE overall performance (Italy, Greece, Spain, Türkiye, Bulgaria, Romania, France, Portugal, Ireland, The Netherlands).
- Evaluation of 3 Additional Benchmarking Countries' PESTLE overall performance (The United Kingdom, Norway, Switzerland)
- A general PESTLE and Factor Assessment for the core countries and benchmarking countries.
- Benchmarking of Good Practices with a focus on customer engagement, interoperability, data management, regulatory environment, and the analysis.
- Analyses of the results and action-oriented recommendations.

DE-RISK the adoption of Local Flexibility Markets to unlock the safe and reliable mass deployment of Renewable Energy Systems is a joint project of a consortium of 11 partners: WeGlobal Danışmanlık A.Ş., QUE Technologies, Troya, UEDAS, NUIG, Universidade Nova De Lisboa, MIWenergia, MIWenergia, R2M Solution Spain Sl, Sofia Energy Agency, Ecrowd, Gridpocket from Türkiye, Greece, Ireland, Portugal, Spain, Bulgaria, and France.

The DE-RISK Project Consortium began works on the project following identifying the main challenges that brought the need of debating the safe and reliable mass deployment of European energy systems within local flexibility markets:

I. EU energy policy set a binding target for Renewable Energy Sources (RES) of 32% to be achieved by the Member States by 2030.
II. An amendment under revised EU Fit for 55 Package aims at rising the target to 40%.
III. According to E.DSO (European Distribution system Operators)'s CoordiNet Project study results, 40% of RES deployment will be covered by wind, and 20% by solar capacities.
IV. Wind and solar sources are the Variable Renewable Energy (VRE) sources and are not dispatchable due to their fluctuating nature.
V. Up to 60% of wind and solar capacities are expected to be installed at the distribution grid level which poses high pressure and the need for balancing systems for DSOs (Distribution System Operators).

Thus, the EDSO-E, IEA and the EU recognise the need for increasing the flexibility at the DSO level as to achieve 2030 EU RES targets safely, reliably, and affordably.

Analysing the work that has already been undertaken by the Consortium in the WP1 and WP2, the DE-RISK project will support the market uptake of Renewable Energy Sources (RES) by de-risking the adoption of Local Flexibility Markets as to increase the RES hosting capacity of the distribution network.

Respectively, the De-Risk project focuses on:

I. The Digital Twins Flexibility platform – with high accuracy simulations de-risking the investments, implementation, and operations.
II. Customer Behaviour Journey – increasing user engagement and active participation in LFMs.
III. Multi-sided Business Models – ensuring long-term and sustainable benefits across the LFMs value chain.
IV. LFM Regulatory Package – ensuring fairness and competitiveness in the adoption and operation of LFMs.
V. Financing Schemes – democratizing the access to sustainable investments.
VI. Exhaustive Validation – demonstrating the DE-RISK as a holistic solution in 4 case studies allocated in Türkiye, Spain Ireland, and France.

1.1. The LFM Potential in the EU

The definition of local flexibility markets (LFMs) should be defined as an electricity-trading platform to trade flexibility at the DSO (Distribution System Operator) level.

Figure 1. Share per sector local flexibility market in EU (DE-RISK WP1, WP2)

Source: 1 Demand Response: A Study Potential In Europe, SIA Partners, www.sia-partners.com/en/news-and-publications/from-our-experts/demand-response-study-its-potential-europe

The above Figure 1 highlights 70% of shares per sector belong local flexibility markets available across EU-27, while 42% of shares come from residential applications, and 27% from tertiary sector.

The LFMs market potential varies from country to country, but out of analysed LFMs in the Task 3.1, France has the largest participation of LFMs in its electricity system which is 8.1GW, followed by a benchmarking country – the United Kingdom with 5.8GW, Italy (5.1GW) and Spain (4.8GW).

The DR potential is estimated at 7.5% for most European countries.

It is worth to mention that the analyses conducted by the European Commission suggest that the demand response program can deliver between EUR 3 and 5 billion worth of net social benefit to be reached by 2030.

1.2. The Opportunities and Challenges of the Local Flexibility Markets

The LFMs provide an opportunity for consumers to get engaged in electric grid operations by reducing or shifting their electricity usage in response to time-based rates or the alternative forms of financial incentives. The DR programmes are currently enforced by selected electric system planners and operators through using the flexibility available at large industrial facilities that are connected to the high-voltage grid having given that the resource options for balancing supply and demand.

Thus, it is especially challenging to unlock the very high potential of the local flexibility markets in the distribution grid where the main sources of flexibility are residential and tertiary buildings that represent up to 70% of the total DR potential.

The main challenges to be addressed for unlocking the full LFMs' potential are:

I. To improve end-user awareness, engagement, and participation in flexibility programmes.
II. Introduction of the automated and dynamic form of system services for traditional load reduction programmes.
III. To increase the data exchange and coordination between stakeholders, e.g., operators of transmission and distribution systems and aggregators in the operating countries.
IV. To introduce new business models, such as aggregation, Virtual Power Plants (VPPs) and other distributed energy resource platforms for a fair and beneficial value chain maintenance.
V. To develop new regulatory frameworks putting innovation at the forefront of all operations while ensuring the quality control of system's complexity and the implementation of risk assessments as to minimise the conflicts of interests between stakeholders.

1.3 DE-RISK Project

Local Flexibility Markets (LFMs) are a strategic solution enabling the electricity consumers to have an impact onto electric grid operations as to reduce or shift their electricity consumption in response to time-based rates (e.g., lower electricity cost at night that changes consumers' behaviours as their electricity-heavy day-to-day tasks can now be performed overnight), or equivalent financial incentives.

The Demand Response (DR) programmes are rolled out across the organisations involved in electricity system planning and operations thanks to allocated flexibility provided by large industrial facilities connected to the high-voltage grid in response to balancing the supply and demand.

Thus, there are certain risks of Local Flexibility Markets' demand response, and the potential of boost in the market uptake of RES (Renewable Energy Systems) promoted within LFMs' planning procedures.

There are also the challenges that need to be addressed to unlock the very high potential of the LFMs in the distribution grid where the residential and tertiary buildings represent more than 70% of the entire demand response potential.

The DE-RISK project overcomes these challenges by de-risking the adoption of LFMs to unlock the full demand response (D)R potential while supporting the market uptake of renewable energy systems (RES).

The main aims of the DE-RISK Project are:

I. Boosting the end-user's active participation in the Local Flexibility Markets by deeply understanding their needs and requirements through innovation and the behavioural analysis-based methodology. The results of the analysis shall be used in developing the behaviour change techniques and their mechanisms of action for engagement in the LFMs, the participatory processes and gamification.

II. Ensuring the low cost of DE-RISK by the deployment of the digital twin automated platforms that enable assessment, validation and unlocking the flexibility potential across fur key studies in Europe: Türkiye, Ireland, Spain, France.

III. Minimising the regulatory gap and road mapping for the local flexibility markets within changing regulatory frameworks and policies. Different market maturity is responsible for case study uses within the implementation of DE-RISK in the chosen countries while ensuring local, national and EU policymakers participate in the process, e.g., through dedicated regulatory workshops.

IV. The development and validation of innovative sustainable business models and financing mechanisms, e.g., crowdfunding, lending, EPC or P2P.

The DE-RISK Project aims for supporting the market uptake of Renewable Energy Systems through fostering the adoption of LFMs and unlocking up to 100GW of flexibility before 2030 according to the latest study on the Demand Response conducted by SIA Partners.

The DE-RISK consortium will only achieve a 100GW flexibility if the investments will be minimised, and the risk will be implemented through forward-thinking customer behaviour change aiming at an increase in users' trust and willingness to become a part of the flexibility market.

The other crucial role of the DE-RISK Project is minimising of the individual associates' buildings, citizens and grids digital twins within their flexibility platform contributing to the gap reduction between the simulation and the real-world scenario which aims for minimising the potential of the technical risks that might occur in the deployment and operational phases.

2. METHODOLOGY

2.1 Background and Context

The PESTLE analysis is carried out in the context of objective 3 of the DE-RISK project which is about identifying the regulatory challenges to local flexibility markets and developing recommendations on how they could be overcome. This is based on state-of-the-art regulatory analysis of the local flexibility markets that provide evidence based and transparent guidelines to policy makers on local, national and EU level. Policies to be developed must focus on simplifying the adoption of LFMs and provide enhanced access to new market participants. The first deliverable in the cascade of analysis steps is the report D3.1 PESTLE analysis and benchmarking of LFM implementations with stakeholder mapping. The focus of the report is on identification of Political, Economic, Social, Technological, Legal and Environmental factors that affect LFM development in both positive and negative aspects and to supplement this analysis with a benchmarking exercise that identifies best practices from selected case studies in partner countries.

This made is necessary to build a streamlined methodology that consisted of desk-based research with a qualitative survey of national project partners to validate the results of the initial analysis.

The subsequent sections outline the methodology by first providing a contextual overview of the PESTLE analysis itself, followed by a more specific discussion on how the PESTLE approach was aligned to meet the objectives of this task.

2.2 PESTLE Analysis General Terminology

PESTLE analysis is a popular tool that is widely employed to analyse the external factors that affect organisations, operations, and socio-economic processes. PESTLE stands for Political, Economic, Sociocultural, Technological, Legal, and Environmental factors. PESTLE analysis helps organisations understand the external environment and develop strategies to align with their goals and objectives. This sub-chapter presents the history of PESTLE analysis, its evolution over time, and its relevance to the DE-RISK project.

Figure 2. Factors for a PESTLE analysis

Conceptually, the origins of PESTLE analysis can be traced back to the 1970s when scholars and practitioners in strategic management began to recognise the importance of understanding the external environment in which businesses operate. Several tools and frameworks were developed to holistically analyse business environments. Examples are SWOT analysis, Porter's Five Forces analysis, and PEST analysis which were some of the most popular frameworks during this period.

The acronym PEST is generated from the first letters of their factor elements, i.e., Political, Economic, Sociological, and Technological analysis. One of the earlier books that introduced this technique to a wider audience is "Exploring Corporate Strategy" by Gerry Johnson, Kevan Scholes, and Richard Whittington in 1984, which is now in its 8th edition (Johnson, Scholes and Whittington, 2008). As the title of the book indicates, the PEST framework was originally designed to help businesses analyse their operations comprehensively. It should be noted that the original PEST analysis framework did not include Legal and Environmental factors.

In the 1990s, the Environmental and Legal factors were added to the PEST analysis, resulting in the PESTLE analysis framework that is widely used today. The addition of Environmental and Legal factors reflected the growing recognition of the importance of environmental sustainability and legal compliance in business operations. The PESTLE approach has been also adopted for analyses beyond the business realm and expanded into the review of wider organizational aspects.

Over time, PESTLE analysis evolved to reflect changes in the external environment and the growing recognition of the importance of environmental sustainability and legal compliance. This report further outlines the evolution of each of the six factors of PESTLE analysis.

Political Factors refer to the impact of government policies, regulations, and political stability on operations. Political factors have always been an important consideration for businesses, but their impact has increased in recent years due to the growing trend towards globalization and increased government intervention in the economy.

Economic Factors refer to the impact of economic conditions, including inflation, interest rates, and economic growth, on the organization under investigation. The relevance of economic factors also needs to reflect the growing trend towards globalization and the increasing interdependence of national economies.

Sociological Factors refer to the impact of social and cultural factors, such as demographics, attitudes, and lifestyle. Again, the impact of sociocultural factors has increased in recent years due to the growing trend towards globalization and the increasing diversity of customer segments.

Technological Factors refer to the impact of technology on operations. Technological factors reflect the rapid pace of technological change and the increasing reliance on technology. One example for this is the paradigm shift towards digitalization and leverage data integration.

Legal Factors represent the impact of laws, regulations, and legal frameworks. Legal aspects now provide an overarching framework for operations, for example due to the growing recognition of the importance of legal compliance and the increasing complexity of legal frameworks, not least in the European context and the interplay between national law and EU law.

Environmental Factors refer to the impact of environmental sustainability on operations and the impact of the operations on the environment. The climate change debate has highlighted the relevance of environmental factors, the importance of environmental sustainability, and the increasing pressure from stakeholders to adopt sustainable practices.

PESTLE analysis continues to be relevant today because it provides a structured approach to holistically assessing the entirety of external factors that can impact operations and determine their success. In an increasingly complex and interconnected world, understanding the external operational framework is of crucial importance to identify both opportunities and threats and adapt to changing circumstances. PESTLE analysis represents an effective tool with which organisations can develop more effective strategies and improve their overall performance and success. It has also been employed in the energy context, e.g. for the analysis of sustainable development of renewable energy (Zalengera et al., 2014), the biofuel market in Europe (Achinas *et al.*, 2019), the decommissioning of

oil and gas platforms (Capobianco *et al.*, 2021), and the renewable energy production in Poland (Igliński et al., 2016).

2.3 PESTLE Methodology for Analysing Local Flexibility Markets (LFMs)

2.3.1 Local Flexibility Markets

When identifying factors for a PESTLE analysis that specifically focusses on LFM, it is also important to outline the main characteristics of LFM. In general, LFMs are needed for balancing the electricity grid at a local level. This is important because electricity grid needs to maintain an equilibrium between supply and demand to ensure stable and reliable power supply.

LFM platforms allow local market participants such as households, businesses, and communities, to offer flexibility services to the electricity system. Examples of such services include demand response, energy storage, and distributed generation, among others. Local flexibility markets enable these participants to either sell their excess capacity or to reduce their consumption during peak periods in response to signals from the electricity system (Rebenaque *et al.*, 2023). This can help to balance the grid and reduce the need for expensive infrastructure investments, such as new power plants or transmission lines.

The growth and demand of local energy flexibility are driven by the increasing penetration of renewable energy sources, the decentralization of the electricity system, and the growing demand for clean energy. A central problem is that renewable energy sources such as wind and solar are intermittent and that their output therefore varies based on weather conditions (Vulic, Rüdisüli and Orehounig, 2023). This variability can create challenges for grid operators and LFM can help to address these challenges by providing a more flexible and responsive grid by enabling services such as congestion management and voltage control[1].

LFM provide a range of opportunities as they create new revenue streams for local market participants, such as homeowners with rooftop solar panels or businesses with energy storage systems or capacities to reduce their electricity demand. By selling their excess capacity or reducing their consumption during peak periods, these participants can earn additional income while also

contributing to a more sustainable and resilient electricity system. This had led to the development of advanced market models of decentralized transactive energy that integrates market strategy with wholesale and local energy markets through coordinated interactions between transmission system

[1]Deliverable: D2.2 Business Use Cases to unlock flexibility service provision. Market enabling interface to unlock flexibility for cost-effective management of smarter distribution grids (in English), https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5dc8f0e46&appId=PPGMS

operator (TSO), distribution system operators (DSOs), and distributed energy resource (DER) owners (Ullah and Park, 2022).

Overall, LFM represent an innovative and promising approach to grid management, offering a range of benefits for both grid operators and local market participants. As such, they are expected to play an increasingly key role in the transition to a clean, decentralized, and flexible energy system.

Challenges to developing Local Flexibility Markets

The challenges to the development and implementation of local flexibility markets in the energy sector can be grouped into several interlinked categories. These are:

1. **Technical challenges:** This concerns the technical integration of decentralized energy resources and their management. It can be difficult to ensure that different distributed energy resources (DERs) can work together effectively and efficiently in a local flexibility market.

2. **Data management:** For an efficient operation of LFMs, they require near-real time information about a complex grid-related parameters and seamless access to respective data sets. Therefore, a system needs to be established that is interoperable and can communicate effectively between different market participants. At the same time, there is also a need to ensure the security and privacy of this data.

3. **Regulatory framework:** The regulatory framework for local flexibility markets is complex and varies between countries. In the European context, there is a need for a clear and consistent regulatory framework to support the development and growth of these markets.

4. **Business models:** The development of successful business models for local flexibility markets is of central importance. There is a need to ensure that the different market participants, including prosumers, aggregators, and distribution system operators, can generate sufficient revenue to justify their participation in the market.

5. **Market design:** The design of local flexibility markets needs to ensure that pricing mechanisms and market structures are effective and efficient. There is also a need to safeguard that these markets can operate alongside existing energy markets and regulatory frameworks.
6. **Customer engagement:** Finally, there is a need to ensure that customers are engaged and incentivised to participate in local flexibility markets. This requires effective communication and education campaigns to raise awareness of the benefits of these markets and to encourage participation.

In summary, the challenges faced by local flexibility markets are complex and multifaceted, requiring a coordinated effort from policymakers, regulators, market participants, and consumers to overcome. However, with effective solutions in place, local flexibility markets have the potential to deliver significant benefits to the energy sector, including improved system reliability, increased renewable energy integration, and reduced carbon emissions.

2.3.2 Defining the PESTLE Factors for the Analysis of Local Flexibility Markets (LFMs)

PESTLE analysis can be used to analyse local flexibility markets by examining the various external factors that can impact the development and success of these markets. Each factor needs to be contextualised to the country under scrutiny and be of direct relevance to LFMs.

Political factors, government policies and regulations that impact the development and operation of local flexibility markets. Thesis includes subsidies, incentives, and taxes that influence the adoption of innovative technologies and the development of flexible energy systems.

For **economic** factors, considerations need to address the cost of energy and how it affects the adoption of flexible energy systems by consumers and businesses. Economic conditions can also affect the funding and investment available for local flexibility markets.

Social factors are about changing consumer preferences and attitudes towards renewable energy which can influence the demand for local flexibility markets. Social factors can also influence the adoption of innovative technologies, such as smart home systems and electric vehicles which can provide flexibility to the energy system.

In terms of **technological** factors, it is for example battery storage and smart grid systems that are critical to the development of local flexibility markets. Technological innovations can also create new opportunities for the integration of renewable energy sources and the management of energy demand. Legal factors, such as regulations related to grid connection and the integration of renewable energy sources, can impact the development and operation of local flexibility markets. Compliance with these regulations is critical for the success of local flexibility markets.

Lastly, when it comes to **environmental** factors, the overarching issue is climate change and the need to reduce greenhouse gas emissions. This drives the adoption of flexible energy systems and local flexibility markets. Environmental concerns can also influence the development of modern technologies and the investment in renewable energy sources.

Table 1 lists a series of 47 factors that were used to guide the analysis

DE-RISK Task 3.1 Pestle Analysis and Benchmarking of Best Practices Implementation of LFMs in Participating Countries and EU - Pestle Factors							
Factor	**Political**	**Economic**	**Social**	**Technological**	**Legal**	**Environmental**	**Comments**
Market structures that support centralised energy production/local flexibility markets	x	x			x		Competition between small RES operators and large technology players. Conflicts between local governments, local communities, investors, and energy operators
Security of energy supply	x	x	x	x	x		Security of energy supply is crucial for operators to maintain the minimum required service level
Innovation capacity and digital independence		x	x	x			Crucial for Local Flexibility Markets as they rely on digital technologies such as smart meters and data analytics
Attitudes towards energy efficient products, services, technologies, and appliances	x	x	x	x	x		Energy efficiency can be influenced by the perceived value of energy savings in terms of reducing electricity costs, improving energy security and reliability, and reducing greenhouse gas emissions
Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	x	x	x	x	x		Can be influenced by a range of factors, including economic incentives, policy and regulation, awareness and education, access to technology and services, behavioural factors, and trust and transparency in the energy system
Smart grids deployment	x	x		x	x		Focused on the grid performance while delivering efficiency of energy distribution and reducing energy loss, integration of renewable energy sources such as wind and solar within LFMs, deployment of Local Flexibility Markets allowing energy users and generators to participate in energy trading and demand response programs, advanced metering infrastructure (AMI) as a core component of small grid deployment and cybersecurity as to minimize possible cyber threats and attacks
Demand response infrastructure deployment (smart metering)	x	x		x	x		Enables electricity users to respond to changes in energy prices and grid conditions by reducing or shifting their energy use, creating a more flexible and efficient electricity system
Decentralised energy system and storage	x	x		x			Decentralised energy systems refer to the generation of energy at a local level, such as through solar panels or wind turbines, while energy storage enables the storage of excess energy for later use
TSO and DSO regulation	x				x		TSOs and DSOs are responsible for operating and maintaining the electricity grid, and their regulatory frameworks play a critical role in the development of local flexibility markets and the transition to a more sustainable and resilient electricity system. The regulation should be focused on the integration of distributed energy sources with the grid, coordination between TSOs and DSOs, market design supported by regulatory frameworks enabling efficient, secure, and reliable energy transactions, data privacy and security within DERs
Availability of ICT solutions for peer-to-peer energy trading/virtual power plants		x		X			Enable the efficient and decentralised exchange of energy between prosumers and the grid: (i) interoperability - allowing different systems to communicate and exchange data with each other within P2P energy trading and VPPs; (ii) Distributed Ledger Technologies (DLTs) including block chains can provide secure and transparent platform for P2P energy trading and VPPS; (iii) Data Analytics - with insights into energy usage patterns allowing its optimization; (iv) Communication Technologies such as IoT (Internet of Things) providing real-time data on energy usage and availability; (v) Cybersecurity - security and protection against cyber threats and attacks
Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	x	x	x	X	x		Critical to empowering customers to participate actively in the energy system, supporting the transition to a more decentralised, sustainable, and customer-centric energy system
Schemes and incentives that give advantage to big energy firms	x	x			x		Unfair contract distribution at local and national level that leads to financial issues for small enterprises involved in RES projects
Grid connection costs	x	x		X			High grid connection costs may prevent technology deployment. Insufficient planning and communication results in higher costs
Uncertainty and limitations in feed-in-tariff levels and schemes	x				x		Lacking transposition of the European Directives, need for a stable policy framework
Legislative frameworks that make setting up LFM ventures difficult	x				x		Insufficient legislative support for SMEs interested in working on RES projects putting them away from the idea
Lack of support from local representatives/local energy agencies	x	x	x		x		No higher figure at local level interested in supporting the RES projects. Possible no funding available that would make them interested in cooperating on the projects
Lack of a policy framework for LFM investments	x				x		Analysis of the various NECPs to see if LC are included in sustainability plans
Not mentioning LC as a relevant actor	x		x		x		Political conflicts between authorities and LC
Complex and changeable policies regarding LFM development	x				x		Low possibility for RES to become profitable amid no policies supporting renewable technologies
Lack of rules regarding the opportunity to operate micro-grids	x			X	x		Lack, or poor communication between the LC and the authorities
Lack of regional focus on renewable energy projects with LFM	x		x				Citizens not interested in the dialogue with the government ignoring their calls for RES expansion in LFMs
Energy policies may have unwanted negative connotations	x	x	x	X	x	x	Leasing policies preventing new investments
Lack of cooperation between local authorities and local communities	x		x		x		Wrong policies addressed at HYD support instead of RES
Difficulties for energy communities to generate enough surplus to cover organisational costs	x		x				Costs of renewable energy sources and energy efficiency measures may be high
Lack of long-term government funding		x		x			This may be affected by climate change, poor weather conditions, lack of funding for larger RES projects
Initial financing problems at local government level	x	x					The government not interested in championing the energy transition and RES, has other priorities such as supporting HYD operators
National energy policy change and shift from RES to HYD	x	x			x		Possible lack of specialized staff handling new projects, federal government had to prioritize other more important economic measures

Difficulty in accessing loans/contracts/funding for LFM projects	x	x		x	x	x	Geopolitical situation of the analysed countries most likely to affect national energy policymaking, the government must prioritize HYD for the time being
Lack of tax exemptions or incentives unlocking new investment opportunities	x	x	x				Lack of available organizations involved in RES funding
Investment incentives for hydrocarbons instead of RES	x	x	x		x		Federal authorities re-prioritized funding for certain energy projects
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	x	x	x		x	x	Governments more interested in funding hydrocarbon technologies from the ideological/economic point of view rather than renewables
Lack of experience with LFM			x	x			Perhaps large wind farm investment does not bring expected profits due to wrongly allocated wind farms where the wind conditions are poor
Low trust in renewable energy technologies	x	x	x		x		Local and federal governments did not work with local communities in the past amid new renewable energy projects. No other communities were yet involved in similar projects, so there is no role model for the RES projects implementation. LC learn on the job with their failures. The governments do not conduct case studies, or polls that would examine such issues that would establish a constructive dialogue between all parties, unwillingness to cooperate with the governments due to geopolitical instability
Possible loss of support if the projects exceed certain size	x		x	x	x	x	Local communities, or the governments not interested in RES from ideological or economic point of view
Lengthy grid connection procedures	x	x	x	x	x		Direct conflicts between the authorities and the local communities
Lack of interest and engagement in the promotion of LFM				x	x		Not enough sustainability and economic awareness among decision makers responsible for new grid connection expansion nationally, or internationally
Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge			x				LC afraid of RES due to lack of knowledge
Lack of experience in commissioning and managing RES projects	x		x		x		Decision makers not willing to accept new projects
Lack of accessible area for new renewable plants			x	x			Energy advisors and experts are needed to explain the possible benefits of RES, size of energy project might be an issue, or a distance from the households. Importance of stakeholder engagement in promoting renewable technologies
Lack of sufficient requalification/training for potential LFM technology staff	x		x	x			All stakeholders without experience required for successful project management
Difficulty in securing labour for LFM projects	x	x	x	x	x	x	Insufficient land/maritime policies regarding the areas needed for new RES projects. Planning errors responsible for project cancellation/changes
Rigid legal, bureaucratic, and administrative procedures	x	x	x	x			Insufficient highly qualified workforce knowledgeable how to operate new RES projects due to lack of training. Failures at legislative/government level due to lack of understanding of the smart meters
Insufficient regulation regarding smart metering		x	x		x		Data update frequency is fundamental to correctly monitor consumption levels and energy generation (to obtain economic benefits)
Strong aversion to risk towards larger RES projects	x	x	x		x		Excess bureaucracy resulting in project delays, investor loss, project cancellations
Lack of cooperation with other local communities to share expertise/knowledge/resources	x		x			x	Unreasonable fear of large RES plants, higher impact on environment, environmental lobby groups not interested in learning more about the technology and oppose new projects
Low citizen involvement in decision making activities	x		x				The communities prioritize their own 'yard' and are unwilling to engage with 'competition'
Low citizen involvement in decision making activities	x		x				No citizen involvement resulting in fewer projects due to no understanding and the support needed for successful renewable energy technology campaigns

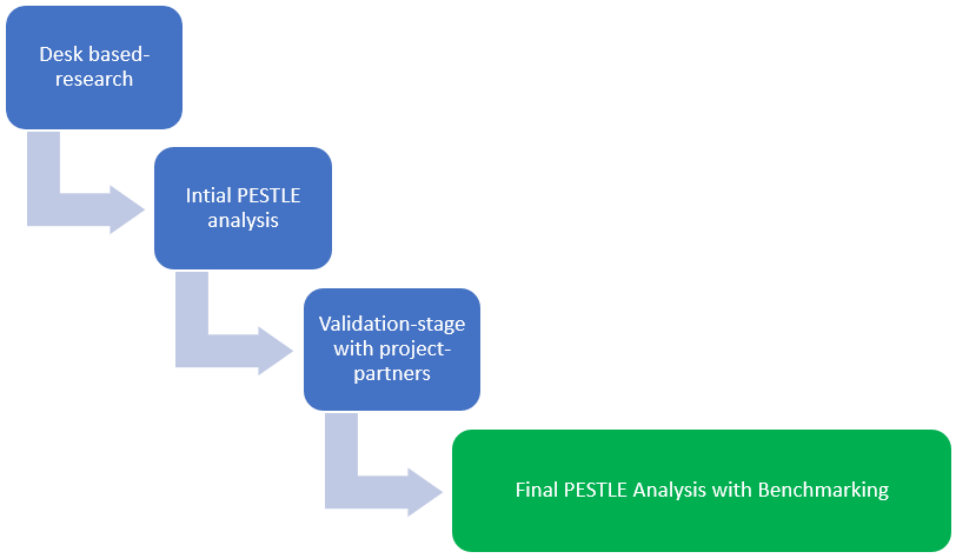
Legend
LC - Local Communities
RES - Renewable Energy Sources
HYD - Hydrocarbons
EC - Energy Communities
LFM - Local Flexibility Market
DSO - Distribution System Operator
TSO - Transmission System Operator
DER - Distributed Energy Resources
P2P - Peer-to-peer
VPPs - Virtual Power Plants

The PESTLE analysis was developed via data collection activities based on desk research. The information was collected through various sources, such as relevant reports, scientific journals, online databases, and government reports.

The central advantage of desk-based research is that it can be conducted quickly compared to other research methods, such as surveys or interviews. However, one important aspect of desk-based research is evaluating the reliability and validity of the sources used. This will safeguard that the information and their analysis is accurate and relevant.

To address this issue, we developed a pragmatic approach so as to safeguard the reliability and validity of the collected information, namely we performed an additional validation by sending the results of our initial analysis to all project partners and asked them to (a) comment on the validity and quality of data sources, (b) suggest additional resources that were not yet included in the initial desk research, and (c) comment on the quality of the initial PESTLE analysis and its intermediate results. The feedback from project partners was then subsequently integrated in the final PESTLE analysis and benchmarking approach, see Figure 3 below.

Figure 3. Procedural flowchart of PESTLE analysis for LFM



3. Country-specific PESTLE Analyses

This chapter presents in-depth analyses of the Political, Economic, Social, Technological, Legal and Environmental (PESTLE) factors in the context of Local Flexibility Markets and Electricity Markets conducted for the countries of the project beneficiaries, as well as for three benchmarking countries.

The report includes a table for each country under scrutiny, which presents the identified country-specific PESTLE factors, in Annex I. Complementary to the country tables, the authors present further analysis following the PESTLE framework for each country. It is important to note that the PESTLE factors differ from country to country, depending on the national market conditions affecting the local flexibility market. The full list of detailed factor-focused tables follows in an Appendix section at the end of this report.

3.1 Italy

Italy is home to numerous world-renowned brands and businesses and is a popular destination for tourists and investors alike. However, as with any market there are various macro-environmental factors that affect the operations of businesses in Italy. As a member of the European Union, Italy is subject to the renewable energy targets set by the EU. The country has set ambitious goals for itself in terms of renewable energy production and consumption.

This PESTLE analysis report will focus on the macro-environmental factors that are currently impacting the renewable energy market in Italy and in Europe, specifically examining the Political, Economic, Sociocultural, Technological, Environmental and Legal components.

Italy is an attractive market for both, natural gas, and renewable-energy technologies. According to the government, 80% of total energy consumption in Italy was satisfied by fossil fuels in 2021: natural gas made up 43% of all sources of energy (used mostly for heating, electrical power generation, transportation, and cooking), oil accounted for 32%, and coal for 4%. Renewable sources accounted for 20% of the total energy mix and a higher percentage of the electrical power generation mix, satisfying 36% of the total electricity demand in 2021.

Considering the ongoing conflict in Ukraine, Italy is taking steps to enhance its domestic energy security and aims to decrease its reliance on Russian gas by 2024. In the short term, the country is focusing on strategies to ensure adequate gas supply for the upcoming/current winter, such as filling storage facilities and diversifying gas sources, including imports from countries like Algeria and Azerbaijan.

The Italian government has also introduced a National Plan for Containment of Natural Gas Consumption in September 2022, which aims to decrease gas consumption.

Over the medium term, Italy intends to continue diversifying its gas sources, implementing new floating storage and regasification units for liquefied natural gas, and accelerating the growth of renewable energy sources.

The Italian and American governments have aligned energy policies, recognising the significance of natural gas for security while simultaneously fostering the transition to cleaner energy sources. This presents opportunities for American firms in both the natural gas and clean energy industries in Italy.

Italy ranks third in Europe for both power consumption and generation from renewable resources and is one of 14 EU countries to reach their 2020 target of renewables as a percentage of total energy consumption is 18.2%[2].

Political

The previous Italian Government has been actively promoting the development of renewable energy in the country through several policies and initiatives, one of the main ones being the PNIEC. However, since then the Italian Government has been facing a lot of changes, the latest big one in 2022, when Giorgia Meloni, a right-wing politician (Brothers of Italy) became prime minister.

In 2019 the Inter-ministerial Committee for Economic Planning (CIPE) was ruled to be transformed to the Inter-ministerial Committee for Sustainable Development (CIPESS) to change the focus slightly.

In the same year, the Italian government adopted the National Energy and Climate Plan (PNIEC)[3] which set a goal of 34% of electricity production from renewable sources by 2020, 38% by 2025 and at least 50% by 2030. The plan was sent to the European Commission in implementation of Regulation (EU) 2018/2019.

The government signed off on an unprecedented EU energy market intervention at an emergency meeting of energy ministers in Brussels on 30 September 2022, including a mandatory 5% electricity use cut during peak hours and a windfall tax on excess energy company profits with a plan to redistribute them to struggling households. The government also introduced several incentives and subsidies to encourage the development of renewable energy projects, including feed-in tariffs, tax credits and grants for research and development. It also set targets for the increased use of biofuels

[2] Statistical Publications - Terna spa 'Electricity data archives and the latest electricity report' (Access 13.03.2023)
[3] Ministry of Economic Development, ministry of the Environment and Protection of Natural Resources and the Sea, Ministry of Infrastructure and Transport (December 2019) 'Integrated National Energy and Climate Plan' https://energy.ec.europa.eu/system/files/2020-02/it_final_necp_main_en_0.pdf

in the transportation sector, with a goal of 10% biofuels in transport by 2020. In the past decade it only reached about 4% with a shift to waste-based feedstock[4].

The coalition parties strongly focused on nuclear power during the campaign to reduce dependence on Russian gas (which sharply rose since 2014) and to become more energy independent, although Italy phased out nuclear power years ago because of a referendum in 1987 and 2011. The right-wing coalition has set no goals for renewables beyond what is required under EU law though. Instead, all three parties in the right-wing coalition have called for increased exploration and production of natural gas in Italy[5].

The left wing supported massive investments in the rapid construction of regasification plants for imports of LNG, but for these to only be temporary and shut down by 2050. Meanwhile, even Giorgia Meloni has called to improve the exploitation of renewable energy with all its potential, as this is currently blocked by bureaucracy and incomprehensible vetoes, which must change[6].

The National Recovery and Resilience Plan (NRRP), as part of the NextGenerationEU (NGEU) programme and Italy's Plan includes investments worth €191.5 billion through the recovery and resilience facility as well as complementary funding for specific projects. The NRRP is designed to be a transformative project and two of its six missions target the countries sustainability. Mission 3 in form of sustainable mobility and further targeting a green revolution and ecological transition (mission 2).

In addition, €69.94 billion was dedicated to latter alone, which includes ecological transition investments and reforms that contribute to creating youth employment in all sectors covered by the EU Green Deal, including renewable energy, transmission and distribution networks and the hydrogen chain. It also includes measures to simplify initiatives regarding energy efficiency and building redevelopment, especially in the Mezzogiorno region which has a high potential for renewable energy.

Some of the key headlines for mission 2 and 3 are:

- Development of agro-voltaic plants.
- Creation of hydrogen valleys.
- Development of biomethane facilities.
- Upgrading naval fleet.
- Support energy communities and self-consumption models.
- Partial upgrading of the railway fleet.
- Building up to 40 hydrogen-charging stations.

[4] https://www.ieabioenergy.com/wp-content/uploads/2021/11/CountryReport2021_Italy_final.pdf
[5] https://www.governo.it/en/articolo/president-council-ministers-giorgia-meloni-s-parliamentary-address-government-programme
[6] https://www.italiadomani.gov.it/content/sogei-ng/it/en/il-piano/missioni-pnrr/rivoluzione-verde-transizione-ecologica.html

- Purchasing of 3,360 low-emission buses.
- Upgrading 115 primary substations and related networks to smart grid.
- Increasing access to electricity for 1850 000 people.

The Italian Recovery and Resilience Plan devotes about 2 billion euros to produce biomethane for projects aiming at reconverting and improving the efficiency of existing biogas plants or the installation of new plants in the agricultural sector with the aim at using the produced biomethane in the industrial and residential heating and cooling sector and in the tertiary and transport sectors.

In 2013, Italy launched its National Energy Strategy (*Strategia Energetica Nazionale*) which set more ambitious domestic objectives to reduce GHG emissions by 21 per cent by 2020 relative to 2005 levels and aimed to generate investments in green economy sectors of EUR 180 billion by 2020 supported by a series of incentives (Ministero Sviluppo Economico, 2013).

Economic

The renewable energy market in Italy is growing, with investments in the sector increasing in recent years. However, the Italian economy is currently facing several challenges, including high public debt and a sluggish growth rate. This may affect the government's ability to continue providing incentives and subsidies for renewable energy projects. The Italian economy has been heavily impacted by the COVID-19 pandemic, with the GDP declining by 8.9% in 2020[7].

However, the government's measures to support the economy, including the Decreto Rilancio law, are expected to help the economy recover in the coming years.

Nonetheless, according to the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), the Italian renewable energy sector has attracted €24.9 billion of investments between 2010 and 2019 (ENEA):

I. €630 million was allocated for the purchase of non-polluting vehicles (cars, commercial vehicles, motorcycles, and mopeds) by 2030[8].
II. Energy taxes in Italy are among the highest in the EU, with an average tax rate on energy of EUR 211 per tonne of oil equivalent (2011 figure)[9].
III. The development of renewable energy projects has the potential to attract foreign investment, which could provide a boost to the Italian economy.

[7] https://www.statista.com/statistics/1109195/forecasted-gdp-growth-in-italy/
[8] https://www.mise.gov.it/it/incentivi/ecobonus-automotive
[9] Banca D'Italia Eurosistema (Ottobre 2013) 'Questioni di Economia e Finanza (Occassional Papers) 'La tassazione ''verde'' in Italia: l'analisi di una carbon tax sui transporti' (In Italian) https://www.bancaditalia.it/pubblicazioni/qef/2013-0206/QEF_206.pdf

IV. The cost of renewable energy technologies, such as wind and solar, has been decreasing in recent years, making renewable energy more cost-competitive with traditional fossil fuels.
V. The Italian government is also focusing on the development of interconnections with other European countries, which will allow the country to trade energy and increase its energy security.
VI. The renewable energy sector has been growing in recent years, driven by the government's policies and the increasing demand for clean energy. Investments in renewable energy projects have been increasing, and the sector is expected to create new job opportunities, particularly in the manufacturing and installation of renewable energy systems (International Renewable Energy Agency).

VII. The Italian energy market is undergoing a process of liberalisation, with the government introducing measures to increase competition and reduce the country's dependence on energy imports including:
    - To separate the production and distribution of energy to increase competition in the market.
    - Opening the energy market to fresh players, including independent power producers and suppliers, to increase competition and improve efficiency.

Social

The public in Italy is supportive of renewable energy and the government is taking this into consideration as they work towards a more sustainable energy mix. As a result of the growth in the renewable energy sector, new job opportunities have been created and the economy has received a boost. The government has made important investments in renewable energy infrastructure, such as wind and solar power plants, to make the market more sustainable and efficient. They are also placing a strong emphasis on energy efficiency and promoting energy-saving technologies. To further increase public support, the government is encouraging community involvement in renewable energy projects and giving local communities a sense of ownership over these assets.

There is strong public support for renewable energy in Italy, with many citizens concerned about the impact of climate change and the country's dependence on fossil fuels. The use of renewable energy has led to an increase in jobs in the industry, especially in research and development, engineering, and installation, further stimulating economic growth in the county.

The governments emphasis on energy efficiency and reduction of energy consumption has encouraged businesses and consumers to adopt energy efficient practices. The Italian government is encouraging community involvement in renewable energy projects, with a focus on promoting local ownership and control of renewable energy assets. This has helped to increase public support for renewable energy and has encouraged local communities to participate in the development of renewable energy projects.

Technological

Italy has a strong tradition of innovation in the renewable energy sector, particularly in the areas of solar and wind power. In April of 2022 they brought the first offshore wind warm online. They are further featuring several floating technologies in developers' plans regarding expanding the capacity of the Italian waters.

The country is also investing in research and development to improve the efficiency and cost-effectiveness of renewable energy technologies. This includes funding for projects aimed at improving the efficiency of renewable energy systems and developing modern technologies to increase the country's reliance on renewable energy.

The Italian government is promoting the adoption of smart grid technology as a way of improving the efficiency and reliability of the country's energy grid. This includes the deployment of smart meters, advanced metering infrastructure, and demand response technologies.

The Italian government is investing in the expansion of renewable energy infrastructure, including the development of new wind and solar power plants, to increase the country's reliance on renewable energy. This is helping to create a more sustainable and efficient energy market and is attracting additional investment to the country.

Legal

Italy has several laws and regulations in place to support the development of renewable energy projects, including the national Renewable Energy Sources Act. However, the legal framework for renewable energy in Italy is complex and can be difficult for developers to navigate.

On February 25, 2022, the Italian Government enacted law-decree no. 23 (Decree), which entirely repeals and replaces article 16 of law-decree no. 4 of January 27, 2022 (known in Italian as the Decreto Sostegni-ter), which had introduced an obligation for renewable energy producers to transfer extra profits generated from the exceptionally high electricity prices to the Gestore dei Servizi Energetici (GSE) to help fund the reduction in the cost of electricity.

On 29 March 2022, Law no. 25 (Sostegni ter Decree) entered into force. The Sostegni ter Decree "Converts into law, with amendments, decree-law no. 4, containing urgent measures in the field of support to businesses and economic operators, labour, health and local services, connected to the emergency from COVID-19, as well as to contain the effects of price increases in the electricity sector"[10].

[10] https://www.dlapiper.com/en/insights/publications/2022/04/decreto-sostegni-ter

The most contested measure was introduced by article 15-bis, “Further interventions on electricity produced by renewable source plants,” which provides for a two-way compensation mechanism on the price of energy, with reference to the electricity fed into the grid for the period from 1 February 2022 to 31 December 2022.

The production plans subject to the compensation mechanism on the price of energy are:

- “Photovoltaic systems with a power exceeding 20 kW that benefit from fixed bonuses deriving from the Energy Account mechanism, not dependent on market prices” (i.e., the incentives referred to in Ministerial Decree 28.7.2005, 19.02.2007, 6.8.2010, 5.5.2011).
- “Power plants exceeding 20 kW powered by solar, hydroelectric, geothermal and wind sources that do not access incentive mechanisms, which entered into operation before 1 January 2010” (so-called merchant).

An updated draft of the FER II Decree was circulated in late July. The FER II decree will establish a support regime for offshore wind, which dozens of announced projects around Italy need to move forward. Final approval of the FER II Decree is still pending:

- The updated draft decree encompasses both floating and fixed-bottom wind, as opposed to an earlier draft, which only featured floating wind support.
- CfDs have been extended from 20 years in the old draft to 25 years in the updated draft.
- The capacity of the allocation rounds planned for 2022-2026 has been increased from 3.5 GW in the old draft to 5 GW in the updated draft.

Italy is planning to implement a contract for difference (CFD) auction model similar to that used in the UK and other parts of Europe, fixing revenue at an agreed strike price.

Italy’s draft framework requires developers to have completed environmental permitting to participate in CFD auctions[11].

Net metering: Net metering is a scheme that allows homeowners and businesses to generate their own renewable energy and sell any excess energy back to the grid. The scheme is governed by the "Decreto sulle fonti rinnovabili" (Decree on Renewable Energy Sources) which sets out the rules and procedures for net metering.

Licensing and permitting: Renewable energy projects in Italy require a license and permit before they can be constructed and operated. The "Legge sulle fonti rinnovabili" (Renewable Energy Law) sets out the requirements for obtaining a license and permit, and the "Regolamento sulla produzione di energia da fonti rinnovabili" (Regulation on Renewable Energy Generation) provides further detail on the application process.

[11] https://www.reutersevents.com/renewables/wind/italy-set-spearhead-floating-wind-southern-europe

The renewable energy certificates: Renewable energy certificates (RECs) are a way of tracking and verifying the production of renewable energy. The "Sistema di Garanzia di Origine" (Guarantee of Origin System) is the legal framework that governs the use of RECs in Italy:

- The "D.Lgs. 11/2017" (Energy Storage Decree) sets out the legal framework for energy storage in Italy, including the requirements for interconnecting storage systems with the grid.
- The "D.Lgs. 11/2017" (Energy Storage Decree) sets out the legal framework for energy storage in Italy, including the requirements for interconnecting storage systems with the grid.

Environmental:

The use of renewable energy can help to reduce Italy's greenhouse gas emissions and mitigate the impacts of climate change.

Sustainable transportation is also a priority for the government, who is promoting the use of electric vehicles and alternative modes of transportation like public transportation, cycling, and walking. To protect the environment and biodiversity, Italy has regulations in place to restrict the construction of new energy infrastructure in protected areas and is promoting renewable energy sources with a minimal impact on the environment.

Italy is also taking steps to protect its biodiversity by implementing regulations to restrict the construction of new energy infrastructure in protected areas, and promoting the use of renewable energy sources that have a minimal impact on the environment. Renewable energy projects can also have a positive impact on local environments, such as reducing air pollution and preserving natural habitats. Water stress is a key environmental challenge in Italy due to high extraction and high concentrations of phosphorus and nitrates[12].

Overall, the renewable energy market in Italy has strong potential for growth, but is facing a few challenges, including economic uncertainty and a complex legal framework. The government's ambitious targets for renewable energy and the public's support for the sector may help to drive the development of new projects in the coming years.

Local Flexibility Markets and electricity services for local flexibility markets

Italy is undergoing a transition towards a more decentralised and sustainable energy system, and local flexibility markets are playing an increasingly important role in this process.

Several pilot projects are underway to test the effectiveness of local flexibility markets, including incentivising businesses and households to reduce electricity consumption during peak periods, and creating a platform for small-scale electricity producers to sell excess energy to nearby consumers. These projects aim to improve the reliability and resilience of the Italian electricity grid, while also

[12] Italy-country profile (March 30, 2017), Green Fiscal Policy Network, https://greenfiscalpolicy.org/policy_briefs/italy-country-profile/

supporting the growth of renewable energy and providing economic benefits to local communities. In addition, specific projects related to electricity services for local flexibility markets are also underway in Italy.

The Smart Community project in Florence involves the creation of a community-based energy system that integrates renewable energy sources, storage systems, and electric vehicles, and uses block chain technology to facilitate peer-to-peer energy trading. The PROSECO project in Milan is developing an innovative platform to manage and optimise energy consumption in buildings, while the "SISSY" project is creating a smart grid system for the city of Genoa.

Italy has also implemented various pilot projects to test local flexibility markets and electricity services. One such project is Smart Polygeneration Grid, which involves the development of a microgrid in the city of Genoa that integrates renewable energy sources, energy storage systems, and electric vehicles.

The microgrid aims to provide grid services through the optimisation of local energy generation and consumption, with the goal of reducing CO2 emissions and improving the reliability of the energy supply. Another project is Flexi-Sync, which aims to create a virtual power plant that aggregates the flexibility of distributed energy resources, such as residential batteries and electric vehicles, to provide grid services. The project is being implemented in the regions of Lombardy and Emilia-Romagna and is expected to increase the integration of renewable energy sources into the grid while also reducing energy costs for consumers.

Additionally, the Energheia is a project that aims to create a block chain-based platform for the exchange of energy between producers and consumers, with the potential to increase the use of renewable energy sources and reduce carbon emissions. These projects and initiatives demonstrate the growing interest in and potential for local flexibility markets and electricity services in Italy, as a means of achieving a more sustainable and reliable energy system.

3.2 Greece

Greece is actively transitioning towards a more sustainable future with a focus on renewable energy. In recent years, investment in the renewable energy sector has increased significantly, leading to the development of various renewable energy projects and infrastructure. This growth has reduced the country's dependence on fossil fuels and created new business opportunities.

The current situation of Greece's renewable energy market is characterised by significant growth and increased investment. The government has implemented policies and incentives, including tax credits, subsidies, and streamlined permitting processes, to encourage the development of renewable energy

sources like wind, solar, hydropower, and biogas. The country's renewable energy infrastructure, particularly in the wind and solar sectors, has developed making Greece an attractive destination for renewable energy investment. Several large-scale projects are underway, and the country is on track to reach its target of producing 20% of its electricity from renewable sources by 2020 and increasing this to 35% by 2030 (Greece Country Profile, International Energy Agency).

Despite progress, the renewable energy market in Greece still faces challenges such as a complex regulatory environment, limited access to financing, and a lack of public awareness and support. However, the sector continues to grow with a positive outlook for the future. The renewable energy sector is crucial to Greece's energy goals and combating the impacts of climate change. The government is committed to promoting renewable energy and has made the country an attractive destination for investment in this sector.

In line with its renewable energy goals, Greece has committed to phasing out most of its coal-fired generation by 2023 and has allocated EUR 5 billion to assist impacted communities. Solar PV and onshore wind are deployed rapidly through auctions, and the government is implementing reforms to standardise and simplify licensing procedures for renewable projects. There are also plans for interconnections and renewables to decarbonise electricity on Greek islands. Additionally, Greece has reformed its wholesale electricity market to better couple with the rest of Europe, resulting in lower prices.

Greece's commitment to transitioning to a more sustainable and low-carbon economy is shown in the following goals relating to the renewable energy market:

I. Increase the share of renewable energy in total energy consumption from 4.8% in 2010 to 18% by 2020, and to 20% by 2025.
II. Increase the share of electricity produced from renewable energy sources from 20% in 2010 to 35% by 2030.
III. Reduce greenhouse gas emissions by 20% below 1990 levels by 2020 and by 80-85% below 1990 levels by 2050.
IV. Develop and promote (the use of) renewable energy technologies including wind, solar, hydro, and biogas.
V. Greece aims to create new jobs in the renewable energy sector, particularly in the installation and maintenance of renewable energy systems.

Political

Greece's National Energy and Climate Plan (NECP or ESSEK as per its Greek acronym) constitutes the strategic plan for the Greek government on climate and energy issues, in compliance with regulation of the European parliament and of the council 2018/1999. It set the following targets, however, is currently under revision:

- Use of RES in gross final energy consumption of at least 30%.
- Use of RES in gross final electricity consumption of at least 55%.
- Use of RES for heating and cooling needs to exceed 30%.
- Use of RES in transport sector to exceed 14%.

A 'National Climate Law' was adopted in 2022 (law 4936/2022) and establishes measures and policies to adapt the country to climate change and ensure decarbonisation by 2050. It also prohibits the production of electricity from solid fossil fuels from 31.12.2028.

The Greek Ministry of Environment and Energy and the Regulatory Authority for Energy (The Regulatory Authority for Energy, RAE) are a key player in the drawing and adoption of national policies and specify the measures and strategies to meet the energy need and achieve the goals. It is also empowered to monitor the operation of all sectors of the energy Market, provide advice to the competent state bodies and adopt regulatory measures towards the full liberalisation of the electricity and natural gas market:

- The RAE may take appropriate interim measures to remedy situations of anti-competitive. Practices and of violations of the applicable national and European legislation on electricity.

The Renewable energy sources operator & guarantees of origin (DAPEEP S.A.) is responsible for renewable energy markets of Greece's national interconnected system and manages the guarantees of origin of electricity from the RES and combined heat and power units.

IPTO (Independent Power Transmission Operator) and HEDNO (Hellenic Electricity Distribution Network Operator) are responsible for the interconnections of RES plants. But the Greek state does not directly participate or own any renewables company.

Renewable Energy Sources Support Law: Greece has a comprehensive legal framework for supporting the development of renewable energy sources. The Renewable Energy Sources Support Law (Law 3468/2006) provides a comprehensive set of incentives and regulatory measures for the promotion of renewable energy sources.

Net Metering System: Greece has implemented a net metering system, which allows customers to generate their own electricity from renewable sources and feed any excess back into the grid, receiving credits for it. This system has encouraged the development of small-scale renewable energy projects and has helped to reduce the country's dependence on fossil fuels[13].

[13] Politopolou, S. (7 November 2018), Net Metering in Greece. Southeast Europe Workshop on Grid Integration of Variable Renewable Energy Sources. HEDNO

A Favourable Regulatory Environment: The Greek government has established a favourable regulatory environment for renewable energy investment. This includes streamlined permitting processes, tax credits, and subsidies for renewable energy projects.

National Energy and Climate Plan: Greece has developed a comprehensive climate and energy policy aimed at reducing greenhouse gas emissions, promoting the use of renewable energy sources, and increasing energy efficiency. The policy includes measures such as the implementation of renewable energy targets, the development of renewable energy infrastructure, and the promotion of energy efficiency[14].

The Renewable Energy Fund: The government has established a Renewable Energy Fund to provide financing for renewable energy projects. The fund provides financing for small-scale renewable energy projects and supports the development of the renewable energy sector in Greece[15].

The Energy Efficiency Law: Greece has implemented a comprehensive energy efficiency law (Law 3851/2010) aimed at reducing energy consumption, improving energy efficiency, and promoting the use of renewable energy sources. The law includes measures such as the development of energy efficiency programs and the promotion of energy-efficient technologies[16].

The European Commission has approved a €341 million Greek measure to support the construction and operation of electricity storage facilities in the country, partly funded by the Recovery and Resilience Facility, to increase the integration of renewable energy in the Greek electricity system and meet emission reduction targets. The scheme will promote the establishment of several electricity storage facilities, with a joint capacity of up to 900 MW, connected to the high-voltage network, and will be selected through a transparent and non-discriminatory bidding process, with the award of contracts expected by the end of 2023 and completion of the storage facilities by the end of 2025 [17].

[14] Greek National Energy and Climate Plan (20 January 2022), IEA/IRENA Renewable Policies Database, https://www.iea.org/policies/12750-greek-national-energy-and-climate-plan
[14] National Energy and Climate Plan (Athens, 2019), Hellenic Republic Ministry of the Environment and Energy, https://energy.ec.europa.eu/system/files/2020-03/el_final_necp_main_en_0.pdf
[15] Law 3851/2010 Accelerating the development of Renewable Energy Sources to deal with climate change and other regulations addressing issues under the authority of the Ministry of Environment, Energy and Climate Change, Article 1 National target for R.E.S. (Renewable Energy Sources) 2010, https://helapco.gr/ims/file/english/law_3851_2010_eng.pdf
[16] Law 3468/2006 Generation of Electricity using Renewable Energy Sources and High-Efficiency Cogeneration of Electricity and Heat and Miscellaneous Provisions (Official Gazette A' 129/28/06/2006), Hellenic Republic Ministry of Development Directorate General for Energy, Renewable Energy Sources and Energy Saving Directorate (2006), https://helapco.gr/ims/file/english/law_3468_2006_eng.pdf
[17] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_4582

Economic

Licensing process in Greece is a long-lasting and bureaucratic procedure and therefore a major difficulty to the promotion of new investments.

Thus, the country has already adopted measures aiming to simplify, further reform, shorten, facilitate, and reduce the stages of the permitting procedure to attract more domestic and foreign RES investors. Foreign investors can invest in renewable energy projects in Greece; however, all monetary transfers abroad must be affected through commercial banks in Greece. Increased number of groups that have traditionally not been active in the electricity sector are actively entering the RES sector. One example is Motor Oil Hellas attaining 75% of the existing RES activity of Ellaktor. The growth of the sector has created new job opportunities and attracted investments. The development of renewable energy infrastructure has reduced the need for imports of fossil fuels, which has had a positive impact on the country's trade balance. Banks have started to offer financing for renewable energy projects and the government also established a renewable energy fund to support investments in this sector (Greek Energy Ministry, YPEN).

Social

The national framework allows natural persons to directly participate in energy communities.

Greece adopts several incentive programs that provide partial financing for housing energy upgrading works aiming to reduce the energy footprint of homes and residences and increase energy saving. It promotes the self-production and net-metering so that citizens gradually become “prosumer”.

Technological

Due to the climatic characteristics, wind and solar power plants represent most of the installed capacity in Greece. Small hydroelectric plants, biogas and biomass are also installed.

The growth of solar photovoltaic (PV) technology has been a major contributor to the development of the renewable energy sector in Greece. The government has implemented several policies to encourage the adoption of this technology, including the establishment of feed-in tariffs and tax credits. The solar power capacity has even overtaken the wind capacity.

The climate is favourable for wind, there has been substantial growth in the wind energy sector.

The development of advanced energy storage solutions has been crucial to the growth of renewable energy in Greece. This has allowed for the integration of renewable energy into the grid and has improved the reliability and efficiency of the energy system.

Greece has also made substantial investments in improving its grid infrastructure, which has been crucial to the growth of renewable energy. The country has implemented several grid integration initiatives, including the development of interconnections between the Greek grid and the rest of Europe[18].

In October the power generation from renewables fully covered Greece's electricity demand for a few hours for the first time[19].

Legal

The RAE may take appropriate interim measures to remedy situations of anti-competitive. Practices and of violations of the applicable national and European legislation on electricity.

The legislative framework governing the activity of electricity production from RES in Greece is established by Law 3468/2006, incorporated into the National Legal Order Directive 2001/77/EC. This has since been amended to comply with the EU Directive 2009/28/EC:

- This includes a mechanism to support the selling prices of electricity produced by RES through the introduction of long-term sales contracts. RES energy also has dispatch priority in relation to that from conventional sources (RAE).
- Law 4685/2020 served to accelerate the environmental permitting process and simplify the first stages of the licensing process.

For example, the Renewable Energy Sources Act provides subsidies to produce electricity from renewable sources. The government has also established a Renewable Energy Independent Agency to support the development of the sector.

In July 2022 Greece passed its first offshore wind law. By 2030 Greece wants to build at least 2 GW of offshore wind. Given the characteristics of Greek waters, much of it will be floating offshore wind farms. According to the law, proposed by the Ministry of Environment and Energy, state-owned company Hellenic Hydrocarbon Resources Management (HHRM) will take over the process of developing offshore wind in the country. It will be renamed Hellenic Hydrocarbon Resources and Energy Resources Management to better reflect its new profile.

[18] https://www.reuters.com/business/energy/greece-bulgaria-romania-hungary-agree-boost-gas-grid-interconnections-2022-12-01/
[19] https://www.reuters.com/business/sustainable-business/greek-renewables-fully-cover-power-demand-first-time-record-2022-10-10/

Environmental

Greece is very vulnerable to the impacts of climate change, including rising temperatures, more frequent heatwaves, and sea level rise.

But the country has abundant renewable energy sources and has made noteworthy progress in developing and implementing environmental policies to support the growth of the renewable energy sector.

Greece runs an ongoing plant focusing on decarbonisation, the electricity generated by which is fully dependent on lignite, an extensive development of mainly PV plants is noted throughout the territory and especially within the exhausted lignite fields.

Local Flexibility Markets and electricity services for local flexibility markets

Greece is actively exploring the potential of local flexibility markets to manage its increasing renewable energy penetration and enhance grid stability. The Greek electricity market operator, ADMIE, developed a local flexibility market platform, launched in 2021. The platform will enable the participation of distributed energy resources, such as rooftop solar panels and energy storage systems, in the electricity market, and provide incentives for demand response programs. This initiative is part of Greece's broader effort to promote a more decentralised and sustainable energy system. Additionally, Greece has launched pilot projects to evaluate the use of block chain technology for secure and transparent transaction settlements between participants in local flexibility markets. Greece has set an ambitious target of achieving 35% renewable energy penetration by 2030, making local flexibility markets a crucial tool for achieving this goal. The country has significant solar and wind energy potential, particularly in the islands, and local flexibility markets can help to harness this potential by enabling the integration of these resources into the grid.

Greece has been actively promoting the implementation of local flexibility markets to improve the integration of renewable energy resources and ensure efficient use of the grid. One notable project in Greece is the Athens Flexibility Aggregator, which aims to create a virtual power plant by aggregating small-scale distributed energy resources, including solar PV systems, energy storage units, and electric vehicles. The project utilizes block chain technology to enable secure and transparent transactions, as well as advanced algorithms to optimise the use of these resources.

The Greek Ministry of Environment and Energy has also launched a pilot project to assess the implementation of a local flexibility market in the island of Tilos, where a wind turbine, solar PV system, and energy storage units are integrated into a microgrid. The project aims to demonstrate the feasibility of using local resources to provide grid services and ensure grid stability. Furthermore, Greece has set a target to increase the share of renewable energy sources in its electricity mix to 35% by 2030, which is expected to further drive the growth of local flexibility markets and related electricity services.

The use of digital technologies such as block chain, IoT and AI will be critical in this transition towards a more flexible and sustainable energy systems.

3.3 Spain

Spain is committed to reducing greenhouse gas emissions and transitioning to a low-carbon economy by promoting the use of renewable energy sources. The country has set ambitious targets to increase the share of renewable energy in its energy mix, with the aim of generating 74% of its electricity from renewable sources by 2030. The renewable energy market in Spain is dynamic and fast-growing, with significant investment opportunities for businesses involved in renewable energy production, distribution, and storage.

The renewable energy market in Spain has been experiencing a significant growth trajectory in recent years. Spain has been making significant investments in renewable energy infrastructure, such as wind and solar power plants, which has resulted in an increase in the share of renewable energy in the country's energy mix. According to the Spanish Photovoltaic Union, the country's solar power capacity has more than doubled in the last two years, with Spain becoming the second-largest market for solar photovoltaic (PV) installations in Europe in 2022, after Germany[20].

Spain's government has introduced several policies and incentives to promote the development and adoption of renewable energy sources. The government has set a target to have 35 gigawatts (GW) of wind and 40 GW of solar energy installed by 2030. Furthermore, Spain has recently approved a climate change and energy transition law that aims to achieve carbon neutrality by 2050.

However, the renewable energy market in Spain faces some challenges, such as the sector's high dependence on government support and incentives, which could be affected by changes in government policies. Spain's energy market is highly regulated, which can create barriers to entry for new businesses. These challenges underscore the importance of conducting a PESTLE analysis to understand the external factors that could impact the renewable energy market and associated markets in Spain. This analysis will help identify the key drivers and barriers to growth and development in the market and guide businesses towards making informed decisions that can help them succeed in this exciting and rapidly evolving industry.

[20] https://www.solarpowereurope.org/press-releases/new-report-reveals-eu-solar-power-soars-by-almost-50-in-2022

Spain's Climate Plan is called the Integrated National Energy and Climate plan (PNIEC) sets out the country's energy and carbon objectives for 2021-2030. These include:

I. To generate 74% of its electricity from renewable sources by 2030. Spain plans to add 60 GW of new renewable energy capacity over the next decade, with a focus on wind and solar power.

II. To have 35 GW of wind energy installed by 2030. This is a significant increase from the current installed capacity of around 27 GW and would require the installation of around 4 GW of new wind capacity per year.

III. To have 40 GW of solar energy installed by 2030.

IV. Achieving carbon neutrality by 2050. In May 2021, the Spanish parliament approved a new climate change and energy transition law, which includes this target. The law also includes a target to reduce greenhouse gas emissions by 23% by 2030 compared to 1990 levels, and to phase out coal-fired power plants by 2025.

Political

Spain is a parliamentary monarchy with a limited role for the king in politics.

The country is divided into 17 autonomous communities, each with its own parliament, and two autonomous cities.

The Ministry for the Ecological Transition and the Demographic Challenge holds the basic competencies on energy, which are focused on the national level, and leads on energy policy formulation.

The Secretary of State for Energy falls under this ministry, while the Directorate General for Energy Policy and Mining falls under the Secretary of State for Energy.

The National Climate Council coordinates the development and monitoring of climate change policies and measures of the central government.

The National Commission of Markets and Competition is an independent regulatory body that reports directly to the Spanish parliament and has authorities on energy, including supervising and controlling the proper operation of energy markets.

The National Integrated Energy and Climate Plan (NECP) is a plan that sets out Spain's energy and climate objectives for the period 2021-2030 in line with the European Union's targets. The plan includes various measures to promote renewable energy, such as increasing the share of renewables in the electricity mix, promoting energy efficiency, and decarbonising the transport sector[21].

In December 2020, Spain announced a new Renewable Energy Plan for the period 2021-2030, which aims to increase the share of renewable energy in the country's final energy consumption to 42% by 2030. The plan includes various measures to promote renewable energy, such as increasing the capacity of wind and solar energy, promoting self-consumption and storage, and supporting research and development[22].

Spain's Energy Transition Law was approved in 2019 and aims to establish a framework for the transition towards a low-carbon economy. The law sets a target of reaching 100% renewable electricity by 2050 and establishes measures to promote renewable energy, such as a feed-in tariff system and a capacity mechanism to ensure the security of the electricity system[23].

In April 2019, Spain introduced a new regulation on self-consumption of renewable energy. The regulation aims to promote the use of renewable energy by facilitating self-consumption, particularly in the residential sector. It establishes a simplified procedure for small-scale installations and eliminates the so-called **Sun Tax** that was previously applied to self-consumption installations.

Spain has developed the **Energy Storage Strategy Plan** strategy to promote energy storage technologies, including batteries, pumped hydro, and thermal storage. The strategy aims to address the intermittency of renewable energy sources and increase the reliability and stability of the grid [24].

The National Fund for the Sustainability of the Electricity System (FNSSE) was created to support the integration of renewable energy into the electricity system. It provides financial support for projects that contribute to the sustainability and stability of the electricity system, including renewable energy projects[25].

The National Renewable Energy Action Plan: Spain has a National Renewable Energy Action Plan that sets out specific targets for renewable energy deployment. The plan outlines measures to support the development of renewable energy technologies and increase their share in the energy mix.

[21] Spain's integrated National Energy and Climate Plan for 2021-2030 (20 January 2020) https://climate-laws.org/geographies/spain/policies/spain-s-integrated-national-energy-and-climate-plan-for-2021-2030 [21] https://energy.ec.europa.eu/system/files/2020-06/es_final_necp_main_en_0.pdf
[22] https://www.iea.org/news/spain-s-extensive-policy-plans-set-to-help-underpin-a-successful-energy-transition-powered-by-renewables-and-efficiency
[23] Climate change and energy transition law (18 November 2022), IEA/IRENA Renewable Policies Database, https://www.iea.org/policies/13323-climate-change-and-energy-transition-law
[24] Energy Storage Strategy (23 March 2022), IEA/IRENA Renewable Policies Database, https://www.iea.org/policies/12809-energy-storage-strategy
[25] https://www.lamoncloa.gob.es/lang/en/gobierno/councilministers/Paginas/2021/20210601council.aspx

Economic

Spain has implemented a feed-in tariff system to incentivise the development of renewable energy sources. Under this system, renewable energy producers are guaranteed a fixed price for the energy they generate for a set period. This system has helped to encourage investment in renewable energy in Spain.

Spain also offers tax incentives for investments in renewable energy. For example, companies that invest in renewable energy are eligible for a tax credit of up to 20% of their investment.

EU funding: Spain has received significant funding from the European Union for renewable energy projects. In 2022, Spain received €869 million from the EU's Just Transition Fund to support the country's transition to a low-carbon economy[26]:

- In the financial period 2021-2027 Spain is set receive €37.3 billion in total as to support its green transition and a fair and competitive economy.

Economic stimulus packages: In response to the COVID-19 pandemic, Spain has implemented economic stimulus packages that include significant investments in renewable energy. For example, Spain's National Energy and Climate Plan includes €181 billion in investments in renewable energy and energy efficiency measures by 2030 (Spain Country Profile, International Energy Agency).

Job creation: The growth of Spain's renewable energy sector has also had a positive impact on job creation. In 2019, the renewable energy sector employed over 100,000 people in Spain[27].

The Spanish Renewable Energy Cooperative Society (Sociedad Cooperativa de Energias Renovables), which provides financing and technical support to renewable energy projects.

The Green Investment Plan, which aims to mobilise public and private investment to support the transition to a low-carbon economy[28].

Spanish Energy Market Reform: The Spanish government implemented a series of reforms in the country's electricity market in 2013, aimed at reducing electricity prices and improving the financial stability of the sector. These reforms included changes to the feed-in tariff system, the introduction of capacity payments, and the creation of a market for renewable energy certificates[29].

[26] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_7868
[27] Plan Nacional Integrado de Enrgia y Clima (PNIEC) 2021-2030 (in Spanish), Ministerio Para La Transicion Ecologica y el Reto Demografico, https://www.miteco.gob.es/es/prensa/pniec.aspx
[28] https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/spains-recovery-and-resilience-plan_en
[29] https://energy.ec.europa.eu/system/files/2014-10/2014_countryreports_spain_0.pdf

Social

Public opinion and attitudes towards renewable energy sources, which can influence the adoption and development of renewable energy technologies:

- According to a survey conducted by the Spanish Photovoltaic Union (UNEF), 85% of the Spanish citizens support the development of renewable energy technologies in the country and its overseas territories.
- The pro-environmental attitudes are visible i.e., in the form of protests against fossil fuel extraction, demands for the closure of coal mines, and public campaigns for more clean energy.

The National Integrated Energy and Climate Plan (PNIEC) estimates that the energy transition will generate around 364,000 direct jobs by 2030.

The Spanish government has taken steps to ensure that vulnerable communities have access to clean energy. For example, the Royal Decree 15/2018 established the Social Energy Fund, which provides financial assistance to low-income households to help them pay for energy bills and to invest in energy efficiency measures. Additionally, the PNIEC includes measures to provide renewable energy access to rural areas and remote islands[30].

The role of energy cooperatives and citizen participation in renewable energy projects, which can help to promote social acceptance and engagement with renewable energy.

Technological

Energy storage technologies, such as batteries, are essential for integrating renewable energy sources into the grid. Spain has been investing in energy storage technologies to support the growth of renewable energy. For instance, the Spanish energy company Endesa plans to invest €1.8 billion in energy storage projects by 2023 (Spanish Recovery, Transformation and Resilience Plan).

Spain has been investing in research and development of renewable energy technologies. According to the Spanish Ministry for the Ecological Transition and the Demographic Challenge, the Spanish government has allocated €200 million for research and development of renewable energy technologies between 2021 and 2023.

The government has also been investing in smart grids, which are intelligent electrical grids that can automatically manage the production, distribution, and consumption of electricity. Smart grids can help integrate renewable energy sources, such as solar and wind power, into the grid. The Spanish government has funded several smart grid projects, such as the InteGrid project (InteGrid Project).

[30] https://www.lamoncloa.gob.es/lang/en/gobierno/councilministers/Paginas/2022/20221011_council.aspx

Spain has been promoting digitalisation in the energy sector. For example, the Spanish government has launched a programme called **Digital Energy 4.0** to support the digital transformation of the energy sector[31].

Legal

Spain introduced **The Royal Decree 244/2019**, which establishes the framework for the development of wind and photovoltaic energy in Spain. It also introduced the net-metering system which allows individuals and businesses to generate their own electricity using renewable sources and sell the excess electricity back to the grid.

Law 24/2013 on the Electricity Sector: This law established a regulatory framework for the electricity sector and promotes the use of renewable energy sources. It includes provisions for the promotion of renewable energy and the development of a competitive and sustainable electricity market.

Spain has been conducting regular auctions to award contracts to produce renewable energy. In 2021, Spain held the first renewable energy auction with a total capacity of 3,000 MW. The auction was aimed at supporting the development of wind and solar energy projects. The Spanish government has set a target of achieving 50% of electricity generation from renewable sources by 2030.

The European Union's energy and environmental regulations, which influence the regulatory environment for renewable energy markets in Spain.

Environmental

Spain faces increased risk of natural disaster due to climate change. They are focusing on renewable energy sources to mitigate climate change by reducing greenhouse gas emissions.

Another environmental factor that may impact Spain's renewable energy market is the potential impact of climate change on the country's natural resources, such as water availability and land use.

Spain is a significant producer of solar power. In 2020, the country added 2.6 GW of solar capacity, bringing the total to 10.3 GW.

[31] Spain: Industria Conectada 4.0 (January 2017), Digital Transformation Monitor, https://ati.ec.europa.eu/sites/default/files/2020-06/DTM_Industria%20Connectada_ES%20v1.pdf
https://www.miteco.gob.es/es/ministerio/recuperacion-transformacion-resiliencia/contenido/28042022_informe_de_ejecucion_del_plan_de_recuperacion_tcm30-539777.pdf

Local Flexibility Markets and electricity services for local flexibility markets

Spain's renewable energy targets have created a need for new solutions to integrate renewable resources and improve grid reliability.

Local flexibility markets have emerged as a solution, enabling the management of distributed energy resources, and allowing them to participate in energy markets.

Spain has several pilot projects underway to evaluate local flexibility markets, including the City-zen project in Barcelona, which aims to develop a smart grid that enables local energy trading between households, and the FlexiDAO project, which is developing a block chain-based platform for managing energy data and enabling the trade of flexibility services. In terms of electricity services, the Spanish transmission system operator, Red Eléctrica de España (REE), is working on several initiatives to improve the management of the electricity system, including the development of a digital platform for real-time monitoring and control of the grid. REE is also working on the integration of renewable energy sources, such as wind and solar, into the grid, as well as developing energy storage solutions to manage grid stability.

Spain has set ambitious goals to reach 74% renewable energy by 2030, which will require significant integration of decentralised energy resources into the electricity grid. Local flexibility markets are seen as a key solution for this integration, allowing consumers and small-scale energy producers to provide grid services and monetize their energy resources. In addition to pilot projects, several large-scale initiatives related to local flexibility markets and electricity services are currently underway in Spain.

The Smart Island Energy System project in the Canary Islands aims to integrate renewable energy, energy storage, and electric mobility into a smart grid, utilizing local flexibility markets to balance supply and demand. The Vigo Smartcity project in Galicia involves the installation of a large-scale battery storage system and the development of a local flexibility market to optimise energy use and reduce energy costs.

The OpenFlex project, led by energy company Endesa, aims to create a platform for the aggregation and management of distributed energy resources across Spain.

3.4 Türkiye

Türkiye is an emerging market for renewable energy, with a rapidly growing demand for electricity and a commitment to reducing its dependence on fossil fuels. Türkiye has recognised the importance of renewable energy to meet its growing demand for energy while reducing its reliance on fossil fuels. The country's ambitious targets to increase the share of renewables in its energy mix have paved the way for significant growth opportunities in the renewable energy market and associated industries. The country is making significant strides towards achieving its ambitious target of producing 30% of its electricity from renewable sources by 2023. The Turkish government has implemented policies and incentives to encourage investment in renewable energy, including feed-in tariffs, tax exemptions, and investment support programs.

Despite these efforts, the renewable energy market in Türkiye faces several challenges. One of the biggest challenges is the country's dependence on imported energy sources, which can make it difficult for renewable energy projects to compete with traditional energy sources. Additionally, the lack of a consistent regulatory framework and political instability can make it difficult for investors to make long-term commitments.

Türkiye has a climate plan known as the National Climate Change Strategy and Action Plan (NCCSAP). The NCCSAP was first adopted in 2011 and updated in 2019 to align with the goals of the Paris Agreement. The plan outlines Türkiye's commitments and targets for reducing greenhouse gas emissions, increasing renewable energy use, and improving energy efficiency.

Under the NCCSAP, Türkiye aims to reduce its greenhouse gas emissions by 21% by 2030, compared to business-as-usual projections. The plan also targets an increase in the share of renewable energy in the country's energy mix to 38% by 2023 and 50% by 2050. Additionally, the NCCSAP sets out measures to increase energy efficiency in buildings, transportation, and industry.

The implementation of the NCCSAP is overseen by the Ministry of Environment and Urbanisation, which is responsible for coordinating with other ministries, public institutions, and stakeholders to ensure that the Plan's targets are met. While there have been some challenges in implementing the NCCSAP, the Turkish government has demonstrated its commitment to reducing greenhouse gas emissions and increasing the share of renewable energy in the country's energy mix.

Some of the main renewable energy goals of the NCCSAP are:

- Increase the share of renewable energy in the total electricity generation capacity to 38% by 2023 and 50% by 2050.
- Increase the installed capacity of wind power to 16 GW and solar power to 10 GW by 2023.
- Develop a geothermal energy capacity of 1.5 GW by 2023.

- Increase the capacity of hydropower to 35 GW by 2023.
- Increase the share of biomass in total energy consumption to 5% by 2023.
- Increase the share of hydrogen in the energy mix to 1% by 2023.

Political

The Feed-in Tariffs: Türkiye has implemented feed-in tariffs for renewable energy projects, which offer guaranteed prices for energy generated from renewable sources, thus providing a financial incentive for investors to develop renewable energy projects. The tariffs vary by technology and capacity, with rates set by the Energy Market Regulatory Authority (EPDK).

Türkiye's National Renewable Energy and Energy Efficiency Action Plan (NREAP) outlines the country's targets and measures for promoting renewable energy and energy efficiency. The plan aims to increase the share of renewable energy in the country's electricity generation to 38% by 2023 and 50% by 2050, as well as reduce energy consumption by 14% by 2023 (TURKEY: National Energy Efficiency Action Plan (NEEAP) 2017-2023. Ministry of Energy and Natural Resources[32].

In 2007, Türkiye introduced the Geothermal Law, which regulates the exploration, development, and use of geothermal resources. The law provides a legal framework for the development of geothermal power plants and offers incentives such as feed-in tariffs and tax exemptions for geothermal projects.

The Wind Energy Renewable Energy Resource Area (YEKA-RWE): In 2017, Türkiye launched a tender for a 1,000 MW wind energy project, known as YEKA-RWE, which is in the northwest of the country. The project is expected to provide clean energy to around 3 million households and create thousands of jobs. Further, the aim is to attract foreign and domestic investors to the renewable energy market and promote competition in the industry (Turkish Energy Ministry).

Türkiye has a Renewable Energy Law, which provides the regulatory framework for the renewable energy industry in the country. The law sets out the procedures and principles for the development and operation of renewable energy projects, including feed-in tariffs, connection requirements, and licensing procedures.

The country also introduced a Smart Grid Strategy and Action Plan, which aims to improve the efficiency of the country's electricity grid and increase the integration of renewable energy sources. The plan includes measures to develop smart grid infrastructure, improve grid management, and support the integration of renewable energy sources into the grid.

[32] TURKIYE*: National Energy Efficiency Action Plan (NEEAP) 2017-2023. Ministry of Energy and Natural Resources, https://policy.asiapacificenergy.org/node/3903*

The Renewable Energy Resource Guarantee Mechanism (YEKDEM) is a feed-in tariff support mechanism for renewable energy projects. Under YEKDEM, eligible renewable energy projects are guaranteed a fixed price for the energy they generate, with payments made by the government for the first 10 years of operation. The mechanism aims to provide financial support for renewable energy projects and encourage investment in the sector (Ministry of Energy and Natural Resources, Türkiye).

Turkish Green Certificate System: The Turkish Green Certificate System is a voluntary certification scheme for renewable energy projects. Under the scheme, eligible renewable energy projects can apply for green certificates, which represent the environmental benefits of the energy generated. The certificates can be traded on the energy exchange, providing additional revenue for renewable energy projects (Turkish Energy Market Regulatory Authority).

Net Metering Regulation: The Net Metering Regulation allows renewable energy generators to offset their electricity consumption with the energy they generate. Under the regulation, eligible renewable energy generators can export excess energy to the grid and receive credits for the energy exported. The regulation aims to encourage the development of small-scale renewable energy projects and promote distributed generation (Turkish Energy Market Regulatory Authority).

Economic

Türkiye provides various investment incentives for renewable energy projects, including tax exemptions, customs duty exemptions, and VAT exemptions. The incentives aim to attract foreign and domestic investors to the renewable energy market and promote the development of the industry (Republic of Türkiye Ministry of Treasury and Finance).

An Investment Support and Promotion Agency of Türkiye (ISPAT), a government agency that provides support to foreign investors in Türkiye. The agency aids with investment planning, site selection, and investment incentives for renewable energy projects. It also helps foreign investors navigate the regulatory framework and obtain necessary permits and licenses (Investment Support and Promotion Agency of Türkiye).

Local Content Requirement: Türkiye has implemented a local content requirement for renewable energy projects, which requires a certain percentage of locally manufactured equipment and components to be used in the projects. The requirement aims to promote domestic manufacturing and create jobs in the renewable energy industry (Ministry of Energy and Natural Resources, Türkiye).

A Green Energy Certificate Market: Türkiye has a Green Energy Certificate Market, which allows renewable energy producers to sell certificates that represent the environmental benefits of the energy they generate. The certificates can be traded on the energy exchange, providing additional revenue for renewable energy projects (Turkish Energy Market Regulatory Authority).

The Auction System: Türkiye has implemented an auction system for the procurement of renewable energy projects, such as wind and solar power plants. The auction system aims to promote competition in the industry and reduce the cost of renewable energy generation.

The Energy Import Dependency: Türkiye is heavily dependent on energy imports, particularly for natural gas and oil. The development of renewable energy projects can help reduce the country's dependence on energy imports and improve energy security[33].

Türkiye has liberalised its electricity market, allowing private companies to compete in the generation and sale of electricity. The liberalisation aims to increase competition in the industry and promote the development of renewable energy projects (Energy Market Regulatory Authority, Türkiye).

Social

The Turkish government has launched various public awareness and education campaigns to promote the benefits of renewable energy and encourage the adoption of sustainable energy practices. The campaigns aim to increase public awareness of the importance of renewable energy for the environment and the economy.

The government has set a target to create 5 million new jobs in the renewable energy sector by 2023. This relies on the potential to create new job opportunities, particularly in the manufacturing, installation, and maintenance of renewable energy systems. Developers are required to obtain the support of local communities before starting renewable energy projects, and local communities are often given the opportunity to participate in the projects through ownership or investment.

According to a study by the World Health Organisation, air pollution is responsible for an estimated 28,000 premature deaths in Türkiye each year. This could be significantly reduced by reducing GHG emissions by implementing renewable energy projects.

Türkiye has a significant energy poverty problem, with around 20% of the population lacking access to reliable and affordable energy. The development of renewable energy projects, particularly in rural areas, has the potential to improve energy access and reduce energy poverty[34].

[33] Turkey 2021 Energy Policy Review (2021), International Energy Agency, https://iea.blob.core.windows.net/assets/cc499a7b-b72a-466c-88de-d792a9daff44/Turkey_2021_Energy_Policy_Review.pdf

Technological

Türkiye has significant renewable energy potential, particularly in wind and solar power. According to the International Renewable Energy Agency, Türkiye has the potential to generate more than 200 GW of electricity from wind and solar power. The Turkish government has invested in research and development of renewable energy technologies, with a focus on increasing efficiency and reducing costs. The government has established research centres and universities dedicated to renewable energy research and has launched various funding programmes for research and development (Ministry of Industry and Technology, Türkiye).

Türkiye is also investing in the upgrade and expansion of its electricity grid infrastructure to support the integration of renewable energy projects.

The government has launched various projects to increase the capacity and flexibility of the grid, including the installation of smart grid technologies, for example:

- **Smart Grid Turkey Project:** This project was launched by the Ministry of Energy and Natural Resources in 2012 with the aim of upgrading the existing electricity grid infrastructure to a smart grid system. The project involves the deployment of advanced communication and control technologies to increase the efficiency and reliability of the grid, as well as to enable the integration of renewable energy sources (Ministry of Energy and Natural Resources, Türkiye).

- **TEIAS Grid Expansion Project:** The Turkish Electricity Transmission Corporation (TEIAS) is responsible for the expansion and maintenance of the national electricity transmission grid. TEIAS has launched various projects to expand the capacity of the grid and to improve its flexibility, including the construction of new transmission lines and substations (Turkish Electricity Transmission Corporation).

- **EnerjiVeri Project:** This project was launched by the Ministry of Energy and Natural Resources in 2017 with the aim of creating a national energy data platform that will enable real-time monitoring and management of the electricity grid. The platform will integrate data from various sources, including renewable energy sources, and will enable the optimization of the grid's performance (Ministry of Energy and Natural Resources, Türkiye).

The development of energy storage technologies is becoming increasingly important for the integration of renewable energy into the grid. Türkiye has launched various projects to develop energy storage technologies, including battery storage systems and pumped hydro storage.

Some projects include:

- TÜBİTAK Energy Institute has conducted research on energy storage technologies, including batteries and fuel cells, as well as hybrid systems that combine multiple storage technologies (TÜBİTAK Energy Institute).

- The Ministry of Energy and Natural Resources has launched a project to develop energy storage systems that will support renewable energy integration and increase the flexibility of the grid. The project aims to deploy 1 GW of energy storage capacity by 2023 (Ministry of Energy and Natural Resources, Türkiye).

- The Turkish company Alka Enerji has developed a battery storage system for residential and commercial use. The system, called AlkaBox, is designed to integrate with solar PV systems and can store excess energy for later use (Alka Enerji).

- The Turkish company Ronesans Endüstri Tesisleri İnşaat Taahhüt A.Ş. has built a pumped hydro storage plant in the province of Kırklareli. The plant has a capacity of 174 MW and can store up to 792 MWh of energy (Ronesans Endüstri Tesisleri İnşaat Taahhüt A.Ş.).

Türkiye has significant offshore wind potential, particularly in the Aegean and Mediterranean Seas. The government has launched various projects to develop offshore wind projects, including the construction of a 1 GW offshore wind farm in the Aegean Sea.

Legal

The Energy Efficiency Law: The Energy Efficiency Law sets out the regulatory framework for energy efficiency in Türkiye. The law requires energy audits for large energy consumers and establishes energy efficiency targets for public buildings and industry. It also provides incentives for energy efficiency investments, such as tax exemptions and financing support (Ministry of Energy and Natural Resources, Türkiye).

The Renewable Energy Law: In 2005, Türkiye enacted the Renewable Energy Law (Law No. 5346) to promote the use of renewable energy sources in the country. The law provides a legal framework for the development of renewable energy projects, including feed-in tariffs, grid connection procedures, and other incentives (Ministry of Energy and Natural Resources, Türkiye).

The Renewable Energy Resource Guarantee Mechanism: This regulation was introduced in 2011 and provides a guarantee of purchase for the electricity generated from renewable energy sources. The mechanism is designed to encourage private sector investments in renewable energy projects by mitigating the risks associated with electricity price fluctuations (Energy Market Regulatory Authority).

A Net Metering Regulation: This regulation was introduced in 2016 and enables households and businesses with solar PV systems to feed excess electricity back into the grid and receive compensation for it. The regulation aims to encourage the adoption of solar PV systems by making them more economically viable for consumers (Energy Market Regulatory Authority).

A Law No. 6446 on Environmental Impact Assessment: This law was enacted in 2013 and provides the legal framework for environmental impact assessments (EIAs) of large-scale projects, including renewable energy projects. The law requires developers to obtain an EIA approval before starting construction, which ensures that the potential environmental impacts of the project are assessed and mitigated (Turkish Ministry of Environment and Urbanisation).

The Carbon Pricing Mechanism: Türkiye has announced plans to introduce a carbon pricing mechanism in 2021 to support the transition to a low-carbon economy. The mechanism is expected to cover emissions from the power generation and industrial sectors and will provide incentives for emissions reductions and investments in renewable energy (Turkish Ministry of Environment and Urbanisation).

The Electricity Market Law: The Electricity Market Law (Law No. 4628) was enacted in 2001 to regulate the electricity market in Türkiye. The law created the Energy Market Regulatory Authority (EMRA), which is responsible for issuing licenses for electricity generation, transmission, and distribution. The law also established the legal framework for the operation of the electricity market, including the pricing and trading of electricity (Energy Market Regulatory Authority, Türkiye).

The Incentives for Renewable Energy Investments: The Turkish government offers various incentives for renewable energy investments, including tax exemptions, reduced customs duties, and access.

Environmental

Solar Power Plant Programme: In 2017, Türkiye launched a Solar Power Plant Program with the aim of installing 5 GW of solar capacity by 2023. The program includes a feed-in tariff system for solar energy and aims to increase the share of solar energy in Türkiye's electricity mix, while reducing greenhouse gas emissions (Solar Power Europe).

The Turkish government requires environmental impact assessments (EIAs) for all major energy projects, including renewable energy projects. The EIAs assess the potential environmental impacts of a project and recommend measures to mitigate them. This helps to ensure that renewable energy projects are developed in an environmentally sustainable manner (Turkish Ministry of Environment and Urbanisation).

Türkiye has launched a forestation programme with the aim of planting 7 billion trees by 2023. The program includes reforestation of degraded land, afforestation of new areas, and protection of existing forests. Trees absorb carbon dioxide from the atmosphere, which helps to mitigate the effects of climate change (Turkish Ministry of Agriculture and Forestry).

A Wind Power Plants Support Mechanism: Türkiye has implemented a support mechanism for wind power plants to encourage investment and development in the wind energy sector. The mechanism includes a feed-in tariff system for wind energy and provides financial incentives for investors (Turkish Ministry of Energy and Natural Resources).

The Turkish cities are often affected by elevated levels of air pollution, particularly during the winter months. Industrial activity, transportation, and heating systems are the main sources of air pollution. Air pollution can have negative impacts on human health and the environment.

Türkiye is facing increasing water scarcity due to a combination of factors, including population growth, urbanisation, and climate change. The country's rivers are overexploited, and groundwater reserves are being depleted.

Like many countries, Türkiye is also vulnerable to the impacts of climate change, including rising temperatures, changes in precipitation patterns, and more frequent extreme weather events.

Local Flexibility Markets and electricity services for local flexibility markets

Türkiye has been exploring local flexibility markets to integrate renewable energy resources and optimise the use of electricity. The country has set an ambitious target of sourcing 30% of its electricity from renewable sources by 2023, and local flexibility markets are seen as a key tool in achieving this goal.

But several pilot projects are currently underway in Türkiye, including the Smart City Sakarya project, which aims to create a local flexibility market in the city of Sakarya through the installation of renewable energy sources and energy storage systems. The project also includes the development of a block chain-based platform to facilitate transactions between energy producers and consumers. In addition, the Smart Energy City project in Istanbul is evaluating the use of demand response programmes to incentivise households to reduce electricity consumption during peak periods. Electricity services for local flexibility markets in Türkiye include the integration of distributed energy resources, such as solar PV and wind turbines, into the grid, and the use of advanced metering infrastructure to monitor and manage energy consumption. The government is also promoting the use of electric vehicles through various incentives, with the aim of increasing their penetration in the market and using their batteries for grid services.

The Turkish Electricity Transmission Corporation has introduced a regulation requiring distribution companies to establish a local energy market platform to enable the participation of local resources in the electricity market.

The country is also working on increasing the share of renewable energy in its electricity generation mix, with a target of reaching 38% renewable energy by 2023. This presents an opportunity for the development of local flexibility markets and electricity services to integrate these renewable resources into the grid.

Moreover, Türkiye has a favourable location for the development of energy storage systems due to its high solar irradiation and wind potential. The country has already made progress in this area with the commissioning of a 5 MW/20 MWh battery storage system in Izmir.

These developments suggest that Türkiye has the potential to become a leader in the development of local flexibility markets and electricity services in the region.

3.5 Bulgaria

Renewable energy has emerged as a significant player in the global energy market, and Bulgaria is no exception. With the increasing demand for clean energy and sustainable development, the renewable energy market in Bulgaria has been steadily growing over the past few years. This growth can be attributed to several factors such as favourable government policies, increased public awareness, and technological advancements in the industry.

As of 2021, Bulgaria's total installed capacity of renewable energy sources (RES) was approximately 2.6 GW, which represents around 20% of the country's total installed capacity. Most of the renewable energy production in Bulgaria comes from wind and solar sources, with wind energy accounting for over 60% of total RES production.

In recent years, Bulgaria has made significant progress in achieving its renewable energy targets, which aim to increase the share of renewable energy in the country's final energy consumption to 27% by 2030. The government has introduced various incentives and policies to encourage the growth of renewable energy, such as feed-in tariffs, tax exemptions, and subsidies.

However, the renewable energy market in Bulgaria is not without its challenges. The country faces issues such as an outdated energy infrastructure, a lack of investment, and regulatory uncertainties. These challenges have slowed down the growth of the renewable energy market and created a significant barrier to entry for new stakeholders.

In 2020, the Bulgarian government adopted a National Plan for Energy and Climate (NPEC) 2021-2030, outlining the country's strategy to reduce greenhouse gas emissions and increase the share of renewable energy in its energy mix[35].

The NPEC sets a target of reducing Bulgaria's greenhouse gas emissions by at least 35% by 2030, compared to 2005 levels. The plan also aims to increase the share of renewable energy in the country's final energy consumption to 27% by 2030.

To achieve these targets, the NPEC proposes a range of measures, such as the promotion of energy efficiency, the deployment of renewable energy sources, and the modernisation of the energy sector. The plan also includes measures to promote sustainable mobility, such as the development of public transport networks and the promotion of electric vehicles.

Some concrete targets are:

- To reduce Bulgaria's greenhouse gas emissions by at least 35% by 2030, compared to 2005 levels. This target is in line with the EU's goal to achieve at least a 40% reduction in greenhouse gas emissions by 2030.
- To increase the share of renewable energy in Bulgaria's final energy consumption to at least 40% by 2030.
- To improve energy efficiency by reducing final energy consumption by 10% by 2030 compared to the baseline scenario, i.e., by promoting energy-efficient buildings, improving processes, and introducing energy-efficient appliances.
- To promote sustainable mobility by increasing the share of public transport in urban areas, promoting cycling, and increasing the use of electric vehicles.

Political

The National Renewable Energy Action Plan (NREAP) is a policy document that outlines Bulgaria's strategy for increasing the share of renewable energy in the country's energy mix. The plan also proposes various measures to support the growth of the renewable energy market, such as the introduction of feed-in tariffs and the promotion of energy efficiency[36].

[35] Integrated Energy and Climate Plan of the Republic of Bulgaria 2021-2030 (2021), Republic of Bulgaria Ministry of Energy and Ministry of the Environment and Water, https://energy.ec.europa.eu/system/files/2020-06/bg_final_necp_main_en_0.pdf
[36] National Renewable Energy Action Plan drawn up in accordance with the template for national renewable energy action plans as set out in Directive 2009/28/EC of the European Parliament and of the Council (2008), Republic of Bulgaria Ministry of Economy, Energy and Tourism, *https://www.me.government.bg/en/library/national-renewable-energy-action-plan-575-c174-m1-1.html*

The Energy Efficiency Act (EEA) is a law that aims to improve energy efficiency in Bulgaria by promoting energy-saving measures and the use of renewable energy sources. The EEA establishes a framework for implementing energy efficiency measures, such as the renovation of buildings, the introduction of energy-efficient appliances, and the improvement of industrial processes[37].

The Green Investment Scheme (GIS) is a policy initiative that allows Bulgaria to sell carbon credits obtained through the implementation of energy efficiency and renewable energy projects. The proceeds from the sale of carbon credits can be used to finance further energy efficiency and renewable energy projects.

The Operational Programme Innovation and Competitiveness (OPIC) is a fund that provides financial support for projects related to research and development, innovation, and entrepreneurship. The fund supports projects in the field of renewable energy, such as the development of new technologies and the improvement of energy efficiency. In the period 2014-2020, Bulgaria received €1.2 billion from the OPIC Fund (OPIC).

The Bulgarian government has introduced various policies to support the growth of the renewable energy market, such as the **Renewable Energy Act (REA)** and the **Energy from Renewable Sources Act** (ERSA).

These policies provide incentives and financial support for renewable energy projects, such as feed-in tariffs, tax exemptions, and subsidies. According to the Bulgarian Ministry of Energy, in 2020, the government provided up to BGN 350 million (€179million) in subsidies and support for renewable energy.

Bulgaria is eligible for funding from the European Union's Cohesion Fund, which provides financial support for Member States to invest in energy efficiency and renewable energy projects. In the period 2021-2027, Bulgaria is expected to receive €4.2 billion in funding from the Cohesion Fund, which can be used to support the growth of the renewable energy market[38]:

- The first major infrastructure programme for Bulgaria for the period 2021-2027 is the Transport Connectivity Programme, for which the EU has allocated € 1.61[39] billion.

[37] Energy Efficiency Act (15 May 2015), Republic of Bulgaria Ministry of Energy and Ministry of the Environment and Water, https://www.me.government.bg/en/library/energy-efficiency-act-537-c25-m258-2.html
[38] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_4267)
[39] https://ec.europa.eu/regional_policy/whats-new/newsroom/10-03-2022-cohesion-policy-in-bulgaria-the-first-2021-2027-programme-adopted_en

Bulgaria has a stable political environment, which is conducive to the growth of the renewable energy market as the country has a multiparty parliamentary democracy and a stable government where all parties are committed to reducing Bulgaria's greenhouse gas emissions and promoting sustainable development.

But despite the government's support for renewable energy, the market in Bulgaria is still facing regulatory uncertainties, which are slowing down its growth. In 2019, the government introduced a controversial amendment to the REA, which proposed to reduce feed-in tariffs for existing renewable energy projects. This move caused uncertainty and instability in the market, leading to a decrease in investment in the sector.

The Bulgarian government introduced **Net Metering** in 2019, which allows households and businesses to install renewable energy systems, such as solar panels, and receive credits on their electricity bills for any excess energy they generate and feed back into the grid[40].

The Bulgarian government has adopted a **Green Public Procurement (GPP)** policy, which requires public authorities to prioritise environmentally friendly products and services in their procurement decisions. The GPP policy encourages the use of renewable energy sources and energy-efficient technologies in public buildings and infrastructure[41].

Bulgaria has also introduced the **Energy Performance of Buildings Directive (EPBD),** which requires all new buildings to meet minimum energy performance standards and mandates the renovation of existing buildings to improve energy efficiency. The EPBD encourages the use of renewable energy sources in buildings and supports the growth of the energy-efficient building market[42].

Moreover, Bulgaria is a member of the Energy Community Treaty, which aims to establish a regional energy market in Southeast Europe and promote the use of renewable energy sources in the region. The Energy Community Treaty provides a framework for cooperation and collaboration among member countries to support the development of renewable energy markets and associated markets[43].

[40] https://www.energymonitor.ai/policy/bulgaria-stalled-energy-transition/
[41] https://www2.aop.bg/en/legislation-and-methodology/policies-and-strategic-documents-2/eu-policies-2/green-public-procurement/
[42] Kulevska, T., Markovski (December 2016), EPBD implementation in Bulgaria Status in December 2016, Concentrated Action. Energy Performance of Buildings, Sustainable Energy Development Agency (SEDA), https://epbd-ca.eu/wp-content/uploads/2018/08/CA-EPBD-IV-Bulgaria-2018.pdf
[43] https://www.energy-community.org/legal/treaty.html

Economic

Bulgaria implemented a Feed-in Tariff (FiT) scheme in 2011 to support the development of renewable energy sources in the country. Under the scheme, renewable energy producers are guaranteed a fixed price for the electricity they generate for a period of up to 20 years. The FiT rates vary depending on the type of renewable energy source, with the highest rates offered for wind energy. However, in 2018, the Bulgarian government decided to reduce the FiT rates for new renewable energy projects, which led to a decrease in investment in the sector.

The country has also introduced a **Green Energy Certificates Scheme**, which allows renewable energy producers to sell certificates to energy suppliers as proof that they have generated a certain amount of renewable energy. The energy suppliers are required by law to purchase a certain number of green certificates each year, which creates a market for the certificates and provides a source of revenue for renewable energy producers.

The government has also established a special fund, called the Bulgarian Energy Efficiency and Renewable Energy Fund, which provides financial support for renewable energy projects.

Bulgaria has set a target of achieving a 16% share of renewable energy in its final energy consumption by 2020, as part of its commitment to the European Union's Renewable Energy Directive. However, in 2019, the share of renewable energy in Bulgaria's final energy consumption was only 13.1%, which indicates that more efforts are needed to achieve the target.

Renewable energy producers in Bulgaria are exempt from paying certain taxes, including property tax, corporate income tax, and value-added tax (VAT) on the purchase of equipment and materials used for renewable energy production[44].

Bulgaria offers reduced customs duties on the import of equipment and materials used for renewable energy production, to make it more affordable for companies to invest in the sector. The country also has access to funding from the European Union to support the development of renewable energy. For example, the **European Regional Development Fund** provides financial support for renewable energy projects in Bulgaria[45].

[44] National Renewable Energy Action Plan drawn up in accordance with the template for national renewable energy action plans as set out in Directive 2009/28/EC of the European Parliament and of the Council (2008), Republic of Bulgaria Ministry of Economy, Energy and Tourism, https://www.me.government.bg/en/library/national-renewable-energy-action-plan-575-c174-m1-1.html

[45] Regulation (EU) 2021/1058 of the European Parliament and of the Council of 24 June 2021 on the European Regional Development Fund and on the Cohesion Fund (24 June 2021), https://ec.europa.eu/regional_policy/funding/erdf_en

Bulgaria has, furthermore, introduced a **Green Investment Scheme**, which allows renewable energy producers to sell green certificates to the Bulgarian government. The government is required by law to purchase a certain number of green certificates each year, which creates a market for the certificates and provides a source of revenue for renewable energy producers.

Social

The development of renewable energy projects can sometimes face opposition from local communities. In Bulgaria, there have been cases of protests against wind farms and other renewable energy facilities. However, the government has introduced measures to improve social acceptance of renewable energy, such as increasing transparency and consultation with local communities.

There is a growing awareness and interest in renewable energy among the Bulgarian public. For example, the Bulgarian Photovoltaic Association (BPVA) has organised public events and campaigns to promote the use of solar energy (BPVA).

Technological

Bulgaria has significant potential for wind power generation, particularly in coastal and mountainous regions. As of 2021, there are over 680 MW of wind power capacity installed in Bulgaria, according to the **Bulgarian Wind Energy Association (BWEA)**.

The country also has a favourable climate for solar power generation, with an average of over 2,000 hours of sunshine per year. As of 2021, there was over 1,000 MW of solar power capacity installed in Bulgaria, according to the **Bulgarian Photovoltaic Association**.

Bulgaria has significant potential for biomass energy, particularly from agricultural and forestry waste. As of 2021, there were over 300 MW of biomass power capacity installed domestically, according to the **Bulgarian Biomass Association (BG BIOM)**.

The government has also introduced smart the grid technology as to improve the efficiency and reliability of its electricity grid. This includes the deployment of advanced metering infrastructure (AMI) and other smart grid technologies[46].

Bulgaria has also introduced energy storage technologies, such as batteries and pumped hydro storage, to help integrate renewable energy into the grid and provide backup power. As of 2021, the largest energy storage project in Bulgaria was a 40 MW/45 MWh battery energy storage system developed by Energo-Pro (Energo-Pro).

[46] https://renewablesnow.com/news/the-world-is-moving-towards-new-energy-future-with-smart-grids-where-does-bulgaria-stand-807159/

Legal

The Renewable Energy Act (REA) was first introduced in 2011 and has since been revised several times to promote renewable energy development in Bulgaria. The act provides a regulatory framework for the promotion of renewable energy sources, including wind, solar, biomass, geothermal, and hydro power. It sets targets for the share of renewable energy in Bulgaria's total energy mix and establishes mechanisms for feed-in tariffs, which provide guaranteed prices for renewable energy producers.

The Energy from Renewable Sources Act (ERSA) was introduced in 2008 to provide the legal framework for electricity generation from renewable energy sources in Bulgaria. The act established feed-in tariffs, which guarantee prices for renewable energy producers, and set targets for renewable energy production in the country[47].

The Energy Efficiency Act (EEA) was introduced in 2015 to promote energy efficiency across all sectors of the Bulgarian economy, including the renewable energy sector. The EEA requires large enterprises to undergo energy audits and provides incentives for energy efficiency investments, such as grants and low-interest loans.

The National Renewable Energy Action Plan (NREAP) was developed in accordance with EU legislation and sets Bulgaria's renewable energy targets for the period of 2010 to 2020. The plan sets a target of 16% renewable energy in gross final energy consumption by 2020.

Environmental

According to the European Environment Agency, Bulgaria's greenhouse gas emissions decreased by 52.4% between 1990 and 2019. The country is committed to reducing its emissions by at least 40% by 2030 compared to 1990 levels, in line with its obligations under the Paris Agreement[48].

Bulgaria has struggled with poor air quality, particularly in its major cities until very recently. To tackle that issue, the country has introduced several measures to improve air quality, including the promotion of renewable energy sources. According to a study by the European Environmental Bureau, switching from coal-fired power to renewable energy sources could reduce premature deaths from air pollution by up to 71% in Bulgaria[49].

[47] Energy from Renewable Sources Act (03.05.2011), Republic of Bulgaria Ministry of Economy, Energy and Tourism https://www.me.government.bg/en/library/energy-from-renewable-sources-act-167-c25-m258-1.html
[48] https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer
[49] Eco-innovation for air quality. Key messages and summary of the event (5-6 February 2018), 21st European Forum on Eco-innovation, https://eea.government.bg/en/news/EcoAP-report.pdf

From environmental perspective, Bulgaria is home to several protected areas, including national parks and nature reserves. The development of renewable energy projects in these areas is subject to strict environmental regulations, including the requirement for environmental impact assessments and public consultations[50].

Moreover, Bulgaria has struggled with poor waste management practices, leading to environmental pollution and health hazards in recent years. The development of renewable energy projects can contribute to improved waste management practices, including the use of biomass from waste for energy generation[51].

Local Flexibility Markets and electricity services for local flexibility markets

Bulgaria is also moving towards a decentralised and sustainable energy system, with a growing number of solar PV installations and energy storage systems. Local flexibility markets are becoming increasingly important in Bulgaria as a solution to better integrate these resources into the grid and ensure efficient usage.

Currently, there are several pilot projects underway in Bulgaria to test local flexibility markets, including incentivising local businesses and households to reduce electricity consumption during peak periods, and developing a platform for small-scale electricity producers to sell excess energy to nearby consumers.

These projects aim to increase the reliability and resilience of the Bulgarian electricity grid by allowing local resources to provide grid services and support the growth of renewable energy. In addition, Bulgaria's electricity system operator, ESO, has implemented a Virtual Power Plant project that integrates distributed renewable energy resources and storage systems into the grid. This project is expected to improve the grid's stability and security, while also reducing energy costs for consumers.

The Bulgarian government has also launched a national initiative to promote the use of electric vehicles and install charging stations throughout the country. The country's Energy Act allows for the participation of electricity consumers in the balancing and ancillary services markets, promoting the integration of decentralized resources into the grid.

Furthermore, the Bulgarian Energy and Water Regulatory Commission has issued guidelines for the operation of virtual power plants, providing a regulatory framework for the aggregation and optimisation of distributed energy resources.

[50] https://biodiversity.europa.eu/countries/bulgaria
[51] https://ec.europa.eu/environment/pdf/waste/framework/BG_factsheet_FINAL.pdf

3.6 Romania

Romania, a member state of the European Union, has been making significant efforts towards developing a sustainable energy sector. In recent years, the country has experienced a remarkable expansion in renewable energy, with the sector contributing to over 45% of the country's electricity consumption. The Romanian government has set a goal of generating 30% of its energy from renewable sources by 2030, with additional targets for energy efficiency and greenhouse gas reduction. However, the target will rise as the European Parliament proposed a new EU-wide target of at least 40% to be met by all Member States by 2030.

Despite the significant progress in the renewable energy sector, Romania still faces challenges related to policy, financing, and infrastructure. The country's energy mix is still heavily reliant on fossil fuels, particularly coal, which accounts for around 20% of its electricity generation. The energy market has too many electricity producers, most of which are state companies. A national strategy is needed in the areas of the circular economy and building practices[52].

Additionally, the government's support for renewable energy projects has been inconsistent, with frequent changes in the regulatory framework, which has led to a lack of investor confidence.

The country has committed to reducing its greenhouse gas emissions by 30% below 1990 levels by 2030 as part of its contribution to the EU's climate targets under the Paris Agreement. Romania has also developed a climate plan to reduce its greenhouse gas emissions and mitigate the impacts of climate change.

The Plan, known as the **National Integrated Energy and Climate Plan (NECP)**, was developed in line with the European Union's climate targets and sets out a roadmap to achieve these targets, with a focus on increasing the share of renewable energy in the country's energy mix and improving energy efficiency. The NECP also includes measures to support the electrification of transport, reduce emissions in the building sector, and promote circular economy principles.

The implementation of the NECP will be crucial in achieving Romania's climate targets and transitioning to a low-carbon economy as some of the goals include:

I. Increasing the share of renewable energy in the final energy consumption to 30.7% by 2030. This will involve significant expansion of the renewable energy sector, particularly wind, solar, and hydropower.

[52] https://www.sgi-network.org/2017/Romania/Environmental_Policies

II. Generating 43% of its electricity from renewable sources by 2030, up from around 33% in 2020. This will involve increasing the installed capacity of wind and solar power, as well as developing other renewable energy sources such as biomass and geothermal.

III. Improving energy efficiency in buildings, transport, and industry, with a target of reducing final energy consumption by 35.1% by 2030 compared to a baseline scenario.

IV. Accelerating the deployment of electric vehicles and increase the share of sustainable transport modes such as cycling and public transport. The goal is to reduce greenhouse gas emissions from the transport sector by 13% by 2030.

Political

Romania's Energy Strategy 2019-2030 is the country's most recent energy policy document, which sets out the country's priorities and goals for the energy sector, including the development of renewable energy. The strategy aims to increase the share of renewable energy in the final energy consumption to 30.7% by 2030, up from around 24% in 2020. The strategy also sets targets for improving energy efficiency and reducing greenhouse gas emissions (Ministry of Energy, Energy Strategy 2019-2030[53].

Romania is one of the countries that has achieved its proposed target, reaching, according to public data, a share of approximately 27% of green energy in 2019[54].

The Romanian government has implemented a support scheme for renewable energy projects, which provides financial incentives for renewable energy production.

The support scheme includes green certificates, which can be traded on the energy market, and a feed-in tariff system for small-scale renewable energy installations:

- Romania implemented a green certificate scheme in 2005 to incentivise the production of renewable energy. Under the scheme, producers of renewable energy receive green certificates for each MWh of electricity they generate, which can be sold on the open market to electricity suppliers or other obligated entities. The scheme has been successful in driving the development of wind and biomass energy in Romania. Source: Romanian Energy Regulatory Authority (ANRE), Green Certificates.

[53] Romania. Summary of the Commission assessment of the draft National Energy and Climate Plan 2021-2030 (2021) European Commission, https://energy.ec.europa.eu/system/files/2019-06/necp_factsheet_ro_final_0.pdf
[54] https://cms.law/en/int/expert-guides/cms-expert-guide-to-renewable-energy/romania

The National Energy and Climate Plan (NECP): Romania's NECP sets out the country's targets and plans for reducing greenhouse gas emissions, increasing the share of renewable energy, and improving energy efficiency. The NECP includes measures to support the development of renewable energy, such as the deployment of wind and solar power and the improvement of grid infrastructure. The NECP also includes measures to support the electrification of transport and reduce emissions in the building sector (Ministry of Energy, National Energy and Climate Plan)[55].

The National Renewable Energy Action Plan (NREAP) is a plan for the development of renewable energy in Romania, which was adopted in 2010. The plan includes specific targets for renewable energy production, as well as measures for promoting renewable energy development, such as financial incentives and regulatory reforms. The NREAP is based on EU directives and is updated every two years[56].

The Operational Programme for Large Infrastructure is a funding program for large infrastructure projects in Romania, including those related to energy. The programme offers financial support for the development of renewable energy projects, such as wind and solar power plants. The funding can be used for project development, construction, and equipment procurement [57].

The National Environmental Protection Fund (AFM) is a state-owned fund that provides financial support for environmental protection projects, including those related to renewable energy. The fund offers grants and loans for renewable energy projects, energy efficiency improvements, and other environmental initiatives[58].

The National Programme for Energy Efficiency in Buildings (PNEEB) is a programme that aims to improve energy efficiency in the residential sector in Romania. The programme offers financial support for building renovation and energy efficiency improvements, including the installation of renewable energy systems such as solar panels and heat pumps. The programme is financed by the European Union and the Romanian government (Ministry of Regional Development and Public Administration, National Programme for Energy Efficiency in Buildings)[59].

[55] https://www.enpg.ro/the-draft-of-the-romanian-national-energy-climate-plan-2021-2030/
[56] (https://www.climatepolicydatabase.org/policies/national-renewable-energy-action-plan-nreap-20).
[57]https://www.gov.ro/en/print?modul=stiri&link=the-event-of-signing-the-decision-approving-the-operational-programme-large-infrastructure-poim-2014-2020#null
https://maritime-spatial-planning.ec.europa.eu/fundings/operational-programme-large-infrastructure-poim
https://www.afm.ro/sisteme_fotovoltaice.php
[58] https://www.cleanenergywire.org/experts/environment-fund-administration-afm-romania
[59] https://www.romania-insider.com/new-romanian-govt-program-energy-efficiency-buildings#:~:text=program%20to%20boost%20energy%20efficiency%20of%20at%20least%204%2C000%20buildings,-20%20October%202022&text=The%20Romanian%20Government%20aims%20to,improved%20thermal%20insulation%20and%20rehabilitation,
https://oportunitati-ue.gov.ro/programul-national-privind-cresterea-performantei-energetice-a-blocurilor-de-locuinte/

The Energy Performance of Buildings Directive (EPBD) is an EU directive that requires member states to improve the energy performance of buildings. The directive sets out minimum energy efficiency standards for new and existing buildings and requires member states to develop national plans for improving the energy performance of their building stock. Romania has implemented the EPBD through the Energy Efficiency Law and the National Program for Energy Efficiency in Buildings (European Commission, Energy Performance of Buildings Directive)[60].

But Romania has not adopted a national air pollution control programme under Directive (EU) 2016/2284 on reducing national emissions of certain atmospheric pollutants [61].

The National Plan for Energy and Environment provides funding for renewable energy projects and aims to create 6,000 new jobs in the sector by 2023[62].

The energy poverty affects many households in Romania, particularly in rural areas:

- The Prima Casa programme provides financial support to first-time homebuyers, which can be used to install energy-efficient heating systems or other energy-saving measures. The program is funded by the state budget and has a budget of €1.2 billion for the period 2020-2021[63].

There are several initiatives aimed at educating the public about renewable energy, such as **the Green School** programme, which provides educational resources and activities related to renewable energy and sustainability for primary and secondary schools. The programme is funded by the Ministry of Environment, Waters and Forests and has been implemented in over 500 schools across the country[64].

Economic

Domestically, the decarbonisation of the energy sector is largely based on the support provided by the EGD, although local renewable energy solutions have the potential to drive decarbonisation for Romania's energy sector, so long as public initiatives are synchronised with business intentions. Nevertheless, the energy market in Romania is competitive, with too many electricity producers. Most producers are state companies, and many household consumers are covered by regulated tariffs. Consequently, Romania performs very well for greenhouse gas emissions, at 4.09 metric tonnes per capita[65].

[60] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en
[61] https://www.sgi-network.org/2017/Romania/Environmental_Policies
[62] Planul National Integrat in domeniul Energiei si Schimbarilor Climatice 2021-2030 (Februare 2021) (in Romanian), http://energie.gov.ro/wp-content/uploads/2022/10/Anexa-HG-PNIESC.pdf
[63] http://primacasa.gov.md/#:~:text=Marja%20maxim%C4%83%2C%20aplicat%C4%83%20pentru%20credite,Cas%C4%83%E2%80%9D%20va%20constitui%203%25
[64] https://www.repf.ro/
[65] https://www.sgi-network.org/2017/Romania/Environmental_Policies

Romania has seen a significant increase in investment in renewable energy in recent years, with the total investment in renewable energy projects reaching €6.5 billion in 2020, up from €5.5 billion in 2019. This represents a 19% increase in investment in just one year (Energynomics).

On another hand, the renewable energy projects are exempt from VAT on the sale of produced electricity nationwide, as well as on the purchase of goods and services related to the production of renewable energy.

Companies that invest in renewable energy projects are eligible for a 50% deduction on their income tax liability for the first year of operation of the project.

Renewable energy projects are exempt from property tax for a period of 5 years from the start of operation.

Renewable energy equipment and components are subject to a reduced customs duty rate of 0% or 5%, depending on the type of equipment.

Romania has seen a significant increase in investment in renewable energy in recent years, with the total investment in renewable energy projects reaching €6.5 billion in 2020, up from €5.5 billion in 2019. This represents a 19% increase in investment in just one year (Energynomics). Furthermore, the government estimates that Romania could receive up to €16 billion from EU Recovery and Modernisation Funds by 2030 allowing upgrades in its energy sector.

The Green Certificate System in Romania is designed to incentivise renewable energy production by providing financial support to producers of green energy. The value of green certificates has fluctuated over the years, but the current value is around €31 per certificate.

Social

There have been cases where local communities have opposed the construction of wind farms and other renewable energy projects due to concerns about noise pollution, visual impact, and other factors. To address these concerns, the Romanian government has implemented policies aimed at increasing community involvement and consultation in renewable energy project development.

Renewable energy projects undergo an environmental impact assessment (EIA) and a public consultation process before being approved (European Environment Agency).

The renewable energy sector employed around 47,000 people in 2019, up from around 42,000 in 2018 (Eurostat). The government has also implemented the policies aimed at promoting the development of the renewable energy sector, which can help to create new jobs and attract investment.

The Romanian government has implemented a few measures to promote energy efficiency, which can help to reduce energy costs and increase competitiveness. One example is the "Casa Verde" programme, which provides financial support to homeowners who invest in energy efficiency improvements, such as insulation or heating system upgrades. The programme is funded by the Environmental Fund Administration and has a budget of €40 million for the period 2020-2023 [66].

Romania has access to European funding for renewable energy projects through various EU programmes, such as the European Structural and Investment Funds (ESIF) and the European Green Deal Investment Plan. These programmes provide grants and loans for renewable energy projects, which can help to reduce the financial burden on investors and encourage the development of the renewable energy market[67].

Technological

The integration of renewable energy sources into the power grid requires modernisation of the grid infrastructure. Romania has been investing in the modernisation of its grid infrastructure to facilitate the integration of renewable energy sources. In 2019, the Romanian electricity transmission company Transelectrica invested €62 million in the modernisation of the national power grid (Transelectrica).

Romania has also been investing in energy storage solutions, including batteries, and pumped hydro storage. In 2018, Hidroelectrica, the largest electricity producer in Romania, announced plans to build two pumped hydro storage plants with a total capacity of 400 MW (Hidroelectrica).

The country has introduced several initiatives to support research and development in renewable energy, including the Research and Innovation Programme for Renewable Energy, which is funded by the European Union (European Commission).

Digitalisation can improve the efficiency and reliability of renewable energy systems. Romania has been investing in digitalisation technologies for renewable energy systems. For example, in 2019, the Romanian solar energy company Renovatio Group implemented a block chain-based platform to track renewable energy production and distribution (PV Magazine).

Legal

Through Law 220/2008, introduced a support scheme to promote electricity from certain renewable sources (giving renewable energy producers an additional gain supplementary to the energy sold on the market:

[66] https://casaverde.ensys.com.ro/
[67] https://commission.europa.eu/funding-tenders/find-funding/funding-management-mode/2014-2020-european-structural-and-investment-funds_en

- **This has recently been amended meaning** public authorities with competence for authorisation, certification and licensing procedures applying to power plants and associated transmission and distribution networks are obliged to issue authorisations, certificates and licenses on the basis of specific procedures developed in accordance with the principle of proportionality and the principle of **energy efficiency first**[68].

The Energy Efficiency Law (121/2014) aims to improve energy efficiency in Romania by promoting energy saving measures and the use of efficient technologies. The law sets targets for reducing energy consumption in buildings, transport, and industry, and requires energy audits for large companies. The law also establishes a fund for financing energy efficiency projects[69].

But despite improvements and commitments made to tackle carbon emissions by the Romanian government, Romania's environmental authorities have been accused of failing to collect accurate data on air pollution in the country, fearing sanctions by the European Union.

Law on Electricity and Natural Gas (123/2012) is the main legislation governing the energy sector in Romania. The law sets out the conditions for the production, transmission, and distribution of electricity and natural gas, including those related to renewable energy. The law also establishes the framework for market liberalization and consumer protection.

The National Energy Regulatory Authority (ANRE) is responsible for granting connection permits for renewable energy projects, but the process can be lengthy and complicated. In 2019, a new grid code was introduced to simplify the connection process and reduce bureaucracy[70].

Renewable energy projects in Romania must also comply with environmental regulations. The Environmental Protection Agency (APA) is responsible for issuing environmental permits for renewable energy projects, and these permits can be subject to public consultation and scrutiny. The process can be time-consuming and costly but is designed to ensure that renewable energy projects are developed in an environmentally responsible manner.

Romania is a member of the European Union and is therefore subject to EU regulations and directives related to renewable energy. The EU's Renewable Energy Directive sets a target for renewable energy to make up at least 32% of final energy consumption in the EU by 2030, and Romania has its own national target of 27% (European Commission).

[68] https://cms-lawnow.com/en/ealerts/2023/01/romania-takes-further-steps-to-promote-renewable-energy-use
[69] [Law on energy efficiency 121/2014 Romania]LEGE pentru modificarea si completarea Legii nr. 121/2014 privind eficienta energetica (19.07.2016), Parlamentul Romaniei (in Romanian), https://www.climate-laws.org/geographies/romania/laws/law-on-energy-efficiency-121-2014#:~:text=The%20main%20objective%20of%20the,reducing%20energy%20consumption%20by%2019%25
[70] https://www.anre.ro/upload/docs/application/pdf/cod_retea_2020_v2.pdf

The main legal framework for environmental protection in Romania is the Environmental Protection Law (Law 137/1995), which sets out requirements for environmental impact assessments, permits, and monitoring.

Environmental

Renewable energy sources are considered a key element in Romania's efforts to reduce greenhouse gas emissions and combat climate change.

The development of renewable energy projects in Romania must comply with a range of environmental regulations, including those related to impact assessments, permits, and authorisations.

The main legal framework for environmental protection in Romania is the **Environmental Protection Law (Law 137/1995),** which sets out requirements for environmental impact assessments, permits, and monitoring. In 2018, a major wind energy project in the Danube Delta was cancelled following protests by environmental groups concerned about the impact on the area's unique biodiversity.

Romania has also made efforts to promote the use of electric vehicles to reduce emissions and improve air quality.

Local Flexibility Markets and electricity services for local flexibility markets

Romania is currently exploring the potential of local flexibility markets and electricity services to optimise the integration of renewable energy sources and improve the efficiency and reliability of the electricity grid.

One project underway is the Smart Energy System pilot programme in the city of Cluj-Napoca, which aims to demonstrate the benefits of local flexibility markets and provide a platform for the integration of distributed energy resources, such as solar PV and battery storage.

Additionally, the Solar Bankability project is assessing a framework for assessing the bankability of solar energy projects in Romania, with a focus on identifying ways to increase the flexibility and profitability of these projects. The implementation of local flexibility markets in Romania can help to reduce the need for expensive grid infrastructure investments, improve the grid's stability, and reduce greenhouse gas emissions.

To this end, Romania's **National Energy Regulatory Authority** has developed new regulations to facilitate the integration of distributed energy resources into the grid, enabling small-scale producers to sell their excess energy to the grid at market prices. The implementation of these regulations, coupled with the ongoing pilot projects, represents a major step towards a more sustainable and

flexible energy system in Romania. In addition to the above projects, Romania is also focusing on developing electricity services to support local flexibility markets.

One key initiative is the deployment of smart meters across the country, which will provide consumers with real-time information on their energy consumption and enable them to adjust their usage accordingly.

The Romanian government has also launched the **Renewable Energy Incentive programme**, which provides financial support to households and small businesses for the installation of renewable energy systems, such as solar PV and geothermal systems. This programme aims to increase the uptake of renewable energy and stimulate the growth of the local clean energy sector. Another notable project in Romania is the SmartCity Brașov initiative, which includes the installation of smart energy systems in public buildings, such as schools and hospitals, to improve energy efficiency and reduce costs. The project is also exploring the potential for integrating electric vehicles into the energy system to provide grid services and reduce carbon emissions.

Overall, Romania's focus on local flexibility markets and electricity services represents a promising step towards a more sustainable and flexible energy system.

3.7 France

France, as one of the most important and environmentally conscious EU Member States, has always put a lot of scope into delivering on its commitments towards achieving the highest rates of sustainability satisfaction amongst all EU-27 Member States.

The French population is among the most concerned European group regarding climate change and environmental impacts of the economy and their day-to-day lives. According to the recent European Social Survey, the French people believe they have the highest-level personal responsibility towards creating a more equitable and sustainable future for all.

France is a world sustainability initiative leader as the country is consistently ranked as one of the most sustainable countries in Europe and globally. This is due to the importance placed on green initiatives promoted by the government and the public, having given France’s open-minded approach to rethinking unsustainable infrastructure and practices and making them better. As a host of the COP21 and the Paris Agreement roundtable, France is widely seen as the frontrunner in energy transition by the international community.

France endeavours to be sustainable in every aspect of its economy e.g., finance. Over the last two decades, banks across France have emerged as leaders in sustainable and climate finance. This includes consumer banks such as BNP Paribas[71], as well as corporate investment banks such as Credit Agricole (Sustainable Banking, Crédit Agricole CIB).

In 2020, France has been ranked fourth worldwide on global sustainability index. This is based on factors such as government policy and citizen actins within the country, while France does extremely well when it comes to tackling pollution, it ranks 45th in terms of sustainability policies. As part of the EU France has a goal to achieve carbon neutrality by 2050, which experts have speculated will be a small defeat for France.

Political

Since the IEA (International Energy Agency) last reviewed French energy policies in 2021[72], the government has made significant steps towards strengthening domestic climate action agenda as to achieve the net-zero carbon economy by 2030. In 2020, the French government updated the **National Low-Carbon Strategy (SNBC**) and **France's Multi-Year Energy Plan (PPE)** as this, lined up the roadmap for years 2019-2023 and 2024-2028. The roadmap became one of the most important and actionable steps for France as to meet its energy independence. The government has increased awareness of the need for climate action and has worked to strengthen its governance. This is why, France created the High Climate Council [Haut Conseil pour le Climat] in 2019 [73] as to lead the French government on the delivery of public measures and policies aiming at reductions in France's GHG emissions.

Ever since the French government announced its stance on climate, this, is facing crucial decisions about its future energy mix due to climate change and the escalation of the war in Ukraine. Historically, France has benefitted from decarbonised electricity based on clean nuclear power but is now putting more scope and implements its nationwide decarbonisation framework (Ministry of Economy, France) championing renewable energy sources.

In October 2022, France unveiled its plan to achieving the sobriete enegetique[74] also known as energy sobriety. The country aims to reduce energy consumption by 10 per cent by 2023, and 40 per cent by 2050 by using key measures. This is followed by a series of recommendations and laws from other EU Member States looking to reduce their dependency on Russian hydrocarbons.

[71] *Sustainability and BNP Paribas: revisit the milestones so far in 2022 - BNP Paribas (group.bnpparibas)*
[72] *France 2021 – Analysis - IEA*
[73] Haut Conseil pour le Climat (hautconseilclimat.fr
[74] Sobriété énergétique : un plan pour réduire notre consommation d'énergie | Ministères Écologie Énergie Territoires (ecologie.gouv.fr

The French energy mix is evolving rapidly through the development of onshore wind and solar power capacities, while hydropower remains predominant with over 25GW installed and 50% of renewable production capacity. Hydropower will stay until 2030 (France Country Profile, International Energy Agency).

Offshore wind is benefitting from political support and is on good track of upscaling further towards achieving larger deployment capacities in a near future. There are a few projects that should be stated and which, solely focus on offshore wind in France such as Fecamp (498MW), Courseulles-sur-Mer (450W) and Saint-Nazaire (480MW), followed by Saint-Brieuc (500MW).

In February 2022, President Emmanuel Macron in his speech in Belfort[75] set out the **French Energy Strategy based on the three pillars:**

i. Sufficiency.
ii. Renewables.
iii. Nuclear Energy.

Furthermore, in a speech in July the same year, Prime Minister Elisabeth Borne[76] promised some of the most radical responses to the climate emergency. Therefore, they were setting the new French government's environmental priorities and transitioning them towards climate and energy.

Although there has been a substantial progress made in recent years, France was the only European country to have missed its 2020 renewable energy targets and has been fined €500 million for falling short on them (France to pay up to €500m for falling short of renewable energy targets (lemonde.fr).

As to improve on its renewable energy deployment, especially in the Local Flexibility Markets' context, France lined-up a draft law on the acceleration of the use of renewable energies[77].

Following some of the latest French energy regulatory changes, the energy efficiency in France improved by an average of 2% year on year between 2000 to 2019 (France 2021 Analysis, International Energy Agency).

The industrial sector has seen a steady progress and larger than 2% gains to other sectors despite the ongoing economic crisis. This trend is because of the policies and legislations affecting buildings and appliances domestically. During this period, the pace of energy efficiency steadily improved in the transportation and public services sectors as witnessed a growth of 0.9% and 0.7% per year respectively for both since 2000. But the industry progress reached 0.9% per year. Although, since 2016 there has been a slowdown of progress at the global level and specifically for industry and services sector that also impacted the French industrial decarbonisation ambitions.

[75] France to build up to 14 new nuclear reactors by 2050, says Macron | France | The Guardian
[76] French PM Borne lays out roadmap in government policy statement (lemonde.fr)
[77] Energy Laws and Regulations | France | GLI (globallegalinsights.com)

France adopted its third **National Energy Efficiency Action Plan (NEEAP)** following the EU Energy Efficiency Directive (2012/27/EU)[78] which set a final consumption target of 131.4 Mtoe for the period of 2020. The energy saving measures were expected to save 20.5 Mtoe in 2020. In 2015 the Energy Transition Act introduced a provision aimed to energy consumption between 2012 and 2050 down, as part of the Transition Act, building renovations will be mandatory by 2025 for high energy consumption buildings (specifically consumption of over 330kWh/m2). The government body institutions will need to renew their vehicle fleet with low- emission-run alternatives very soon. In 2005 the Energy Law was implemented, which was meaning energy savings obligations for energy companies, with the possibility of trading energy savings certificates. The energy savings target was 2133 TWhc (Cumac), meaning lifetime discounted cumulative savings.

The 2021-2030 Integrated National Energy and Climate Plan (NECP) targets[79] a 32.6% improvement of energy efficiency compared to the European baseline scenario (PRIMES 2007, primary energy consumption baseline) corresponding to the final energy consumption target of 120.9 Mtoe in 2030.

Economic

A more competitive electricity retail market[80] is slowly emerging in France, with many electricity suppliers offering market deals to French consumers, some below regulated tariffs.

In October 2021, France announced a €30 billion investment plan for 2030[81]. The France's new investment ambition is addressed at the industrial development in the energy, automotive and space sectors, €8 billion would be allocated to the energy technology investment to decarbonise the industry, while €4 billion would be allocated to the development of electric and plug-in hybrid vehicles' nationwide development.

In the energy sector, the actions are implemented by two successive five-year energy investment plans:

i. La programmation pluriannelle de l'energie.
ii. PPE.

Building on the SNBC and PPE, the selected regions are implementing their own climate and energy transition goals under the regional plans for spatial planning, sustainable development, and equalities funding strategies, including a wide renewable energy deployment, as well as greater Local Flexibility Market deployment that goes in line with the **French Electricity Security Policy**[82].

[78] EUR-Lex - 32012L0027 - EN - EUR-Lex (europa.eu)
[79] FR_Final_NECP_main_EN.docx (europa.eu)
[80] Retail electricity market - CRE
[81] France 2030 : un plan d'investissement pour la France | economie.gouv.fr
[82] France Electricity Security Policy – Analysis - IEA

The wind energy in France is available locally and does not need to be imported from other countries. Its competitiveness and dependence are thus partially relying on the market prices of fossil fuels which also saves money for the government and the domestic consumers. According to the government estimates, the wind energy was set to contribute €8 billion to the France's state revenue in 2022 - 2023. However, the government reported that it secured the revenue of $31 billion dollars in Windfall tax from renewable energy firms in the last two years and will continue doing so through 2023[83].

Under the government-backed Contracts for Difference (CfDs)[84] scheme, this contract states that the project developer pays the government the difference between state guaranteed purchase price of electricity and the wholesale electricity market price which is currently high due to the war in Ukraine. As more wind energy continues to develop and be deployed where savings will increase.

A major actor in the French energy transition, Caisse d' Epargne CEPAC, has announced the signing of a €350 million financing package[85], with the European Investment Bank (EIB), dedicated exclusively to financing solar and wind projects. However, this should be watched as there is the likelihood that the project will receive more funding after full utilisation.

As part of the **French 2030 National Investment Plan**[86] the French government will invest EUR 1 billion in renewable energy-related innovation projects. The eventual aim is to increase the renewable power installed capacity by ten times by 2050, up to 100 GW. Thus, the offshore wind capacities are expected to represent more than 40% of the given 100GW capacities to be commissioned by 2050.

In the transportation and the building sectors, France already levies a carbon tax [87] as part of its Energy Taxation Plan priced at €44/tonne of CO2. However, carbon pricing cannot be done without policies, the social appearance of additional taxes reached a limit as the protest on 2018-19 showed, when excise taxes on motor fuels and the related carbon components both increased during a period of high oil prices.

The France 2030 Programme is composed of the strategic investment support mechanisms[88] including:

I. EUR 8 billion allocated for the energy sector to develop small nuclear reactors (€1 billion), green hydrogen (€1.9 billion), and decarbonise industry (€5.6 billion).
II. EUR 4 billion to produce nearly two million electric and hybrid vehicles (€2.5 billion) and low-carbon airplanes (€1.2 billion).
III. France Excise tax list.

[83] France to Reap $31 Billion Windfall From Renewable Energy Firms - Bloomberg
[84] The French contract for difference / foreign exchange market is relatively young, but very dynamic | Contracts-For-Difference.com
[85] France: Energy transition - Caisse d'Epargne CEPAC and EIB sign major partnership agreement
[86] Presentation of the "France 2030" plan - Business France
[87] 'In France, the current carbon tax system still overly favors restraint over cooperation' (lemonde.fr)
[88] France - Corporate - Other taxes (pwc.com)

Social

Following the fact that the French public has the highest rate of personal responsibility held for creating a sustainable future, with 71 % believing that Russian's invasion of Ukraine and the consequences of the war should accelerate the green transition in France.

But despite the energy inflation crisis, nearly a half (47%) of French citizens consider climate change to be the biggest challenge the country is facing (this is an 8-percentage increase compared to the 2022 prognoses). While 89% say that 'if they do not drastically reduce our consumption of energy and goods soon, then we will be heading for a global catastrophe'. Although there was a nationwide uproar about the excite tax as 68% of people are in favour of heavily taxing of highly polluting goods and services such as sport utility vehicles (SUVs) and air transport, while 63% are in favour of indexing energy prices to the level of consumption per household. As to support this, the French government has recently banned the short-haul domestic flights in France and develop the railway infrastructure that will offset the lost flight capacities.

On another hand, the renewables sector, in particular wind and solar has seen a dynamic growth in jobs and investments under the SNBC, which is projected to accelerate with the creation of 300,000 – 500,000 new jobs by 2030 and 800,000 by 2050, boosted by investments in transport, buildings, and energy.

But the domestic concerns over climate change effects rise in France come right after inflation and are increasing rapidly (47% now consider it to be the biggest challenge compared with 39% in 2021. This figure is particularly high amongst French people aged 65 and over which is 58% up from 15% in 2021. Finally, 80% of French citizens no say they feel the effects of climate change in their daily lives this figure also increased 9% from 2021.

Also, France has promoted green finance and a green budgeting approach across government, aligning national expenditures and revenue processes with climate and other environmental goals[89].

A citizen convention on the climate, **Convention Citoyenne pour le Climat** (The Citizen Convention on the Climate) launched in 2019, created a people's assembly of 150 randomly selected citizens. Their task is to overhaul environmental laws, introducing the policies by the French people rather that getting it imposed on them by the government. It is this people-first approach that has allowed France to smoothly integrate green and environmental goals into its Covid -19 economic stimulus program. Also, Plan de relance (**Plan de relance**, the French government) explicitly addresses both, ecological sustainability and economic justice and allocates 30% of stimulus fund to the green projects, including the development of the clean transportation, energy efficiency, youth reskilling and decarbonisation.

[89] Financing: a key issue in the fight against climate change - Ministry for Europe and Foreign Affairs (diplomatie.gouv.fr)

According to the Mayor of Paris' office and the French government, there are 26,400 employees occupying strictly green-focused roles in the Paris Metropolitan Area only as those roles are focused on the production and the distribution of energy and water resources for Paris. Respectively, 19% of all green occupations in France are found in the Paris region.

The French Energy Minister, Pannier-Runacher said in October 2022 that nearly 800 million euros has been set aside to help people to reduce their energy use including up to €9,000/household in subsidies to help the switch from gas boiler to more energy efficient heat pumps [90].

Technological

France has a highly skilled energy industry, which can be the backbone for a resilient economic recovery supporting the net-zero ambitions set by the government. The nuclear and the oil and gas sectors are reportedly accounting for most of the energy-related employment today in the French energy sector (France OECD Data).

In March 2022, the French Prime Minister announced the launch of two floating wind farm projects in the Mediterranean coast of metropolitan France as the government launched its first Floating Offshore Wind Tenders [91].The two floating wind farms, with a capacity of approximately 250 MW each will be completed later with two extensions of 500 MW each.

The France 2030 Investment Plan[92] which budget provisions were voted by the French National Assembly, has been granted with €34 billion of financial pledge, including €30 billion in subsidies and €4 billion in funding schemes to be deployed over 5 years. There was also €3.5 billion allocated for the year 2022, of which €22.84 billion in grants, and €0.66 billion in equity investments.

These are France's investment in technologies. On February the 10th 2022 additional provisions[93] **were unveiled and are as follows:**

I. France will be cutting energy consumption by 40%, through building renovation, the renewal of the domestic vehicle fleet and the decarbonisation of the industry.

II. The construction of six new nuclear reactors EPR 2, for 25 GW. The lifespan of the reactors has been extended to over 50 years each.

III. Investments in renewable energies worth of €1 billion. The installed renewable power capacities will increase ten times by 2050 up to 100 GW since the 2022 measures. Thus, 40GW will be covered by offshore wind farm capacities.

[90] France launches energy savings push to avoid winter power cuts | Reuters
[91] France Launches Floating Offshore Wind Tenders | Offshore Wind
[92] France 2030: un plan d'investissement pour la France | economie.gouv.fr
[93] France 2030" Investment Plan – Policies - IEA

IV. Additional funding of €1.9 billion has been allocated for the hydrogen sector as part of the France 2030 Investment Plan framework. The funding will go towards the development of decarbonised hydrogen technologies, in line with France's ambition to become a leader in green hydrogen production and decarbonise its industry sector.

Legal

To keep on track with its 2050 Net-Zero commitments, France intensified works on the new policies and legislations unlocking country's energy and local flexibility market's potential (Valarezo et al, June 2021).

In March 2022, The Ministry of Ecological Transition Published a Decarbonisation Roadmap [94] for the chemicals sector. The document highlights the progress that has been made in the sector, its future needs and emissions, and ways for the sector to reduce its carbon emissions. This also sets a new emission reduction target of 26% by 2030, compared to 201 which is seen by the experts as a big chance for the developments in the hydrogen sector.

The goals highlighted in the roadmap[95]:

I. Improving energy efficiency (-1.8 MtCO2 e.g., reduction of Annual GHG emissions between 2015 and 2030).
II. Reducing nitrous oxide (N2O) (-0.8 MtCO2).
III. Reducing hydrofluorocarbon (HFC) emissions (-0.9 MtCO2).
IV. Producing low-carbon heat (-1.4 MtCO2 e.g., for heat from biomass and -0.8 MtCO2 e.g., for heat from Solid Recovered Fuel - SRF).

Also, the Roadmap encourages competitive and predictable access to low-carbon electricity, while providing incentives for energy efficiency, including:

- Tools to support competitive low-carbon energy supply for industry.
- Extending and securing the interruptible and tariff reduction mechanisms of the public electricity network.

It is also set for implementing compensation of indirect costs of the ETS scheme for the period 2021-203, and encouraging a favourable energy tax system that will improve electrification.

Pursuant to **Article L. 134-3 et L. 431-6-II of the Energy Code (Code de l'Énergie)** [96], the natural gas transmission network operators must submit annual investment programmes to the **Energy Regulation Commission** (Commission de Régulation de l'Énergie) for approval.

[94] Decarbonisation roadmap for the chemicals sector – Policies - IEA
[95] 2021.05.07_Annexe_au_cp_feuille_de_route_decarbonation_chimie.pdf (ecologie.gouv.fr)
[96] Hydrogen law and regulation in France | CMS Expert Guides

This aims to ensure investments are in line with:

i. The energy security objectives,
ii. A proper development of storage facilities,
iii. A transparent and non-discriminatory access for all users
iv. The lowest possible costs for users. Investments cover new facilities, regional works, renovation plans, integrity, and security improvements as well as methane emissions reduction programmes.

Following the International Energy Agency (IEA)'s report from 29 April 2022, the regulated entity Storengy also sent its **2022 Investment Programme** on October 2021 for approval

In April 2021, a regulated entity GRTgaz sent its 2021 Investment Programme on November 2020 for approval[97] by the Energy Regulatory Commission. **This included a programme to reduce its methane emissions by 67% by 2030, based on the following four lines of action:**

I. Reduction of fugitive leaks from vents (improvements on seals and isolation valves).
II. Recovery of gas from depressurization (recompression or cogeneration).
III. Management of leaks from compressor packing systems (sealing improvements).
IV. Prevention of faults and accidents that could generate untimely safety constraints and lead to gas venting.

Respectively, the **Article L. 421-7-1 of the Energy Code (Code de l'Énergie)[98]** states that the operators of underground natural gas storage facilities must submit annual investment programs to the Energy Regulation Commission (Commission de Régulation de l'Énergie) for approval.

This aims to ensure investments are in line with:

v. The energy security objectives,
vi. A proper development of storage facilities,
vii. A transparent and non-discriminatory access for all users
viii. The lowest possible costs for users. Investments cover new facilities, regional works, renovation plans, integrity, and security improvements as well as methane emissions reduction programs.

Following the International Energy Agency (IEA)'s report from 29 April 2022, the regulated entity Storengy also sent its 2022 Investment Program on October 2021 for approval[99] following GRTgaz's lead on the matter. **This included a programme to reduce its methane emissions by 25% by 2025, targeting the operator's main emission sources:**

[97] Deliberation by the Energy Regulation Commission of 21 January 2021, approving GRTgaz's investment program for 2021 – Policies - IEA
[98] Hydrogen law and regulation in France | CMS Expert Guides
[99] Deliberation of the Energy Regulation Commission of 20 January 2022, approving Storengy's investment program for 2022 – Policies - IEA

I. 45% from operational emissions (35% vented from compressor systems).
II. 35% from maintenance activities.
III. 20% from fugitive emissions (5% from accidental leaks).

GRTgaz estimated this programme would prevent the emission of 25kt of CO2 equivalent per year between 2020 and 2050, which would represent a cost of between €79 and €53 per tonne of CO2e (considering the expected lifespan of the assets involved).

The Energy Regulation Commission approved the expenses related to the most mature actions (elimination of fugitive leaks from vents and reduction of faults and accidents) as well as those aimed at testing new technologies (improvements at compression stations):

- Detection and reporting: developing a system for measuring emissions, including metering equipment (€1.4 million for 2022-2025, €0.2 million in 2022),
- Reduction of venting: use of mobile flares or gas recovery systems; potential implementation of a double valve system to limit vented volumes from equipment subject to regular maintenance (€7.3 million for 2022-2025, €0.6 million in 2022),
- Reduction of emissions from compressors: replacement of used seals and upgrade of sealing systems (€3.5 million for 2022-2025, €1.2 million in 2022).

The French Energy Regulation Commission approved the investment in the methane emissions reduction programme submitted by Storengy for a total budget of €2.0 million in 2022. However, the anticipated emissions quota does not fall within the EU Emissions Trading Scheme (ETS)'s emissions scope. This follows the previous experience with similar projects presented by other major French Transmission System Operators, GRtgaz and RTE as the assessment based on the total cost of emissions avoided with the negative value of CO2, estimated at €250/t.

As part of the **French Resilience and Recovery Plan**[100], the French government allocated specific measures to foster green mobility and strengthen the resilience of the energy system. Among these measures, investments in electric grids in rural areas will increase to enhance resilience towards extreme climate events (heatwaves, storms, floods) and towards energy transition (renewable electricity and storage technologies). Overall, €50 million will be allocated to this goal between 2021 and 2026.

The French government granted €295 million to the automotive sector as to support its recovery post Covid-19 crisis. A €5 billion state-guaranteed loan was also extended to the Renault company being one of the largest French automotive producers. An investment fund was created to ensure the financial sustainability of the industry, with BPI France, the state, and two companies (Renault and

[100] French Recovery Plan | Agence France Trésor (aft.gouv.fr)

PSA) as main holders (€100 million per stakeholder). The total available financial support for supply chain companies in the automotive sector will amount in up to €600 million for all contracts.

An additional funding scheme will support future investments to modernise the auto industry, subject to hydrogen technology-based production and production requirements for electric vehicles (EV), with €200 million that was made available in 2020.

On September 26, the French government published its first State Budget, as an **Annex to the 2021 Finance Bill** (**The State Budget**). This event attests to France's strong commitment, notably under the OECD-led **Paris Collaborative on Green Budgeting** (Joined by France in December 2017) [101] to integrate green tools into the national budget process.

Building on the methodology outlined in late 2019 by two State inspection bodies - the General Inspectorate of Finance (IGF) and the General Council for Ecology and Sustainable Development (CGEDD), the Green Budget has four core characteristics making it the most comprehensive worldwide up- to-date:

- Provides an assessment of the green impact of all State budget expenditures,
- Covers tax expenditures,
- Reflects not only concerns related to climate change, but also other environmental issues such as biodiversity and the fight against pollution,
- Rates not only expenditures favourable to the environment but also expenditures with a negative impact.

Published by the French government on the 26 September 2020 **Green Budget**[102] concludes that out of a total of €574.2 billion in budgetary spending and tax expenditures, €52.8 billion has a direct impact on the environment (consisting of €41.8 billion in budgetary expenditure).

The main milestones lined-up in the Green Budget are as follows:

- €38.1 billion is favourable to the environment on at least one environmental criterion.
- €4.7 billion is favourable to the environment on at least one criterion but has negative effects on one or more other criteria, mainly in the railways for the transport infrastructure.
- €10bn is unfavourable on at least one environmental criterion without having any favourable impact, mostly tax expenditures (€7.2bn in the fuel tax).

[101] Paris Collaborative on Green Budgeting - OECD
[102] France's "Green Budget" for 2021 (imf.org)

Environmental

As part of the France 2030 National Investment Plan, the French government will invest EUR 1 billion in renewable energy innovation projects. The eventual aim is to increase the renewable power installed capacity by ten times by 2050, up to 100 GW. Offshore wind farms will represent 40 GW of this installed capacity for France and the French overseas territories.

In the framework of its **Economic and Social Resilience Plan**, the French government is investing EUR 50 million to retrofit its public buildings to make them more energy-efficient and reduce their gas consumption.

The Law on Energy Transition for Green Growth (Energy Transition Law)[103] sets the following targets:

I. Greenhouse gas emission (GHG): -40% between 1990 and 2030 / -75% (factor 4) between 1990 and 2050. The trajectory is detailed in the National Carbon Budgets (Carbon Brief Profile - France).
II. Final energy consumption (France: Energy Country Profile - Our World in Data): -50% by 2050 with respect to 2012, with intermediate target of -20% in 2030.
III. Fossil fuels energy consumption (Fossil fuel energy consumption (% of total - France | Data worldbank.org) -30% in 2030 with respect to 2012.
IV. Renewable energy (Renewable electricity output (% of total electricity output) - France | Data (worldbank.org): target of 23% of gross final energy consumption in 2020, and 32% in 2030.
V. Nuclear energy (Electricity production from nuclear sources % of total - France | Data worldbank.org): share of nuclear energy in electricity production to be brought down to 50% by 2025.
VI. Buildings energy efficiency performance[104] levels to comply with 'low consumption buildings' norms for the entire building stock by 2050.
VII. Waste[105]: reduce by 50% the amount of waste disposed in landfills by 2025, addressing energy poverty issues.

On February 17, 2021, the French Government enacted Ordinance 2021-167[106] related to the hydrogen sector, as foreseen in the National Hydrogen Strategy[107] encompassed in the National France Relance Recovery Plan.

[103] Law no. 2015-992 on Energy Transition for Green Growth (Energy Transition Law) - France - Climate Change Laws of the World (climate-laws.org)
[104] New EPC rating in France: what changes on July 1st, 2021? - Stone and wood
[105] France's Anti-waste and Circular Economy Law (ellenmacarthurfoundation.org
[106] Ordinance 2021-167 related to hydrogen – Policies - IEA
[107] focus-on-hydrogen-eur-7-2-Billion-strategy-for-hydrogen-energy-in-france.pdf (cliffordchance.com)

The legislation sets:

- Clarification of the definition of three types of hydrogen: renewable, low-carbon, and with carbon emissions.
- The definition of two tracking system to certify the origin of the consumed hydrogen.
- A defined framework for the public support of renewable and low-carbon hydrogen, which can take the form of an operational aid, or a combination of operational aid and financial aid for investments,
- The trajectory and the role of transport and distribution networks operators for natural gas if renewable hydrogen was to be injected in those networks.

As part of its Recovery and Resilience Plan, the French government is putting forward its Hydrogen Plan with three priorities:

- Diminishing GHG emissions for the industry.
- Developing heavy hydrogen-focused industry.
- Supporting R&D for training. The aim is to scale at industry-level to reduce production and technology costs. The plan is expected to create 50,000 to 100,000 jobs by 2030.

The Digital and Environment Roadmap[108] sets out a series of measures designed to bring together digital and ecological transition objectives. The measures aim to improve transparency around environmental impacts of digitalisation, to reduce these impacts, and to support innovative solutions that harness digitalisation for environmental improvements.

Several measures were proposed through France's Citizen's Convention for Climate, and many involve the French telecommunications regulatory authority (ARCEP) and the French Agency for Ecological Transition (ADEME). The main targets presented in the roadmap include:

- Working with the major digital economy stakeholders as to formalise codes of good conduct in terms of environmental impact, with the aim of feeding these into EU processes, so they could eventually become legally enforceable.
- An initial framework letter from the government asking the ARCEP to work on ways and means of taking environmental issues into account in the allocation criteria for the next 26Ghz frequency bands.
- Requesting ARCEP to analyse the impacts of the commercial practice of subsidising mobile phones, following the request of the Citizen's Convention for the Climate, to enable the Government to take measures as needed.
- Exemplary public sector procurement, aiming for 20% of telephone and IT equipment to be refurbished or second-hand fixed, and adoption of eco-design by digital public services in the framework of the roadmap.

[108] A "digital and environmental" roadmap to converge the digital and ecological transitions - Labo (societenumerique.gouv.fr)

- Launching of an awareness campaign on less polluting digital practices as the ecological impact of uses can be minimised by smoother communication with the French citizens.
- Supporting high-potential greentech start-ups through the **Mission French Tech programme** as to accelerate their development.
- Launching calls for projects to support the development of innovative solutions using 5G network and Artificial Intelligence for ecological transition practices.
- Providing € 21 million from the recovery plan to ADEME's circular economy fund to support the development of repair and reuse, particularly in the field of electrical and electronic equipment.
- Setting-up of the environmental barometer based on environmental data collected from digital economy actors.
- Increasing funding for regional demonstrator projects by supporting VSEs/SMEs in their efforts towards sustainable digital products and practices with a budget of € 4 million/year financed by the

Recovery Plan.

Although France is making progress and investing heavily into a greener more sustainable future. There is still a lot of work to be done as France was the only EU country that has failed to reach its 2020 renewable energy targets, which was agreed under the EU renewable energy directive. In 2022 and onwards the government of France will need to make in crucial decision and make legislation to ensure the country is on track to meet the 2050 net zero emissions goals.

Local Flexibility Markets and electricity services for local flexibility markets

France is at the forefront of promoting local flexibility markets as part of its energy transition efforts towards a decarbonised and decentralised energy system.

Local flexibility markets are seen as a key solution to manage the increasing penetration of renewable energy sources and electric vehicles, as well as to reduce peak demand and optimise energy consumption.

Several pilot projects are underway in France to assess local flexibility markets, including incentivising residential and commercial customers to shift their energy consumption to off-peak hours and developing a platform for aggregators to trade flexibility services in real-time. These projects aim to improve the reliability and stability of the French electricity grid and create new revenue streams for local communities and energy stakeholders.

In terms of electricity services, France has implemented the CRE4-1 project to test innovative solutions for integrating renewable energy sources into the grid, including flexibility services such as demand response and energy storage.

In addition, the "Nice Grid" project is evaluating the use of smart grids and local flexibility markets to manage the integration of renewable energy sources and electric vehicles into the grid. The project includes the installation of a battery storage system, as well as the deployment of smart meters and a digital platform for energy management.

Another project, Flexgrid, aims to develop a platform for local flexibility markets and enable small-scale renewable energy producers and consumers to trade flexibility services in real-time.

France has several pilot projects in place to evaluate local flexibility markets, including a project in the town of Nanterre, where residential households are incentivised to adjust their electricity consumption during peak periods.

In addition, several large-scale projects are also underway in France to support the growth of renewable energy and local flexibility markets. For example, the Nice Grid project involves the deployment of a smart grid system that allows for the management of local energy flows, and the Flex grid project focuses on the development of a local energy marketplace for the exchange of energy between different stakeholders. These projects are expected to improve the integration of renewable energy sources into the grid, reduce energy costs, and promote the growth of local communities.

Moreover, several energy companies in France have launched their own local flexibility marketplaces, including EDF's DYNADIS platform, which allows for the participation of various energy resources, such as demand response and distributed generation.

3.8 Portugal

Portugal is one of the few countries in the world that has set ambitious goals to achieve carbon neutrality by 2050. The country has been actively investing in renewable energy sources, such as solar, wind, and hydro power, to reduce its dependency on fossil fuels and lower greenhouse gas emissions.

The renewable energy market in Portugal has been growing steadily over the past few years, with a significant increase in renewable energy production and capacity. However, the renewable energy market in Portugal is not immune to external factors that may affect its growth and development. According to the International Energy Agency, in 2020, Portugal generated 57% of its electricity from renewable energy sources, making it one of the leading countries in renewable energy production in Europe.

Solar energy is one of the fastest-growing renewable energy sources in Portugal, with the country's sunny climate and abundant natural resources making it an ideal location for solar energy production.

The wind energy sector is also rapidly expanding, with several new wind farms being developed in Portugal.

Hydro power has traditionally been an important source of renewable energy in Portugal, with the country's large river networks providing significant potential for hydroelectricity generation. Portugal has also been exploring new forms of renewable energy, such as wave and tidal energy, to further diversify its energy mix.

In addition to the growth in renewable energy production, Portugal has also been investing in renewable energy research and development, with a focus on improving the efficiency and reliability of renewable energy technologies.

The Portuguese government has set ambitious targets for the development of renewable energy, with a goal to achieve 80% of its electricity consumption from renewable sources by 2030, but this has been pushed forward to 2026 back in 2022[109]. The government has also implemented various policies and initiatives to support the growth of the renewable energy sector, such as feed-in tariffs, tax incentives, and funding for renewable energy research and development.

The country has established a **National Energy and Climate Plan (NECP)**[110] that outlines its targets and strategies for the development of renewable energy with the main goals are:

- To achieve a 47% share of renewable energy in its final energy consumption by 2030, with a focus on increasing the use of wind and solar energy.
- To improve its energy efficiency by 35% by 2030, through the implementation of various energy efficiency measures and policies.
- To achieve carbon neutrality by 2050, through a combination of reducing greenhouse gas emissions and enhancing carbon sinks, such as forests.
- To become a leading producer and exporter of green hydrogen, with a goal to have 4 GW of electrolysis capacity by 2030.

Political

The Directorate-General for Energy and Geology (DGEG) is responsible for developing and implementing Portugal's energy policy, including transposing relevant EU directives and regulations.

The Energy Services Regulatory Authority (ERSE) is the independent regulator for the energy sector with responsibility over the markets for electricity, natural gas, oil, biofuels, and electric mobility.

[109] https://electrek.co/2022/04/05/portugal-brings-forward-80-clean-energy-target-to-2026-from-2030/
[110] Portugal National Energy and Climate Plan 2021-2030 (NCEP 2030) (December 2019), The Government of Portugal, https://energy.ec.europa.eu/system/files/2020-06/pt_final_necp_main_en_0.pdf

The National Entity for the Energy Sector (ENSE) is a public organisation that has numerous responsibilities over the energy sector, including serving as the Portuguese central stockholding entity with responsibility for oil reserves.

Portugal was among the first countries in the world to set 2050 carbon neutrality goals. Portugal's energy and climate policies push for carbon neutrality primarily through broad electrification of energy demand and a rapid expansion of renewable electricity generation, along with increased energy efficiency.

There is a strong focus on reducing energy import dependency and maintaining affordable access to energy. These policy goals are supported through clear targets, detailed national strategies and a wide range of regulations, economy-wide programs, and sector-specific measures.

The European Union (EU) Emission Trading System (ETS) encourages GHG emissions reductions from Portugal's energy-intensive industries and electricity generation.

The National Energy and Climate Plan (NECP) outlines its targets and strategies for the development of renewable energy. The NECP includes measures such as increasing the share of renewable energy in final energy consumption and improving energy efficiency[111]:

- The plan aims to achieve 47% renewable energy production participation by 2030, with a focus on wind, solar, and hydroelectric power.

The National Renewable Energy Action Plan (NREAP)[112] sets out Portugal's target of achieving 31% of its final energy consumption from renewable sources by 2020. The plan includes several measures to increase the share of renewable energy in the country, such as increasing the use of wind, solar, and hydropower.

Portugal introduced a **Feed-in Tarif scheme** in 2001[113] promoting the development of renewable energy projects. Under the scheme, producers of renewable energy are guaranteed a fixed price for their energy for a set period. The FiT scheme has been instrumental in the development of Portugal's wind power sector (Country Profile Portugal, European Environment Agency).

Portugal also offers support mechanisms for small-scale renewables, such as solar PV and biomass. The government provides subsidies and tax incentives to encourage the installation of these technologies.

[111] Portugal National Energy and Climate Plan 2021-2030 (NCEP 2030) (December 2019), The Government of Portugal, https://energy.ec.europa.eu/system/files/2020-06/pt_final_necp_main_en_0.pdf
[112] https://climatepolicydatabase.org/policies/national-renewable-energy-action-plan-nreap-13
[113] Barros, J., Leite D. H (October 2011), Feed-in tariffs for wind energy in Portugal: Current status and prospective future, University of Porto, DOI: 10.1109/EPQU.2011.6128949

Portugal has a net-metering scheme that allows residential and commercial customers to receive credit for excess electricity generated by their renewable energy systems, such as solar panels or wind turbines:

- This incentivises the installation of small-scale renewables, such as solar PV and promotes the development of distributed generation.

In 2017, Portugal launched its **Energy Storage Roadmap**[114], which promotes the development of energy storage technologies, such as batteries and pumped hydro, to support the integration of renewable energy into the grid.

Competitive auction system for the development of renewable energy projects:

- First solar auction in 2020, awarding contracts for 670 MW of new solar capacity. The government also plans to hold wind and solar auctions in the coming years to support the development of these sectors.

The carbon pricing system that puts a price on carbon emissions:

- Designed to incentivise the transition to cleaner energy sources and reduce greenhouse gas emissions. The carbon pricing system in Portugal is part of the European Union Emissions Trading System (EU ETS).

Portugal has invested in interconnection with Spain to increase access to renewable energy sources. The two countries are working to develop a joint auction system for renewable energy projects, which will help to reduce costs and increase efficiency.

Energy Efficiency and Environmental Fund (FEE) aims to promote the efficient use of energy and the development of renewable energy sources. The fund provides financial support for energy efficiency projects and the development of renewable energy technologies.

Energy Regulatory Authority (ERSE) responsible for regulating and supervising the electricity and gas sectors in Portugal. The authority ensures that the electricity and gas markets operate in a competitive and transparent manner and promotes the use of renewable energy sources.

Economic

The National Energy and Climate Plan (NECP) sets 2030 targets for a 17% reduction of non-ETS GHG emissions and a 45-55% reduction in total GHG emissions (both compared to 2005 levels)[115].

[114] Energy Storage Portugal (March 2023), Macedo Vitorino, 20230322-Storage.ENG.pdf (macedovitorino.com)
[115] Portugal 2021 Energy Policy Review (2021), International Energy Agency, https://iea.blob.core.windows.net/assets/a58d6151-f75f-4cd7-891e-6b06540ce01f/Portugal2021EnergyPolicyReview.pdf

NECP sets targets for energy efficiency, renewable energy, cross-border electricity interconnection, and external energy dependency:

- The NECP sets 2030 targets for combined public and private spending on overall RD&D to increase to 3% of GDP and for combined public and private spending on energy RD&D and on climate and water RD&D to both increase to 0.2% of GDP.

Portugal sees a key role for hydrogen produced from renewable energy in hard-to-decarbonise sectors and for achieving carbon neutrality.

Portugal's energy RD&D measures and programmes support commercial deployment of products and services, pilot projects, and industrial clusters focused on new technologies, and business models based on low-carbon products and services.

Reduced tax exemptions, higher ETS prices, low natural gas prices, and increasing generation from low-cost renewables have significantly eroded the competitive position of coal-fired generation in Portugal.

Portugal aims to increase renewable electricity generation capacity, with most of the growth expected to come from solar photovoltaic (PV), wind, and hydropower. Portugal has programmes and measures to support efficient use of electricity.

Social

There is a strong focus on maintaining affordable access to energy, especially in the transportation sector as Portugal's transport policy is focused on the decarbonisation of road vehicles, with a strong emphasis on transitioning to electric vehicles (EVs).

Portugal is working to encourage a shift from private vehicles to public transport, and active and shared mobility.

The National Energy Agency in Portugal (ADENE) is a private non-profit public benefit association with the mission to develop public interest activities in the areas of energy efficiency (including in buildings, industry, and mobility) and water efficiency.

Technological

Portugal sees a key role for hydrogen produced from renewable energy in hard-to-decarbonise sectors and for achieving carbon neutrality.

The National Hydrogen Strategy (EN-H2) sets a goal for hydrogen produced from renewable energy to cover 1.5-2.0% of Portugal's energy demand by 2030. Also, Portugal supports the deployment of EV charging infrastructure. Major transmission projects are ongoing or were constructed beginning in 2021 to integrate solar PV and hydropower generation.

A legal framework approved in 2019 promotes energy communities and self-consumption of renewable generation. Both the NECP and the EN-H2 call for research, development, and demonstration (RD&D).

Legal

Portugal passed a law transposing EU Directive 2015/1513, which promotes the production and use of advanced biofuels and seeks to limit the use of first-generation biofuels[116].

The Decree-Law 8/2021 set the biofuel blending targets for 2021, and the government is working to transpose further the EU requirements for biofuels.

The Green Taxation Law was passed in 2014 to better align energy sector taxation with decarbonisation goals. Portugal established a carbon tax in 2015 that covers fossil fuel demand in all non-ETS sectors.

Revenue from the carbon tax and ETS allowance auctions are allocated to Portugal's Environmental Fund, which supports a wide range of government programmes, including some decarbonisation measures.

Portugal adapted the National Electric System (SEN)[117] to align with the country's commitment to achieve carbon neutrality by 2050, by complying with:

- The Directive (EU) 2019/944, which establishes common rules for the internal electricity market.
- The Directive (EU) 2018/2001, which promotes the use of renewable energy sources.
- The changes to the SEN include simplifying the administrative control of activities, maximising the potential of the electricity network, introducing competitive mechanisms, promoting consumer participation, and creating a legal framework for new technologies such as hybrids, hybridisation, and storage.
- The changes were approved and published in January 2022 through the Decreto-Lei no. 15/2022 and were subsequently corrected by the Declaração de Retificação no. 11-A/2022 in March 2022.

[116] https://iea.blob.core.windows.net/assets/a58d6151-f75f-4cd7-891e-6b06540ce01f/Portugal2021EnergyPolicyReview.pdf
[117] Sistema Eletrico Nacional (SEN) (2022), Politica Energetica, Direcao-Geral de Energia e Geologia (in Portugese), https://www.dgeg.gov.pt/pt/areas-transversais/relacoes-internacionais/politica-energetica/sistema-eletrico-nacional-sen/

Environmental

The NECP sets targets for a reduction in GHG emissions, energy efficiency, renewable energy, cross-border electricity interconnection, and external energy dependency.

Portugal's emissions reduction strategy is focused on decarbonising the electricity supply and decarbonisation of road vehicles.

Portugal has a biofuel blending obligation that requires fuel suppliers to blend a certain share of biofuels into automotive diesel and gasoline, with a focus on advanced biofuels and a reduction in overall biofuels consumption by 2030.

Portugal has achieved, or is on track to meet, most of its 2020 energy sector targets for greenhouse gas (GHG) emissions, renewable energy, energy efficiency, electricity interconnection and energy dependency.

But the Azores and Madeira autonomous regions set their own energy and climate policies and strategies.

The Azores and Madeira are testing different approaches to increase the share of renewables, boost the use of electric vehicles (EVs), and improve the energy efficiency of residential and service sector buildings. The Azores' and Madeira's programmes to support the energy transition appear to be more ambitious than those for mainland Portugal.

Local Flexibility Markets and electricity services for local flexibility markets

Portugal has been a leader in renewable energy adoption and is now exploring local flexibility markets as a means of improving the integration of renewable energy resources into the grid.

The country has set ambitious goals to achieve 80% renewable energy by 2030 and local flexibility markets are seen as a key tool to reach this target. One of the pilot projects, FlexPlan, is aimed at creating a market platform for distributed energy resources such as residential solar PV, batteries, and electric vehicles to provide flexibility services to the grid.

Another project, Local4Grid, is a collaboration between several entities including utilities and municipalities to create local energy communities, where members can trade their excess energy production or consumption flexibility through a block chain-based platform. In addition, the country is also working on integrating electric vehicles into the grid through a project called MOBI.E. The project is creating a network of charging stations that can both supply and consume electricity from the grid, thereby enabling electric vehicles to serve as mobile storage units. This innovative approach creates opportunities for electric vehicles to participate in local flexibility markets by selling their stored electricity back to the grid when demand is high.

In addition to the projects mentioned above, Portugal has launched several initiatives to promote the use of local flexibility markets and electricity services. One such initiative is the "FlexPlan" project, which aims to develop a platform for local energy communities to trade energy with each other and with the grid operator. The project is focused on integrating renewable energy sources and promoting energy efficiency measures.

Another project is the Local Energy Communities initiative, aimed at empowering local communities to participate in the energy transition and promote the use of renewable energy. This initiative involves the installation of photovoltaic systems and energy storage in local communities, with the aim of creating a network of energy communities that can exchange energy with each other and the grid.

Furthermore, the Portuguese government has recently launched a programme to support the development of energy storage systems, which are seen as a key enabler of local flexibility markets. The programme aims to install 150 MW of energy storage capacity by 2023, with a focus on supporting the integration of renewable energy sources and promoting energy security.

3.9 Ireland

The renewable energy market in Ireland has been experiencing steady growth over the past decade, with the country's transition to a low-carbon economy being a key driver. As of 2021, renewable energy sources such as wind, solar, and hydroelectricity account for over

40% of the country's electricity generation, with wind energy being the dominant source. This growth has been facilitated by supportive government policies, including **the Renewable Energy Support Scheme and the Climate Action Plan**[118].

Ireland's Climate Action Plan, launched in 2019, sets out an ambitious roadmap to reduce the country's greenhouse gas emissions by 51% by 2030 compared to 2018 levels, and to achieve net-zero emissions by 2050. The plan includes a range of measures to support the growth of renewable energy, including the development of offshore wind, solar energy, and biomass, as well as the electrification of the transport sector.

To achieve these goals, the government has also set targets to increase the country's renewable energy capacity. The target is to generate 70% of Ireland's electricity from renewable sources by 2030, which will require a significant expansion of the country's renewable energy infrastructure.

[118] Climate Action Plan (21 December 2022), Department of the Environment, Climate and Communications f the Republic of Ireland, https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

In addition to the Climate Action Plan, Ireland has also committed to the EU's renewable energy targets, which require Member States to produce at least 40% of their energy from renewable sources by 2030.

The main goals of the Climate Action Plan can be summarised as:

- Reducing greenhouse gas emissions by 51% by 2030 compared to 2018 levels and achieving net-zero emissions by 2050.
- Increasing the share of renewable energy in the country's electricity generation to 70% by 2030.
- Electrifying the transport sector, with the aim of having almost 1 million electric vehicles on Irish roads by 2030.
- Improving energy efficiency in buildings by retrofitting 500,000 homes to a B2 energy rating by 2030.
- Phasing out non-recyclable plastic and achieving a 60% recycling rate for plastic packaging by 2030.
- Reducing carbon emissions in the agriculture sector by improving farming practices and supporting the development of low-carbon agriculture.
- Establishing a just transition fund to support workers and communities affected by the transition to a low-carbon economy.

Overall, Ireland's renewable energy market presents significant opportunities for businesses in the sector. The government's supportive policies and ambitious targets, combined with the country's natural resources, make it an attractive location for renewable energy investment.

Political

The Irish government has set a target to increase the share of renewable energy in the country's electricity generation to 70% by 2030, which will require a significant expansion of the country's renewable energy infrastructure[119].

The National Development Plan outlines the government's investment priorities for the period 2018-2027. The plan includes significant investment in renewable energy, with a focus on offshore wind, hydrogen, and other emerging technologies[120].

The Renewable Energy Support Scheme (RESS) is a government programme that provides financial incentives to renewable energy projects in Ireland. The scheme is aimed at supporting the development of renewable electricity projects in the country, including wind, solar, and biomass [121].

[119] https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

[120] National Development Plan 2018-2027 (16 February 2018), Department of Public Expenditure, NDP Delivery and reform of the Republic of Ireland, https://www.gov.ie/en/policy-information/07e507-national-development-plan-2018-2027/

[121]https://www.seai.ie/communityenergy/ress/#:~:text=RESS%20aims%20to%20promote%20the,renewable%20electricity%20projects%20in%20Ireland

The RESS-1 is the first phase of the RESS and was launched in 2020. This scheme supports the development of up to 1.5 GW of renewable electricity capacity in Ireland[122].

The government has also established the Climate Action Fund, a €500 million fund aimed at supporting projects that will help Ireland meet its climate change targets. The fund is focused on supporting initiatives that will reduce greenhouse gas emissions, increase renewable energy generation, and improve energy efficiency[123].

The Irish government has introduced regulations to support the development of offshore wind energy projects. In 2020, the government announced a new marine planning regime to facilitate the development of up to 5 GW of offshore wind energy by 2030[124]:

- The Wind Energy Development Guidelines were updated in 2019 and provide guidance to local authorities and developers on the planning and development of wind energy projects in Ireland.

The government has also introduced measures to support the development of electric vehicles (EVs) in Ireland. **The EV Home Charger Grant** provides financial support to homeowners who install an electric vehicle home charger, while the Accelerated Capital Allowance scheme provides tax relief for companies that purchase energy-efficient equipment, including EVs [125].

The Green New Deal is a government plan that aims to transform Ireland's economy and society, creating new jobs and supporting the transition to a low-carbon economy. The plan includes a range of measures to support the development of renewable energy projects, including wind, solar, and hydropower[126].

In July 2021, the Irish government announced its commitment to achieving net zero greenhouse gas emissions by 2050. This ambitious target will require significant investment in renewable energy and other low-carbon technologies[127].

The Irish government is investing in the development of the country's electricity grid to support the integration of renewable energy. This includes the development of new transmission infrastructure and the deployment of smart grid technologies[128].

[122] Renewable Electricity Support Scheme (RESS) (20 December 2019), Department of the Environment, Climate and Communications of the Republic of Ireland, https://www.gov.ie/en/publication/36d8d2-renewable-electricity-support-scheme/#ress-1
[123] Climate Action Fund (28 February 2020),), Department of the Environment, Climate and Communications of the Republic of Ireland, https://www.gov.ie/en/publication/de5d3-climate-action-fund/
[124] Offshore Renewable Energy Development Plan II (OREDP II), Department of the Environment, Climate and Communications of the Republic of Ireland, https://www.gov.ie/en/publication/71e36-offshore-renewable-energy-development-plan-ii-oredp-ii/
[125] https://www.seai.ie/grants/electric-vehicle-grants/electric-vehicle-home-charger-grant/
[126] https://ireland.representation.ec.europa.eu/strategy-and-priorities/key-eu-policies-ireland/environment-irelands-green-deal_en#:~:text=%E2%80%A2%E2%80%A2%E2%80%A2,LIFE%20funding%20for%20Ireland,efficiency%20and%20renewable%20energy%20projects
[127] Net Zero by 2050. Exploring Decarbonisation Pathways for Heating and Cooling in Ireland (January 2023), National Health Study, https://www.seai.ie/data-and-insights/national-heat-study/net-zero-by-2050/
[128] https://www.eirgridgroup.com/the-grid/irelands-strategy/

The Irish government has introduced a carbon pricing mechanism, known as the **Carbon Tax**, to encourage the transition to low-carbon technologies. The tax applies to fossil fuels such as coal, oil, and gas, and the revenue generated is used to fund climate action initiatives[129].

The lack of planning permission for wind turbines has been a significant obstacle to the development of wind energy projects in Ireland. There have been concerns about the impact of wind turbines on the landscape and on local communities.

The excessive cost of grid connection has also been an obstacle to the development of renewable energy projects in Ireland. The cost of connecting to the national grid can be a significant barrier to entry for small-scale renewable energy projects.

The availability of finance can be a challenge for renewable energy projects, particularly for smaller-scale projects. The lack of access to finance can make it difficult for businesses and homeowners to invest in renewable energy technologies.

The lack of skilled workers in the renewable energy sector can be a challenge for the industry. There is a need for more training and education programs to develop the skills and expertise required to support the growth of the sector.

The impact of Brexit on the renewable energy industry is another potential obstacle. The UK is a key market for Irish renewable energy exports, and any disruption to trade could have a negative impact on the industry.

Economic

The Sustainable Energy Authority of Ireland (SEAI) provides a range of supports to businesses and homeowners who want to invest in renewable energy. These include grants, training, and advice on renewable energy technologies[130].

The Feed-in Tariff (FIT) scheme provides a guaranteed price for electricity generated from renewable energy sources. The scheme is designed to support the development of small-scale renewable energy projects, including wind turbines, solar panels, and hydropower[131].

[129]https://www.citizensinformation.ie/en/money_and_tax/tax/motor_carbon_other_taxes/carbon_tax.html#:~:text=Budget%202023,result%20in%20a%20price%20increase

[130] https://www.seai.ie/business-and-public-sector/business-grants-and-supports/

[131] Renewable Energy Feed-in Tariff (REFIT) Scheme, Department of the Environment, Climate and Communications of the Republic of Ireland (22 May 2020), https://www.gov.ie/en/publication/9bf994-renewable-energy-feed-in-tariff-refit-scheme/

The Better Energy Homes scheme provides financial support to homeowners who want to improve the energy efficiency of their homes. The scheme includes grants for insulation, heating upgrades, and renewable energy systems[132].

The Renewable Heat Incentive (RHI) scheme provides financial support to businesses that install renewable heating systems, such as biomass boilers and heat pumps[133].

The Just Transition Fund is a €11 million fund that supports communities that are affected by the transition to a low-carbon economy. The fund supports projects that create new jobs and economic opportunities in renewable energy and other low-carbon sectors[134].

According to a report by the Irish Wind Energy Association (IWEA), the wind energy sector has contributed over €4 billion to the Irish economy since 2000, with an average annual contribution of €241 million. The renewable energy sector is estimated to contribute around €1.5 billion to the Irish economy annually.

Ireland has the potential to become a major exporter of renewable energy, particularly wind energy. The country's favourable location and abundant wind resources mean that it can generate excess renewable energy, which can be exported to other countries through interconnectors. The Irish government has announced plans to build a new interconnector to France, which would allow Ireland to export renewable energy to the European market[135].

The Irish government has established several funds to support the growth of the renewable energy sector. These include the Renewable Energy Investment Fund (REIF), which provides financing for renewable energy projects, and the Climate Action Fund, which provides funding for projects that contribute to Ireland's climate action goal.

The government introduced a €240 million financing facility secured by solar developer Power Capital Renewable Energy from an Eiffel Investment Group led set of investors to construct over 1.2 GW of solar assets and expand internationally[136].

[132] Better Energy Homes Programme. Application Guide, Applying For and Claiming Cash Grants Version 17, SEAI Sustainable Energy Authority of Ireland, https://www.seai.ie/publications/Homeowner-Application-Guide.pdf
[133] Economic analysis for the Renewable Heat Incentive for Ireland (December 2017), Frontier Economics, Element Energy, https://www.seai.ie/business-and-public-sector/business-grants-and-supports/support-scheme-renewable-heat/Economic-analysis-for-Renewable-Heat-Incentive-for-Ireland.pdf
[134] EU Just Transition Fund (19 December 2022), Department of the Environment, Climate and Communications of the Republic of Ireland, https://www.gov.ie/en/publication/4d421-eu-just-transition-fund/
[135] https://www.gov.ie/en/press-release/b4f97-conclusion-of-the-celtic-interconnector-agreements-between-france-and-ireland/
[136] https://www.eib.org/en/press/all/2023-006-eur240000000-financing-facility-secured-by-irish-solar-developer-power-capital-renewable-energy-from-an-eiffel-investment-group-led-set-of-investors-to-construct-over-1-2-gw-of-solar-assets-in-ireland-and-expand-internationally

Several international companies have invested in Ireland's renewable energy sector in recent years. For example, Amazon has invested in a 23.2 MW wind farm in County Galway, while Facebook has signed a power purchase agreement (PPA) for renewable energy from a wind farm in County Kerry[137].

Social

There is growing public awareness and acceptance of renewable energy in Ireland, with polls indicating that over 90% of Irish people support the development of renewable energy. To support this trend, the Irish government has launched several public awareness campaigns, including the Power of One campaign, which encourages individuals to make small changes to reduce their energy consumption[138].

There is a growing trend towards community-led renewable energy projects in Ireland, with communities coming together to develop and own renewable energy projects. The Irish government has established the **Community Energy Grant Scheme** to support the development of community-led renewable energy projects[139].

Energy poverty is a significant social issue in Ireland, with an estimated 400,000 households experiencing fuel poverty. To address this issue, the Irish government has launched the **Better Energy Warmer Homes Scheme**, which provides free energy efficiency upgrades to low-income households[140].

Technological

Ireland has significant offshore wind energy potential, with some estimates suggesting that the country could generate up to 50 GW of electricity from offshore wind by 2050. To support the development of this technology, the Irish government has established the Marine Renewable Energy Ireland (MaREI) Centre, which is a national research centre that focuses on marine and renewable energy.

Ireland is developing a smart grid system to support the integration of renewable energy sources into the electricity grid. The smart grid system will enable the grid to balance supply and demand more effectively, while also enabling greater integration of renewable energy sources, such as wind and solar (SEAI).

[137] https://www.aboutamazon.eu/news/amazon-web-services/amazon-announces-new-project-in-ireland-as-part-of-commitment-to-be-100-powered-by-renewable-energy, https://www.datacenterdynamics.com/en/news/facebook-signs-806mw-renewable-ppas-ireland-and-us/?mkt_tok=eyJpIjoiTkRCbVptSTVZVEZsWW1WaSIsInQiOiJwalBoaHE4aEtZdmhueHJES2NLVzQxbzI5aUZleWliNlhFZmJ4RjljMXY0UFdONVVzSmpzQ3dpTzdPS2hRbjFLanJjakdjck1McTNBNHJSM2NGVWk2aE1HQjAxRmdxNHpRcWc1eHA3Z0dmMVpOTmlDR0NFaGx4YXlETk5LYkFyQyJ9

[138] Spandagos, C., Tovar Reanos, M. A., Lynch, A. M. (2022), Public acceptance of sustainable energy innovations in the European Union: A multidimensional comparative framework for national policy, Journal of Cleaner Production 340, 130721 https://www.esri.ie/system/files/publications/JA202212.pdf

[139] https://www.seai.ie/grants/community-grants/overview/#:~:text=The%20Community%20Grant%20programme%20supports,registered%20SEAI%20Project%20Co%2Dordinators

[140] https://www.midlandwarmerhomes.ie/bewhs/

The growth of renewable energy sources such as wind and solar has led to an increased need for energy storage systems. The Irish government has launched several initiatives to support the development of energy storage technologies, including the establishment of the Renewable Energy RD&D Fund, which provides funding for research and development of renewable energy technologies[141].

Ireland is also promoting the uptake of electric vehicles (EVs) as a means of reducing greenhouse gas emissions in the transport sector. The government has implemented several initiatives to support the growth of EVs, including the Electric Vehicle Home Charger Grant and the Accelerated Capital Allowance Scheme for Electric Vehicles[142].

Thus, Ireland has a strong research and development (R&D) sector, which is focused on the development of renewable energy technologies. The Irish government has established several programmes to support R&D in the renewable energy sector, including the Energy Research Programme and the Sustainable Energy Authority of Ireland (SEAI) Research and Development Programme[143].

Legal

The electricity sector in Ireland is regulated by the Commission for Regulation of Utilities (CRU), which is responsible for ensuring the security and reliability of the electricity supply. The CRU has established several codes and guidelines to regulate the development of renewable energy projects (The Commission for Regulation of Utilities, CRU, Ireland).

All renewable energy projects in Ireland require planning permission from the local authority. The planning process is governed by the Planning and Development Act 2000, which sets out the procedures for obtaining planning permission[144].

Renewable energy projects in Ireland must also obtain a grid connection from EirGrid, the national electricity grid operator. EirGrid has established several guidelines and procedures to regulate the connection of renewable energy projects to the grid[145].

Climate Action and Low Carbon Development Act 2015 provides a framework for national mitigation and adaptation plans, including the National Climate Action Plan, and sets legally binding greenhouse gas emissions reduction targets for Ireland [146].

[141] https://www.seai.ie/grants/research-funding/research-development-and-demonstration-fund/
[142] https://www.gov.ie/en/campaigns/18b95-zero-emission-vehicles-ireland/
[143] https://www.seai.ie/grants/research-funding/
[144] https://epawebapp.epa.ie/licences/lic_eDMS/090151b280703521.pdf
[145] https://www.matheson.com/insights/detail/new-grid-connection-policy-in-ireland
[146] https://www.irishstatutebook.ie/eli/2015/act/46/enacted/en/html

Renewable Energy Directive (RED II) sets a target for the EU to reach at least a 40% share of renewable energy by 2030 and requires member states to adopt national targets to contribute to this goal.

The Biofuels Obligation Scheme requires fuel suppliers to blend biofuels with fossil fuels to reduce greenhouse gas emissions from transport[147].

The Energy Efficiency Directive requires member states to implement measures to achieve energy savings targets, including the promotion of energy efficiency in buildings and the adoption of energy-efficient technologies[148].

The Electricity Regulation Act 1999 regulates the electricity sector in Ireland and provides for the licensing and regulation of electricity suppliers and generators[149].

Environmental

Ireland has significant potential for offshore wind energy, with estimates suggesting that the country could generate up to 140 GW of electricity from offshore wind.

According to the Environmental Protection Agency (EPA), greenhouse gas emissions in Ireland decreased by 6.1% in 2020, primarily due to the impact of the COVID-19 pandemic. However, emissions from the energy sector increased slightly, highlighting the importance of transitioning to renewable energy sources.

The development of renewable energy projects can have an impact on biodiversity and habitat protection. The Irish government has established guidelines for renewable energy development to ensure that projects are in areas that do not harm important habitats or protected species.

Renewable energy technologies such as wind and solar power do not produce waste, but there are still environmental considerations related to the production and disposal of renewable energy equipment. The Irish government has established waste management regulations to ensure that renewable energy equipment is disposed of safely and responsibly.

The Irish government has established a National Circular Economy Strategy, which aims to reduce waste and promote the reuse of materials. The development of renewable energy technologies can contribute to a circular economy by using recycled materials and reducing the need for fossil fuels.

[147] EU Renewable Energy Targets. Biofuels Obligation Scheme (2 September 2019), Department of the Environment, Climate and Communications of the Republic of Ireland, https://www.gov.ie/en/publication/91f03c-biofuels/#:~:text=This%20scheme%20was%20introduced%20in,across%20their%20general%20fuel%20mix

[148] Energy Efficiency Directive. Article 7, High level decision June 2020, Government of Ireland, https://assets.gov.ie/77866/026aac3f-3a30-43d0-b12f-cb788c4e94e4.pdf

[149] Electricity Regulation Act. 1999, Number 23 (1999), ISB, Office of the Attorney General, https://www.irishstatutebook.ie/eli/1999/act/23/enacted/en/html

The development of renewable energy projects is subject to Environmental Impact Assessments (EIAs) to assess the potential environmental impacts of the project. This helps to ensure that projects are developed in an environmentally responsible manner and that any negative impacts are minimised.

Local Flexibility Markets and electricity services for local flexibility markets

In Ireland, local flexibility markets are a key component of the country's strategy to transition to a low-carbon energy system.

These markets allow for the efficient and cost-effective integration of renewable energy sources into the grid, as well as the optimisation of demand response programmes. Ireland's electricity system operator, EirGrid, has developed a range of initiatives to promote local flexibility, including the DS3 program, which aimed at reaching 75% renewable electricity on the grid by 2020 and to create a secure and sustainable electricity system.

The programme includes a range of measures, such as demand response, energy storage, and virtual power plants, to enable greater integration of renewables into the grid. EirGrid has also launched the OpenHydro project, which aims to develop the country's wave energy resources. The project involves the deployment of a 2 MW tidal turbine off the coast of north-west Ireland, which will provide electricity to the local grid. In addition to these initiatives, EirGrid is working to develop new market structures that allow for greater participation of distributed energy resources, such as rooftop solar panels and battery storage systems, in local flexibility markets.

Ireland has launched the SEAI Better Energy Communities Programme to support community energy projects and encourage the uptake of energy efficiency measures. In terms of local flexibility markets, Ireland has established the Small-Scale Flexibility Aggregation Project, which aims to provide opportunities for smaller-scale distributed energy resources to participate in the market.

The project is part of Ireland's efforts to create a more decentralised and flexible energy system, which can accommodate the growing number of distributed energy resources, including rooftop solar panels and small-scale wind turbines.

Furthermore, the Sustainable Energy Authority of Ireland has also launched a pilot programme to test a local energy market in the Dingle peninsula, which aims to promote the use of local renewable energy and reduce carbon emissions.

3.10 The Netherlands

The Netherlands has set an ambitious target to achieve 100% renewable energy by 2050. As the demand for renewable energy continues to grow, the renewable energy market in the Netherlands is poised for significant growth. However, as with any market, there are external factors that can influence its growth and success.

The renewable energy market in the Netherlands has been growing steadily over the past few years. The Netherlands is a crucial player in global energy trade and plays a significant role in the European energy market.

However, primary focus of Dutch energy policy is transitioning to a low-carbon energy system. Although the Netherlands has successfully decoupled economic growth from greenhouse gas emissions, the country still heavily relies on fossil fuels. To address this, numerous measures have been introduced to support decarbonisation. For instance, the Stimulation of Sustainable Energy Production Scheme (SDE+)[150] uses competitive auctions to award subsidies to renewables, hydrogen, and carbon capture, based on avoided CO2 emissions.

According to the International Energy Agency (The Netherlands Country Profile, International Energy Agency), in 2019, renewable energy sources accounted for 11.1% of the total energy supply in the Netherlands. The main sources of renewable energy in the Netherlands are wind energy, solar energy, and biomass. It is one of the leading countries in offshore wind energy, with a total installed capacity of over 15.000MW. Additionally, the Netherlands has been driving rapid deployment of offshore wind energy through an offshore wind roadmap that aims for 11.5 GW of capacity by 2030. The country has also been rapidly increasing its solar energy capacity in the past years, with over 7GW of installed solar capacity achieved by the end of 2020.

Furthermore, strong innovation programmes support the deployment of key decarbonisation technologies as well as policies leading this way. This includes the 2019 Climate Act which set legally binding targets to reduce greenhouse gas emissions by 49% by 2030 and by 95% by 2050 (compared to 1990 levels), and to have 100% of electricity generated from renewables by 2050 (The Dutch Government Climate Policy).

Overall, the Dutch government is committed to transitioning to a low-carbon energy system and has implemented various measures to promote the growth of renewable energy. The Netherlands' role as a hub for the global energy trade puts it in a unique position to lead the transition to a sustainable energy future.

[150] Stimulation of sustainable energy production and climate transition (SDE++) (17 October 2022), Netherlands Enterprise Agency, https://english.rvo.nl/subsidies-programmes/sde

The country has the following targets:

I. By end of 2023, achieve a renewable energy share of 16% in its total energy consumption. This target is set under the Energy Agreement for Sustainable Growth, signed in 2013 between the government, industry, and civil society[151].

II. By 2030, generate up to 70% of its electricity from renewable sources, with an installed capacity of 11.5 GW of offshore wind energy. This target is part of the National Climate Agreement signed in 2019[152].

III. By 2050, achieve a fully renewable electricity system, with 100% of electricity generated from renewable sources.

Political

The National Climate Agreement [153]aims to reduce GHG emissions and combat climate change, with measures including:

- 70% of its electricity from renewable sources by 2030, and to reach 100% renewable electricity by 2050, by increasing support for renewable energy projects and accelerating deployment of offshore wind energy.
- Reduce energy consumption by 50% by 2050.
- Reduce CO2 emissions from transportation by 49% by 2030 by promoting electric vehicles and expanding public transportations options.
- Reduce GHG emissions from agriculture by 3.5 mega tonnes by 2030, i.e., by reducing fertilisers.

Subsidy programmes: The Dutch government has implemented subsidy programmes as to support the growth of renewable energy, such as the SDE+ scheme which provides financial support for renewable energy production.

This scheme has been extended and is now known as the SDE++ scheme, which also supports the deployment of technologies that reduce greenhouse gas emissions such as carbon capture, utilisation, and storage (CCUS):

- Funding comes from the Ministry of Economic Affairs and Climate Policy.
- Subsidies are awarded to renewable energy, hydrogen, and carbon capture projects based on the amount of avoided CO2 emissions.
- The SDE+ scheme is one of the key policy instruments of the Dutch government to promote the growth of renewable energy in the country.

[151] https://www.government.nl/documents/publications/2013/09/06/energy-agreement-for-sustainable-growth
[152] https://www.klimaatakkoord.nl/documenten/publicaties/2019/06/28/national-climate-agreement-the-netherlands
[153] National Climate Agreement (28 June 2019), House of Representatives, The Hague, https://www.government.nl/documents/reports/2019/06/28/climate-agreement

EU regulations: As a member of the European Union, the Netherlands is subject to various EU regulations related to renewable energy, including the Renewable Energy Directive (RED II) which sets binding targets for renewable energy use across the EU.

The government- implemented Regulations to encourage production of renewable energy, such as:

- Renewable Energy Production Incentive (MEP)[154].
  - Subsidy available for a wide range of renewable energy technologies, including solar, wind, hydro, and biomass.
  - Paid per kWh of renewable energy produced and is adjusted annually based on market conditions.
  - Introduced in 2003, supported the production of more than 50 TWh of renewable energy since its introduction.

- Energy Tax Exemption Scheme for Sustainable Energy (EIA)[155]:
  - -Provides a tax deduction for investments in sustainable energy.
  - -Amount of tax deduction is a percentage of the investment costs and is adjusted annually based on market conditions.
  - Introduced in 2001, supported more than 5,000 sustainable energy projects.

The new Offshore Wind Energy Roadmap 2019-2030[156]:

- Key policy initiative aimed at accelerating the deployment of offshore wind energy, it outlines the steps with government will take to achieve targets of offshore wind capacity.
- On 11 February 2022, the Dutch Government raised the **offshore wind energy** target from 11.5 to about 21 GW around 2030.

The measures include:

- Competitive tendering system to award permits for new offshore windfarms.
- Investment in the expansion of the offshore grid infrastructure.
- Support for the development of new offshore wind technologies and innovations.
- Streamlining of the permitting process for new offshore wind projects.

[154] The Netherlands – Case Study, The European Environment Agency (EEA) 'Energy Support and Innovation' project
[155] Energy Investment Allowance – EIA (28 December 2022), Netherlands Enterprise Agency, https://english.rvo.nl/subsidies-programmes/energy-investment-allowance-eia
[156] Plans 2030-2050 (01 March 2023), Netherlands Enterprise Agency, https://english.rvo.nl/information/offshore-wind-energy/new-offshore-wind-energy-roadmap

The Groningen Energy Agreement[157] (provincial policies, also some for other provinces)

- Aims to make the province energy-neutral by 2035.
- The province of Zeeland has also implemented policies to support the growth of offshore wind energy, such as the Windkracht 2020 programme which aims to develop 950 MW of offshore wind capacity by end of 2023.

The Dutch government has adopted number of green deals (voluntary agreements between the government, businesses, and civil society organsations to promote sustainable development)[158]:

The Net Metering System

- Owners of small-scale renewable energy systems, such as solar panels, can offset their electricity bills by feeding excess energy back into the grid.
- Electricity produced is credited at the retail price, to make small-scale renewable energy more financially viable.

The Dutch Parliament has approved the proposal to phase out the net metering soon[159].

The Green Certificate System[160]**:**

- Allows consumers to purchase renewable energy certificates to offset electrical consumption. These can be used to meet sustainability targets.
- Aims to increase the number of sustainably (re)developed buildings.
- Energy Performance Certificates (EPCs)[161]:
  - Mandatory for all buildings in the Netherlands and rate the energy efficiency of buildings on a scale from A (most efficient) to G (least efficient).
  - Helps to encourage the construction of more energy-efficient buildings.

The Energy Transition Fund - This is a fund set up by the Dutch government to support the development and deployment of new technologies in the energy transition. It provides financial support for the projects related to renewable energy, energy efficiency, and energy storage.

[157] Peter de Laat (June 2022), Overview of Hydrogen Projects in the Netherlands, TKI Nieuw Gas Topsector Energie, https://www.topsectorenergie.nl/sites/default/files/uploads/TKI%20Gas/publicaties/Overview%20Hydrogen%20projects%20in%20the%20Netherlands%20-%20version%2027%20july%202022.pdf
[158] https://www.greendeals.nl/english
[159] https://www.pv-magazine.com/2023/02/09/dutch-parliament-approves-proposal-to-phase-out-net-metering/
[160] https://resourcehub.bakermckenzie.com/en/resources/global-sustainable-buildings-index/europe-middle-east-and-africa/netherlands/topics/green-certification
[161] https://www.government.nl/topics/energy-performance-certificates-for-homes-and-buildings

Economic

The renewable energy sector in the Netherlands is expected to grow significantly in the coming years, leading to job creation and economic growth. The Dutch government has estimated that the renewable energy sector could create up to 72,000 jobs by 2030.

The Netherlands is an attractive location for foreign investors in the renewable energy sector due to its stable political climate, skilled workforce, and favourable business environment. In 2020, the Netherlands ranked fourth in the world in the Renewable Energy Country Attractiveness Index, 2021 it ranked ninth [162].

The Netherlands is a net exporter of energy, and the renewable energy sector is expected to play an increasingly key role in this:

- The Netherlands is investing in green hydrogen production, which could become a significant export product in the future[163].

But the subsidies and incentives to support the development of renewable energy sector, including SDE+ and EIA (see above), as well as the Innovation credit[164]:

- Innovation credit is a loan with a low interest rate and flexible repayment options, designed to help innovative projects overcome financial barriers.
- Part of the larger **Dutch Innovation Fund**, which aims to stimulate innovation and entrepreneurship in the country, with a budget of €1.7 billion.
- Available to small and medium-sized enterprises (SMEs) and large companies, as well as public-private partnerships (PPPs) and non-profit organisations.

Growth of the renewable energy sector in the Netherlands is also driving the growth of related industries such as construction, engineering, and logistics.

Social

The renewable energy sector in the Netherlands enjoys strong public support. According to a survey conducted by the Dutch Ministry of Economic Affairs and Climate Policy, over 80% of the Dutch population supports the country's transition to renewable energy sources.

The renewable energy sector currently employs over 20,000 people, and this number is expected to increase as the country ramps up its renewable energy target[165].

[162] https://www.statista.com/statistics/1121004/renewable-energy-country-attractiveness-score-global/
[163] https://investinholland.com/news/the-netherlands-fueling-a-green-hydrogen-future/
[164] Subsidy (SDE++ scheme for producing renewable energy and applying CO2-reducing techniques) | Clean energy for EU islands (europa.eu)
[165] Global Energy System Based On 100% Renewable Energy – Power Sector (November 2017), Energy Watch Group, LUT Lappeenranta University of Technology, http://energywatchgroup.org/wp-content/uploads/Full-Study-100-Renewable-Energy-Worldwide-Power-Sector-1.pdf

Also, the growing trend towards community-owned renewable energy installations, communities are often involved in planning and development of new renewable energy projects.

High energy poverty in the Netherlands:

- Defined as spending 13-20% of income on energy.
- 7% of households are energy poor in terms of affordability or energetic home quality.
- 48% of households are not able to participate in the energy transition on their own[166].

Technological

There is a strong focus on innovation in the renewable energy sector, with numerous programmes and initiatives aimed at developing and deploying innovative technologies for example:

TKI Wind op Zee - government-sponsored program aimed at accelerating the development of offshore wind energy in the Netherlands. It focuses on innovation, cost reduction, and the integration of offshore wind farms into the energy system.

Smart Grids and Flexibility - government-funded research and development programme aimed at developing smart grid technologies that can integrate renewable energy sources and increase grid flexibility.

Solar Energy Application Centre (SEAC) - research and development centre that focuses on accelerating the deployment of solar energy technologies in the Netherlands. It provides testing and certification services for solar panels and supports the development of new solar technologies.

Topsector Energy - a public-private partnership aimed at accelerating the development of innovative technologies in the energy sector.

The Dutch Offshore Wind Innovation Centre (DOWIC) is a partnership between industry, government, and knowledge institutions that aims to accelerate the development and deployment of offshore wind technologies[167]:

- The government has set ambitious targets for the development of offshore wind energy and is investing in research and development of new technologies to support this goal.

[166] Mulder, P., Longa, D. F., Straver, K. (February 2023), Energy poverty in the Netherlands at the national and local level: A multi-dimensional spatial analysis, Energy Research & Social Science, Vol. 96, 102892, https://www.sciencedirect.com/science/article/pii/S2214629622003954
[167] https://owic-eemshaven.nl/en/

The Energy Research Centre of the Netherlands (ECN) is a leading research institution that focuses on the development of sustainable energy technologies. The ECN has been involved in numerous research and development projects related to renewable energy, including offshore wind energy[168].

The Biobased Delta[169]:

- The public-private partnership aimed at developing new renewable energy technologies.

The Energy Storage Roadmap[170]:

The Dutch government is also investing in the development of new technologies to support the transition to a hydrogen economy, with initiatives such as the Hydrogen Coalition[171] and the Green Hydrogen Atlas of the Netherlands:

- **The Hydrogen Coalition:** Partnership between 30+ business and institutional stakeholders aimed at advancing green hydrogen technologies, proposing regional clusters, and accelerating investments in the national infrastructure supporting the growth of the hydrogen market.
- **The Green Hydrogen Atlas:** An online tool launched by the Dutch Ministry of Economic Affairs and Climate Policy, providing information on the potential for green hydrogen production and existing/planned hydrogen projects to support the development of the increasingly important green hydrogen sector in the Netherlands.

The renewable energy policies and regulations in the Netherlands are primarily driven by the EU's Renewable Energy Directive and the Paris Agreement:

- **The Renewable Energy Directive (RED II):** The Netherlands, along with other EU Member States, is required to meet renewable energy targets under the RED II, which sets a binding target of 42.5% of renewable energy by 2030.
- **The Energy Agreement for Sustainable Growth** is a multi-stakeholder agreement signed in 2013, which outlines the Netherlands' long-term energy policy goals and targets. It includes commitments to renewable energy, energy efficiency, and greenhouse gas emissions reduction.
- **The Offshore Wind Energy Act** regulates the construction and operation of offshore wind farms in the Dutch Exclusive Economic Zone. It establishes a legal framework for the development, operation, and decommissioning of offshore wind farms.
- **The Electricity Act 1998** regulates the production, transport, distribution, and supply of electricity in the Netherlands. It includes provisions related to renewable energy production, grid connection, and market participation.

[168] Scheepers, M., Een Klimaatneutraal Energiesysteem Voor Nederland. Nieuwe Verkenning Toont Grenzen Mogelijkheden. White Paper (April 2022) (in Dutch), TNO innovation for life, https://www.tno.nl/en/about-tno/organisation/units/energy-transition/
[169] https://circularbiobaseddelta.nl
[170] https://www.prnewswire.com/news-releases/roadmap-for-integration-of-energy-storage-in-dutch-power-mix-301481760.html) and the Innovation Credit (https://english.rvo.nl/subsidies-programmes/innovation-credit
[171] https://www.h2-view.com/story/coalition-presents-hydrogen-pact-to-push-forward-a-dutch-hydrogen-supply-chain/

The Heat Act regulates the production, distribution, and supply of heat in the Netherlands. It includes provisions related to the use of renewable energy sources for heat production and distribution.

- **The Environmental Impact Assessment (EIA) Regulations** require developers of certain projects, including renewable energy projects, to conduct an environmental impact assessment before proceeding with the project. This assessment includes an evaluation of the potential environmental impacts of the project and measures to mitigate these impacts.
- **The Environmental Management Act** establishes the legal framework for environmental management in the Netherlands. It includes provisions related to environmental permits, pollution prevention, and waste management.
- **The Carbon Tax:** The Netherlands introduced a carbon tax in 2021, which applies to companies emitting more than 25,000 tonnes of CO2 per year. The tax is intended to provide a financial incentive for companies to reduce their carbon emissions and transition to renewable energy sources.
- **The Energy Performance of Buildings Directive (EPBD)** sets energy performance standards for new and existing buildings in the European Union, including the Netherlands. It requires member states to implement measures to improve the energy efficiency of buildings and promote the use of renewable energy sources in buildings.

Environmental

The Netherlands is especially vulnerable to sea level rise and flooding due its low-lying delta region. It has invested heavily in flood protection measures and is exploring innovative solutions (floating building, green roofs).

But the rapid growth of renewable energy production has raised concerns about the potential environmental impact on marine ecosystems and biodiversity.

Local Flexibility Markets and electricity services for local flexibility markets

The Netherlands is at the forefront of developing local flexibility markets and electricity services. The country has set ambitious targets to transition to a low-carbon economy and reduce greenhouse gas emissions by 55% by 2030.

The Dutch government has introduced several programmes and initiatives to incentivise the adoption of renewable energy and energy storage technologies. **The Flexibility Market Programme**, launched in 2019, aims to create a more flexible energy system by incentivising households and businesses to shift their energy consumption and generation. The program also encourages the development of local flexibility markets, which enable local communities to trade energy among themselves.

Another programme, the **Energy Agreement**, promotes the adoption of renewable energy technologies and energy efficiency measures. The Dutch government has also implemented smart grid technology, which allows for more efficient and reliable distribution of energy.

The Netherlands is home to several innovative energy companies, such as Eneco, which has developed a virtual power plant that integrates distributed energy resources, including solar panels and batteries.

The country also hosts several research institutes, including the Energy Delta Institute, which conducts research and provides training on energy transition and sustainable energy. In addition to the projects mentioned above, the Netherlands is also working on a national pilot project called Power Matching City. This project aims to assess the use of smart grids and home energy management systems to enable households to become more self-sufficient and participate in local flexibility markets. The project involves 25 households in Hoogkerk, a suburb of Groningen, and uses a mix of renewable energy sources, such as solar and wind, and energy storage solutions, such as batteries and electric vehicles, to provide flexibility.

Furthermore, the Netherlands has set a target of achieving a fully renewable electricity supply by 2050, and local flexibility markets will play a crucial role in achieving this goal. The country is already seeing significant growth in renewable energy generation, with wind energy being the primary source of electricity production.

The Dutch government is also promoting the development of community energy initiatives, which encourage citizens to invest in renewable energy projects in their local area. This approach is expected to increase the demand for local flexibility services, creating new opportunities for market participants.

4. Benchmarking Countries

4.1 The United Kingdom

The renewable energy market in the United Kingdom has seen a significant growth in recent years, with renewable and clean energy sources accounting for around 48.5% of the country's total electricity generation in 2022. Wind power has emerged as a major source of renewable energy in the UK, with the country's offshore wind capacity now the largest in the world. According to the data from National Grid ESO, the United Kingdom has generated over 20GW of electricity coming purely from wind energy in 2022 which is the all-years' high figure for the country.

In addition to wind power, the UK is also investing in other forms of renewable energy, such as solar, hydro, and biomass. The country has set ambitious targets for renewable energy, with a goal of achieving net-zero greenhouse gas emissions by 2050.

To achieve this goal, the UK government has launched several initiatives aimed at promoting the growth of renewable energy. These include financial incentives for renewable energy projects, the creation of new green jobs, and investment in research and development of new technologies.

The United Kingdom has also set out a comprehensive Climate Plan that outlines its goals and ambitions for reducing greenhouse gas emissions and transitioning to a low-carbon economy. The plan includes a range of measures such as:

I. Phasing out the sale of new petrol and diesel vehicles by 2030.
II. Expanding offshore wind capacity to 40 GW by 2030.
III. Increasing the use of low-carbon hydrogen and carbon capture technologies.
IV. Investing in energy-efficient buildings and infrastructure.
V. Encouraging sustainable land use and agriculture with avoiding the land use change to increase further.

The UK's Climate Plan is a crucial part of the country's strategy for meeting its net-zero emissions target and transitioning to a more sustainable economy. By prioritising renewable energy and investing in recent technologies and infrastructure, the UK is well-positioned to become a leader in the global transition to a low-carbon future.

Political

The UK government has set ambitious targets for renewable energy, including a goal of achieving net-zero greenhouse gas emissions by 2050. The government's **Energy White Paper**[172], published in December 2020, outlines a range of policies aimed at promoting the growth of renewable energy, including:

- **The Contracts for Difference (CfD) Scheme** provides financial incentives for renewable energy projects, ensuring that they receive a fixed price for their electricity over a set period. The government has recently launched a new CfD round for offshore wind projects, with a budget of £265 million[173].
- **The Green Homes Grant scheme** provided funding for energy-efficient home improvements, including insulation, double glazing, and renewable energy systems. The scheme ended in March 2022, with £1.5 billion in funding[174].
- **An Industrial Decarbonisation Strategy** aims to support the decarbonisation of heavy industry, including steel, cement, and chemicals, by promoting the use of low-carbon technologies and increasing energy efficiency[175].

[172] Powering our Net Zero Future (December 2020), HM Government, Energy White Paper , CP 337, https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future
[173] https://www.gov.uk/government/publications/contracts-for-difference/contract-for-difference
[174] https://www.gov.uk/green-deal-energy-saving-measures,https://www.greenmatch.co.uk/blog/green-homes-grant
[175] Industrial Decarbonisation Strategy (March 2021), HM Government, CP 399, https://www.gov.uk/government/publications/industrial-decarbonisation-strategy

The **Clean Growth Strategy** was published in 2017 and sets out a range of policies and measures aimed at reducing greenhouse gas emissions and promoting low-carbon growth. The strategy includes a commitment to phase out unabated coal-fired power stations by 2025, and to provide up to £557 million in funding for new renewable energy projects[176].

The government's Industrial Strategy, published in 2018, includes a focus on the development of clean technologies, including renewable energy. The strategy includes a £20 million investment in a new clean energy sector deal, aimed at supporting the growth of the offshore wind, electric vehicle, and nuclear industries[177].

This plan, published in 2017, sets out a range of policies aimed at promoting the development of smart energy systems, including renewable energy. The plan includes measures to support the deployment of energy storage, demand-side response, and smart grid technologies[178].

The UK has set legally binding carbon budgets, which require the country to reduce its greenhouse gas emissions by a certain amount over a set period. The budgets provide a clear framework for the development of low-carbon policies and the transition to a low-carbon economy[179].

The Net Zero Review: In 2020, the UK government launched a review of the country's net-zero target, with the aim of setting out a plan for achieving net-zero greenhouse gas emissions by 2050. The review considered a range of policies and measures, including those related to renewable energy, to support the achievement of the target[180].

Regulatory frameworks: The UK has a range of regulatory frameworks in place to support the growth of renewable energy, including:

- **The Renewable Energy Directive** requires Member States to ensure that at least 40% of their final energy consumption comes from renewable sources by 2030. The United Kingdom decided to rise this target to at least 50% after leaving the EU post-Brexit.
- **The Smart Export Guarantee (SEG)** requires energy suppliers to offer a payment for excess electricity generated by small-scale renewable energy systems, such as solar panels[181].
- **The Offshore Wind Sector Deal** sets out a framework for the growth of the UK's offshore wind industry, including a target of 30 GW of offshore wind capacity by 2030[182] .

[176] The Clean Growth Strategy. Leading the way to a low carbon future (October 2017), HM Government, https://www.gov.uk/government/publications/clean-growth-strategy
[177] Build Back Better our plan for growth (March 2021), HM Treasury, https://www.gov.uk/government/publications/build-back-better-our-plan-for-growth
[178] Transitioning to a net zero energy system. Smart Systems and Flexibility Plan 2021 (July 2021), Department for Business, Energy & Industrial Strategy, ofgem, https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021
[179] https://www.gov.uk/guidance/carbon-budgets
[180] https://www.gov.uk/government/news/net-zero-review-uk-could-do-more-to-reap-economic-benefits-of-green-growth
[181] https://energysavingtrust.org.uk/advice/smart-export-guarantee/
[182] Industrial Strategy. Offshore Wind Sector Deal, HM Government (2019), https://www.gov.uk/government/publications/offshore-wind-sector-deal

- **The Renewable Obligation Certificates (ROCs) scheme** provides financial incentives for renewable energy projects by requiring energy suppliers to source a certain percentage of their electricity from renewable sources. Energy suppliers can purchase ROCs from renewable energy generators to meet their obligations. The scheme closed to new entrants in 2017, but existing projects can still receive support until 2037[183].
- **Feed-in Tariffs (FITs)** provided financial incentives for small-scale renewable energy projects, such as solar panels and wind turbines, by guaranteeing a fixed payment for electricity generated by these systems. The scheme closed to new entrants in 2019, but existing projects can still receive support until their contract ends[184].
- **The Capacity Market** provides financial incentives for reliable energy capacity, including renewable energy, by guaranteeing a payment for electricity capacity during times of peak demand. The scheme is designed to ensure that the UK has enough capacity to meet demand and avoid power cuts[185].

The UK government has introduced **a Carbon Pricing Scheme** that puts a price on carbon emissions, incentivising companies to reduce their emissions and invest in renewable energy. The scheme currently operates through the EU Emissions Trading System (ETS), but the UK has launched its own ETS from 2021[186].

Local planning regulations can have a significant impact on the development of renewable energy projects, and the UK has introduced policies to support their development. For example, the National Planning Policy Framework[187] encourages local authorities to identify suitable sites for renewable energy projects and streamline the planning process for their development.

There are a range of funding opportunities available to support renewable energy projects in the UK, including:

- **The Green Investment Group:** This government-owned investment bank provides financing for renewable energy projects, including wind, solar, and hydro.
- **Innovate UK:** This government agency provides funding for innovative projects in a range of sectors, including renewable energy.
- **The Heat Networks Investment Project:** This £320 million fund provides financing for low-carbon heat networks, which can use renewable energy sources such as biomass and geothermal energy.

[183] https://www.ofgem.gov.uk/environmental-and-social-schemes/renewables-obligation-ro
[184] https://sse.co.uk/help/energy/feed-in-tariffs
[185] https://www.gov.uk/government/collections/electricity-market-reform-capacity-market
[186] https://www.gov.uk/government/publications/determinations-of-the-uk-ets-carbon-price/uk-ets-carbon-prices-for-use-in-civil-penalties-2021-and-2022
[187] National Policy Planning Framework (2021), Ministry of Housing, Communities & Local Government, https://www.gov.uk/government/publications/national-planning-policy-framework--2

Economic

According to a report by the Renewable Energy Association, the sector currently employs over 128,000 people in the UK, and this could rise to over 400,000 by 2030.

Bloomberg New Energy Finance reported that the UK attracted $10.3 billion in renewable energy investment in 2020, making it the fourth largest RES market in the world.

The cost of electricity from offshore wind has fallen by 60% over the last five years and is now cheaper than new gas-fired power plants, according to a report by the Committee on Climate Change.

The UK government has launched several policies to support the development of renewable energy, including feed-in tariffs. These tariffs provide financial incentives for small-scale renewable energy projects, such as solar panels and wind turbines.

The government has also launched the Contracts for Difference (CfD) scheme, which provides long-term contracts to renewable energy projects at a fixed price. This provides certainty for investors and helps to reduce the cost of renewable energy.

The Green Investment Group (GIG) was established by the UK government in 2012 to support the growth of renewable energy in the UK. The GIG provides finance to renewable energy projects and has invested over £16 billion in the sector since its creation (The Green Investment Group).

The Renewable Heat Incentive (RHI) is a government scheme that provides financial incentives to households and businesses that install renewable heating systems, such as solar thermal panels, heat pumps and biomass boilers. The scheme is designed to encourage the uptake of renewable heating and reduce carbon emissions[188].

The Energy Entrepreneurs Fund (EEF) is a government scheme that provides funding to innovative, low-carbon energy projects in the UK. The fund is open to businesses, individuals and academic institutions and has supported a range of projects, including energy storage, smart grid technologies and renewable energy[189].

The Smart Export Guarantee (SEG) is a government scheme that requires energy suppliers to pay customers for any excess renewable energy they generate and export back to the grid. The scheme is designed to encourage the uptake of small-scale renewable energy projects, such as solar panels[190].

[188] https://www.ofgem.gov.uk/environmental-and-social-schemes/domestic-renewable-heat-incentive-domestic-rhi
[189] https://www.gov.uk/government/collections/energy-entrepeneurs-fund
[190] https://www.ofgem.gov.uk/environmental-and-social-schemes/smart-export-guarantee-seg

The Offshore Wind Growth Partnership (OWGP) is a government-funded scheme that provides funding and support to UK companies that are looking to enter the offshore wind supply chain. The aim of the scheme is to help UK businesses to benefit from the growth of the offshore wind industry and to create new jobs (OWGP).

Announced in 2018, the Industrial Energy Transformation Fund provides funding for energy efficiency and decarbonisation projects in energy-intensive industries, such as steel, cement, and chemicals[191].

Social

According to a survey conducted by the previous Department for Business, Energy and Industrial Strategy in 2020, around 80% of the UK public support the use of renewable energy for electricity generation. This suggests that there is a strong social demand for renewable energy and a willingness to pay for it.

But the community energy is a growing trend in the UK, with communities coming together to develop, own, and operate renewable energy projects. The UK government has supported this trend in the past by providing funding and support through initiatives such as the **Rural Community Energy Fund**[192] closed in 2022, and the **Urban Community Energy Fund** that concluded in 2016.

The energy poverty is a significant issue in the UK, with many households struggling to pay their energy bills. The UK government has implemented policies such as the **Warm Home Discount Scheme** and the **Energy Company Obligation** to address this issue and promote energy efficiency in households, as well as the energy bill relief skill [193] and discounting energy bills for every household in the winter of 2022/2023[194].

The renewable energy sector has the potential to create significant job opportunities in the UK. According to a report by RenewableUK, the UK's wind, wave, and tidal energy industries could create up to 120,000 jobs by 2030. Jobs in the UKs offshore wind industry alone are estimated to grow to 97,000 people.

Technological

The UK is a global leader in offshore wind energy, with over 10 GW of installed capacity, and plans to increase this to 40 GW by 2030. The government has launched several policies to support the development of offshore wind, including the Offshore Wind Sector Deal, which aims to drive down costs and support innovation in the sector.

[191] https://www.gov.uk/government/collections/industrial-energy-transformation-fund
[192] https://www.gov.uk/guidance/urban-community-energy-fund
[193] https://www.gov.uk/guidance/energy-bills-discount-scheme
[194] https://www.gov.uk/get-help-energy-bills/getting-discount-energy-bill

The UK has over 13 GW of installed solar capacity, and the government has set a target of 40 GW of installed solar capacity by 2030. The government has launched several policies to support the development of solar energy, including the Smart Export Guarantee, which guarantees payments for excess electricity generated by small-scale solar projects.

The UK has set a target of 50 GW of energy storage capacity by 2050. The government has launched several policies to support the development of energy storage, including the **Faraday Battery Challenge,** which aims to support the development of battery technology in the UK[195].

The UK government has launched a hydrogen strategy, which aims to develop a low-carbon hydrogen economy in the country. The strategy includes plans to develop a hydrogen supply chain, support research and development into hydrogen technologies, and increase the use of hydrogen in transport and heating.

Also, the government has launched a few funds to support the development of renewable energy technologies, including the **Clean Growth Fund**, the **Green Investment Group**, and the **Energy Entrepreneurs Fund**. These funds provide financial support to innovative clean energy projects, helping to drive the growth of the renewable energy market in the UK.

Legal

Introduced in 2013, the Green Deal was a scheme designed to help households and businesses invest in energy efficiency improvements, such as insulation and efficient heating systems. The scheme provided loans to finance the improvements, which were repaid through energy bills.

Renewable Obligation Order (ROO): Introduced in 2002, the ROO was designed to incentivise the development of large-scale renewable electricity projects in the UK. The scheme required electricity suppliers to source a proportion of their electricity from renewable sources, with the obligation level increasing over time[196].

The Energy Act 2013 introduced several measures aimed at increasing investment in renewable energy, including the creation of the Contracts for Difference (CfD) scheme and the introduction of the Capacity Market, which provides incentives for investment in energy storage and demand-side response[197].

[195] https://www.faraday.ac.uk/the-faraday-battery-challenge/
[196] https://www.ofgem.gov.uk/environmental-and-social-schemes/renewables-obligation-ro/renewables-obligation-ro-energy-suppliers
[197] https://www.legislation.gov.uk/ukpga/2013/32/contents/enacted

The Electricity and Gas (Community Energy Saving Programme) Order 2009: This order provided funding to support community-led energy efficiency and renewable energy projects in the UK[198].

The Climate Change Act 2008: This act established legally binding targets for reducing greenhouse gas emissions in the UK, with a long-term goal of reaching net-zero emissions by 2050[199].

The Renewable Heat Incentive (RHI) Scheme: This scheme provides financial incentives for households, businesses, and public sector organisations to invest in renewable heating technologies, such as heat pumps, solar thermal, and biomass boilers[200].

Announced in 2019, the Offshore Wind Sector Deal is a partnership between the UK government and the offshore wind industry aimed at increasing the capacity of offshore wind in the UK to 30 GW by 2030.

Environmental

The UK has set legally binding targets to reduce carbon emissions by at least 68% by 2030, compared to 1990 levels, and to reach net zero emissions by 2050. These targets are supported by a range of policies and measures aimed at promoting renewable energy and other low-carbon technologies. In 2020, renewable energy sources accounted for 43% of the UK's electricity generation, up from 24% in 2015. Wind power was the largest contributor, accounting for 24% of total electricity generation.

The Renewable Heat Incentive (RHI) is a government scheme that provides financial incentives for the use of renewable heat technologies in homes and businesses. The scheme supports technologies such as biomass boilers, solar thermal panels, and ground source heat pumps.

The UK government has committed to phasing out the sale of new petrol and diesel cars and vans by 2030. To support this transition, the government has established a range of measures to promote the uptake of electric vehicles, including grants for EV purchase, funding for EV charging infrastructure, and exemptions from some taxes and fees[201].

Local Flexibility Markets and electricity services for local flexibility markets

The United Kingdom is rapidly transitioning towards a more decentralised and sustainable energy system, and local flexibility markets are playing a key role in this transformation. These markets allow for the efficient integration of renewable energy resources, energy storage systems, and electric vehicles, ensuring optimal usage and increased grid reliability.

[198] https://www.legislation.gov.uk/ukdsi/2009/9780111481929/contents
[199] https://www.legislation.gov.uk/ukpga/2008/27/contents
[200] https://www.ofgem.gov.uk/environmental-and-social-schemes/domestic-renewable-heat-incentive-domestic-rhi
[201] Taking charge: the electric vehicle infrastructure strategy (2022), HM Government, https://www.gov.uk/government/publications/uk-electric-vehicle-infrastructure-strategy

Numerous local flexibility projects are underway across the country, including the Piclo Flex platform, which enables the trading of flexibility services between different energy market players. Other notable projects include the Project LEO initiative, which involves the installation of an integrated smart grid in Oxfordshire, and the Orkney Smart Grid project, which aims to create a fully integrated renewable energy system on the Orkney Islands.

The United Kingdom's electricity services for local flexibility markets include the Grid Trading Platform which allows small-scale electricity producers to sell excess energy back to the grid, and the Distributed Energy Resource Management System which enables the coordination and optimisation of local energy resources.

The country has set ambitious goals to reach net-zero emissions by 2050, which has spurred innovation in the energy sector. One of the most notable projects in the UK is the "Electricity Market Reform," which aims to promote the growth of low-carbon technologies through a combination of support mechanisms and market reforms.

Additionally, the UK has established a regulatory framework to enable the deployment of smart grid technologies, such as demand response and energy storage. Specific projects include the Cornwall Local Energy Market, which is a pilot program testing the use of block chain technology to create a local energy market, and the "Flexibility First" program, which aims to create an integrated market for flexibility services.

The UK has also implemented the Electricity System Operator, which allows for distributed energy resources to participate in the wholesale electricity market. These initiatives aim to enable the integration of renewable energy sources and create a more flexible and resilient energy system. Furthermore, the UK is developing new business models and financing mechanisms to support the growth of local flexibility markets, including community-owned energy schemes and peer-to-peer trading platforms.

4.2 Norway

Norway's renewable energy market and its associated industries are an important part of the country's economic and environmental landscape. The country has been a leader in renewable energy, with a strong focus on hydropower and wind power. The country's commitment to sustainable energy production has been reflected in policies and initiatives that promote the use of clean energy sources. The renewable energy market in Norway and associated industries, such as energy storage and distribution, are vital components of the country's economy and efforts towards reducing greenhouse gas emissions. However, like any market, the renewable energy sector in Norway is subject to various external factors that can impact its growth and profitability.

According to recent reports, the country's renewable energy capacity has been increasing steadily over the years, with hydropower and wind power being the primary sources of renewable energy. In 2020, hydropower accounted for 96% of Norway's electricity production, while wind power made up 3%. Despite the dominance of hydropower, there has been a recent increase in wind power projects, with several large-scale wind farms in development.

Additionally, there is growing interest in other renewable energy sources, such as solar and geothermal energy. The growth of Norway's renewable energy market has been facilitated by supportive government policies, including tax incentives and subsidies, as well as increased investment from both domestic and foreign companies. However, challenges such as grid limitations and high production costs remain, and the market is also subject to external factors such as changes in global energy markets and international regulations.

Norway is a signatory to the Paris Agreement, which commits countries to limiting global warming to well below 2 degrees Celsius above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 degrees Celsius. Additionally, is also has a climate plan that outlines its commitment to reducing greenhouse gas emissions and transitioning to a low-carbon economy. The plan, called the **Climate Agreement for 2020-2030**[202], was adopted in 2020 and sets a target of reducing greenhouse gas emissions by at least 50% by 2030 compared to 1990 levels. The plan also includes measures to promote the development and use of renewable energy, such as increasing the share of biofuels in transportation and supporting the deployment of offshore wind power.

The main renewable energy goals of the agreement are:

I. To increase the share of renewable energy in final energy consumption to at least 67.5% by 2030.

II. To increase the share of biofuels in transportation to at least 20% by 2020 and 30% by 2030.

III. To increase the production and consumption of renewable electricity in Norway, with a goal of increasing production from 153TWh in 2019 to 160TWh by 2030.

IV. To support the deployment of offshore wind power, with a goal of developing 3.5 GW of offshore wind capacity by 2030.

V. To promote the use of renewable energy in industry, with a goal of reducing emissions from industry by at least 40% by 2030 compared to 2005 levels.

[202] Norway's Climate Action Plan for 2021-2030 – Meld. St. 13 (2020-2021) Report to the Storting (white paper) https://www.regjeringen.no/en/dokumenter/meld.-st.-13-20202021/id2827405/?q=production,%20conversion,%20transmission,%20trading,%20distribution,%20and%20use%20of%20energy

Political

The main policy instruments in Norway's Climate Action Plan are GHG taxation, regulatory measures, climate-related requirements in public procurement processes, information on climate-friendly options, financial support for the development of innovative technologies, and initiatives to promote research and innovation.

Norway aims to cut emissions from non-ETS sectors by 45% from 2005 levels by 2030 through the Climate Action Plan, which includes policies to address emissions from transport, buildings, waste, agriculture, and some minor emissions from industry production and the oil and gas industry:

- The Climate Action Plan also includes an aim to gradually increase the national carbon tax rate to NOK 2,000 (EUR 196) per tonne of CO2 equivalent (t CO2-eq) in 2030.

The Climate Change Act adopted by the Norwegian parliament in June 2017 establishes by law Norway's NDC target and the target of becoming a low emissions society by 2050, which is equivalent to reducing emissions by around 90-95% from 1990 levels.

The Green Energy Fund was established by the Norwegian government in 2001 and renamed in 2020to support the development of new renewable energy projects, particularly in the areas of wind, solar, and tidal energy. The fund provides financing for both large-scale and small-scale projects and aims to accelerate the transition to a low-carbon economy[203].

The Renewable Energy Act: This legislation provides a framework for the development and use of renewable energy in Norway. The act outlines specific targets for renewable energy production and consumption, as well as measures to promote the deployment of new renewable energy projects.

The Energy Certificate System: This system is designed to incentivise the development of renewable energy projects by providing certificates to producers of renewable energy. These certificates can be sold to energy suppliers, who are required by law to meet certain renewable energy targets[204].

The Offshore Renewable Energy Strategy: This strategy was developed by the Norwegian government to support the development of offshore wind and other renewable energy projects. The strategy includes measures to streamline the regulatory process for offshore projects, as well as funding to support research and development in the sector[205].

[203] https://www.enova.no/about-enova/; https://www.regjeringen.no/en/dep/kld/organisation/selskaper/enova/id2599611/
[204] https://necs.statnett.no/home
[205] https://www.regjeringen.no/en/aktuelt/ambitious-offshore-wind-powerinitiative/id2912297/#:~:text='Today%2C%20we%20are%20launching%20a,we%20currently%20produce%20in%20Norway

The Climate and Energy Fund: This fund provides financing for a range of projects related to climate change and sustainable development, including renewable energy projects. The fund is supported by the Norwegian government and aims to support innovative and sustainable solutions to environmental challenges[206].

Also, Norway has adopted several EU climate and energy directives into its domestic regulation, including the EU Renewable Energy Directive, the Energy Performance of Buildings Directive, the CHP Directive on combined heat and power, as well as the Eco-design and Energy Labelling Directives

The government published a Hydrogen Strategy in June 2020, followed by a white paper in 2021 that assessed the entire energy sector and included a road map for hydrogen[207].

Economic

Norway has established a carbon tax, covering the combustion of fossil fuels and the petroleum sector, with a current rate of around 766 Norwegian krone per tonne of CO2 equivalent (NOK/t CO2-eq) (76 EUR/t CO2-equivalent) for emissions outside the EU Emissions Trading System (ETS).

Norway is one of the world's largest producers of hydropower and is also investing heavily in wind and solar power. As of 2021, Norway has installed wind power capacity of over 4.93 GW, with an additional 4.5 GW opened for the development, and solar power capacity of 1.1 GW. In 2021 though, hydropower accounted for 91.5 % of electricity output, wind power 7.5% to Norway's electricity mix[208].

According to the International Renewable Energy Agency (IRENA) and the International Energy Agency (IEA), renewable energy in Norway accounted for approximately 98% of electricity production, with 92% coming from hydropower sources in 2022[209].

The Norwegian government has established various policies and initiatives to support the growth of renewable energy, such as the **Renewable Energy Act of 2012** set a target of producing 67.5% of Norway's electricity from renewable sources by 2020 which was further exceeded to reach 98% in 2022. The government has also implemented a green certificate scheme to incentivize the development of new renewable energy projects[210,211].

[206] https://www.iea.org/policies/2617-climate-and-energy-fundenova-industry
[206] https://www.norfund.no/the-climate-investment-fund/
[207] Norway 2022 Energy Policy Review (2022), International Energy Agency, https://iea.blob.core.windows.net/assets/de28c6a6-8240-41d9-9082-a5dd65d9f3eb/NORWAY2022.pdf
[208]https://www.statista.com/statistics/1025497/distribution-of-electricity-production-in-norway-by-source/
[209] https://www.irena.org/publications/2021/Aug/Renewable-energy-statistics-2021
[210] https://thelawreviews.co.uk/title/the-renewable-energy-law-review/norway
[211]https://www.regjeringen.no/en/historical-archive/Stoltenbergs-2nd-Government/Ministry-of-Petroleum-and-Energy/taler-og-artikler/2010/offshore-renewable-energy-production--po/id620419/

Norway is a member of the International Renewable Energy Agency and has pledged to provide financial support to developing countries to help them transition to renewable energy. One example is Norway's Climate Investment Fund, committing to invest in SAEL to develop 3000 MW clean energy[212].

The country has also got a strong and stable economy, which enables investment in renewable energy infrastructure.

The renewable energy sector is a significant contributor to the Norwegian economy. A 2019 report by Multiconsult estimated that the renewable energy sector could contribute up to NOK 150 billion (approximately USD 17.5 billion) to the Norwegian economy by 2030[213].

Social

The public opinion: according to a survey conducted by Statistics Norway in 2020, 8 out of 10 Norwegians believe that climate change is a fundamental problem, and 7 out of 10 believe that Norway should do more to address it. The same survey found that most Norwegians support the development of renewable energy sources such as wind and solar power.

The development of renewable energy projects in Norway often involves local communities, who may have concerns about issues such as noise, visual impact, and land use. The Norwegian government has implemented policies to promote local participation and ownership in renewable energy projects, such as the **Green Energy Certificate Scheme and the Enova Grant Programme (ENOVA)**:

- The polluter-pays principle is a cornerstone of the Norwegian policy framework on climate change.

Norway has made significant efforts to promote gender diversity in the energy sector. For example, the Norwegian Ministry of Petroleum and Energy has established a Gender Equality Committee to promote equal opportunities and combat gender-based discrimination in the sector.

Norway has implemented strict health and safety regulations for the renewable energy sector, including requirements for risk assessments and safety plans. The Norwegian Labour Inspection Authority oversees compliance with these regulations and conducts regular inspections of renewable energy facilities.

[212] https://www.norway.no/en/india/norway-india/news-and-events/newsnde/norways-climate-investment-fund-to-invest-in-sael-to-develop-3000-mw-clean-energy/
[213] 2020 Sustainability Report, Multiconsult, https://www.multiconsult.no/assets/Multiconsult-Sustainability-Report-2020.pdf

Technological

Norway has a high-level of renewable energy penetration, with hydropower being the dominant renewable source. In 2020, hydropower accounted for 95% of the country's total electricity production. Other renewable sources, including wind power and bioenergy, accounted for the remaining 5% (Norwegian Water Resources and Energy Directorate).

In recent years, Norway has seen significant growth in wind power capacity, with several large-scale wind projects being developed. As of 2021, Norway had a total wind power capacity of 4.5 GW (Norwegian Water Resources and Energy Directorate).

Norway is investing in the development of new renewable energy technologies, such as floating offshore wind turbines. In 2019, Norway's first floating offshore wind turbine, Hywind Tampen[214], was installed in the North Sea, marking a significant milestone in the country's efforts to expand its renewable energy mix (Equinor).

The country is also investing in the development of energy storage solutions, such as battery technology, to support the integration of renewable energy sources into the grid. The country has set a target to increase battery production capacity to 50 GWh per year by 2030 (Norwegian Ministry of Climate and Environment):

- CCS (carbon capture and storage) is a priority area for Norway's climate action and is identified as an important measure in Norway's NDC. The Langskip (Longship) project, currently under construction, is a central part of the government's policy for CCS. The project comprises state support to two full-scale capture facilities and one storage facility in the North Sea. Langskip aims to facilitate learning and cost reductions for subsequent projects in an international perspective.

Norway is also part of several international collaborations focused on the development of renewable energy technologies, such as the **European Technology and Innovation Platform for Wind Energy** and the International Energy Agency's **Technology Collaboration Programme on Ocean Energy Systems** (Norwegian Ministry of Petroleum and Energy).

Legal

Norway has put in place policies and measures aimed at cutting emissions from non-ETS sectors, including from transport, buildings, waste, and agriculture.

The Norwegian Water Resources and Energy Directorate (NVE) is responsible for regulating the country's energy sector. The NVE is responsible for granting licenses for the construction and

[214] Offshore renewable energy production; - possibilities and challenged (16 November 2010), British Norwegian Green Energy revolution, https://www.regjeringen.no/en/historical-archive/Stoltenbergs-2nd-Government/Ministry-of-Petroleum-and-Energy/taler-og-artikler/2010/offshore-renewable-energy-production--po/id620419/

operation of new renewable energy projects, as well as for overseeing the transmission and distribution of electricity.

Norway has established regulations for land use, land-use change, and forestry (LULUCF) under its agreement with the EU, which it plans to continue to follow domestically.

Norway has a **Climate Change Act**, which establishes by law Norway's NDC target and the target of becoming a low-emissions society by 2050.

The nation also implemented a **Carbon Tax**, which is one of the highest in the world. The tax applies to all sectors of the economy, including the energy sector. The carbon tax is based on the CO2 content of fuels, and the tax rate is currently set at NOK 2,139 (approximately USD 245) per tonne of CO2.

The Energy Act[215] in Norway is known as "Act relating to the production, conversion, transmission, trading, distribution, and use of energy, etc.". This is the original name of the legislation, and it was enacted in 1990 to provide a framework for the regulation and development of the energy sector in Norway, including the promotion of renewable energy. Since then, the Renewable Energy Act has been amended several times, including the most recent amendments in 2022, to reflect changes in the energy sector and to support the country's transition to a low-carbon economy.

The Norwegian government has also implemented several policies to promote energy efficiency, including the **Energy Efficiency Regulations** (2010), which set energy performance requirements for new buildings and require the renovation of existing buildings to meet certain energy performance standards.

One of the key legal challenges facing Norway's renewable energy market is the regulatory framework for energy storage. Currently, there is no specific regulation for energy storage in Norway, which may create uncertainty for investors and developers. The Norwegian government is working to develop a regulatory framework for energy storage, which is expected to be implemented in the coming years.

Environmental

Norway has abundant natural resources that can be harnessed for renewable energy production, including wind, hydropower, and bioenergy.

Also, Norway is committed to reducing its greenhouse gas emissions and transitioning to a low-carbon economy, which supports the development of renewable energy.

[215] Act relating to production, conversion, transmission, trading, distribution and use or energy, etc. (Energy Act) (04.04.2022) (in Norwegian), Ministry of Petroleum and Energy, https://lovdata.no/dokument/NL/lov/1990-06-29-50

Norway has a long coastline and significant offshore wind potential. The government has launched several initiatives to support the development of offshore wind projects, including the allocation of areas for offshore wind development and financial support for research and development.

The wind power projects can have environmental impacts, including impacts on bird populations and visual impacts on the landscape. The Norwegian government has established guidelines for wind power development that aim to minimise these impacts, including guidelines on siting and design.

Local Flexibility Markets and electricity services for local flexibility markets

Norway has been investing heavily in renewable energy, including wind and hydroelectric power. Local flexibility markets have become increasingly important in Norway to integrate these resources into the grid and ensure efficient usage.

There are several pilot projects underway to test local flexibility markets, such as the ENERGIX-funded project, which aims to develop a virtual power plant that integrates renewable energy sources and energy storage systems to provide grid services. The project will also test various market designs to incentivise energy users to adjust their consumption during periods of peak demand. Another project is the Norwegian Smart Grid Centre, which is testing local energy trading between households and small-scale producers. This project uses block chain technology to enable peer-to-peer transactions between participants.

Additionally, several utilities in Norway have launched demand response programmes, allowing customers to adjust their energy consumption in response to changes in electricity prices. To achieve Norway's goals regarding reducing greenhouse gas emissions, it is promoting the development of new renewable energy sources, such as wind and hydroelectric power, and investing in smart grid technologies.

One such initiative is the Smart Grid Norway programme, which includes several pilot projects to test different technologies and business models for local flexibility markets and electricity services, such as demand response, energy storage, and electric vehicle charging.

Another project is the Fjordkraft Varme Flex project, which involves the installation of smart heating systems in residential buildings to enable demand response and reduce peak electricity consumption. The project uses a digital platform to monitor and control the heating systems and offers financial incentives to consumers who participate in the demand response programme.

Norway is also home to several innovative startups and companies that are developing modern technologies and solutions for local flexibility markets and electricity services. For example, Tibber is a Norwegian startup that offers a digital energy management platform for households and small businesses, enabling them to optimize their energy consumption, control their electricity costs, and

participate in energy markets. Another company, Entelios, provides energy management solutions for large commercial and industrial customers, helping them to reduce their energy costs and improve their energy efficiency.

Overall, Norway's commitment to renewable energy and smart grid technologies, combined with its innovative startups and pilot projects, make it a promising market for local flexibility markets and electricity services.

4.3 Switzerland

The renewable energy market has emerged as a key player in Switzerland's energy landscape, driven by the country's commitment to reducing carbon emissions and transitioning towards a more sustainable future. The Swiss government has set ambitious targets for increasing the share of renewable energy in the country's total energy mix, including a goal to achieve 100% renewable electricity production by 2050. To achieve these goals, the renewable energy industry in Switzerland is rapidly growing, with investments pouring into solar, wind, and hydro power projects.

But despite the considerable progress made in recent years, there are still challenges facing the renewable energy market in Switzerland. The industry is heavily regulated, with strict environmental and planning laws that can make it difficult for companies to obtain permits for new projects. Additionally, the country's mountainous terrain can pose significant technical challenges for certain types of renewable energy projects, such as wind power.

Switzerland has committed to various international agreements and initiatives, such as the Paris Agreement, and is actively working towards achieving the United Nations Sustainable Development Goals (SDGs) by 2030.

The Swiss Federal Council further adopted the **Swiss CO2 Act** in 2021[216], which sets ambitious targets for reducing emissions and transitioning towards a more sustainable economy. The plan includes a series of measures designed to reduce greenhouse gas emissions by 50% compared to 1990 levels by 2030, with the goal of achieving net zero emissions by 2050.

[216] Federal Act on the Reduction of CO2 Emissions (CO2 Act) (translated to English), The Swiss Federal Council https://www.admin.ch/gov/en/start/documentation/votes/20210613/co2-act.html

The plan includes a mix of policies and initiatives, such as incentives for renewable energy production, the promotion of energy-efficient buildings and transportation, and the introduction of a carbon tax on fossil fuels. Additionally, the plan emphasises the importance of international cooperation and collaboration to address the global challenge of climate change.

The key renewable energy goals of the Swiss CO2 Act include:

I. Increase the share of renewable energy in Switzerland's total energy consumption to 26.4% by 2030. This includes a target of 4,400 GWh of new renewable energy capacity to be added each year.

II. Increase the share of renewable energy in Switzerland's electricity production to 60% by 2030. This includes a target of 1,000 GWh of new solar power capacity to be added each year.

III. Increase the efficiency of energy use in buildings by promoting energy-efficient building standards and incentivising energy-efficient renovations.

IV. Encourage the transition to low-emission transportation by promoting the use of electric vehicles and improving public transportation infrastructure.

Political

The Swiss CO2 Act, which sets ambitious targets for reducing greenhouse gas emissions and transitioning towards a more sustainable economy, including increasing the share of renewable energy in Switzerland's total energy consumption and electricity production[217].

The Swiss Federal Office of Energy, which is responsible for implementing and enforcing energy policies and regulations in Switzerland.

The Swiss Federal Energy Act of 2016, which provides a legal framework for the promotion of renewable energy sources and energy efficiency measures in Switzerland (Swiss Federal Office of Energy:

- Aims to ensure an economically and environmentally viable supply and distribution of energy, thrifty and efficient energy consumption, and a transition towards renewable energy supply, particularly from local sources.
- Defines non-binding targets for overall energy and electricity consumption for 2020 and 2035.
- Specifies the principles of feed-in of electricity, self-consumption, and the feed-in tariff system as well as investment grants related to PV, hydroelectricity, and biomass.

[217] https://climate-laws.org/geographies/switzerland/laws/co2-act-act-641-71-fully-revised-version

The Swiss Energy Agency, which is responsible for promoting the use of renewable energy sources and energy efficiency measures in Switzerland. The agency provides information and advice on renewable energy technologies and manages certification schemes such as the Naturemade and Minergie labels for sustainable and energy-efficient building practices (Swiss Energy Agency).

The Swiss Energy and Climate Summit, which is an annual event that brings together policymakers, industry leaders, and experts to discuss the latest trends and opportunities in the energy sector. The event focuses on topics such as renewable energy, energy efficiency, and sustainable finance, and provides a platform for networking and collaboration (Swiss Federal Office for Energy).

Economic

Financial incentives for renewable energy projects, including subsidies for solar and wind power, and feed-in tariffs for electricity generated from renewable sources.

The Swiss Climate Cent Foundation, which provides funding and support for climate protection projects in Switzerland and around the world (Swiss Climate Cent Foundation).

The Swiss Energy Innovation Challenge, which is a startup competition that aims to support innovative solutions to the challenges facing Switzerland's energy system. The competition provides funding and mentorship to selected startups and offers access to a network of industry experts and investors (Swiss Federal Office of Energy).

The Swiss Renewable Energy Fund, which is a private investment fund that invests in renewable energy projects in Switzerland and internationally. The fund focuses on projects that have a positive impact on the environment and society and aims to provide attractive returns for investors (Swiss Renewable Energy Fund).

The Swiss Green Economy Symposium, which brings together business leaders, policymakers, and experts to discuss and promote sustainable business practices and renewable energy solutions.

The Swiss Federal Office of Energy provides funding and support for research and development projects in the renewable energy sector. These projects aim to advance the state of the art in areas such as solar energy, wind power, and energy storage, and to promote the commercialisation of new technologies (Swiss Federal Office of Energy).

The Swiss Sustainable Finance Association, which is a network of banks, asset managers, and other financial institutions that promote sustainable finance practices in Switzerland. The association aims to encourage the integration of environmental and social factors into investment decisions, and to support the growth of sustainable industries such as renewable energy (Swiss Sustainable Finance Association).

Social

The growing awareness and concern among Swiss citizens about the impacts of climate change and the importance of transitioning to renewable energy sources.

The Swiss Climate Strike movement, which has seen thousands of young people take to the streets to demand action on climate change. The movement has put pressure on policymakers to take bolder action on reducing greenhouse gas emissions and transitioning to renewable energy sources (Swissinfo).

The Swiss Energy Council, which is a forum for dialogue and collaboration between stakeholders in the Swiss energy sector. The council brings together representatives from government, industry, academia, and civil society to discuss and develop solutions to the challenges facing Switzerland's energy system (Swiss Energy Council).

The Swiss Federal Office of Energy promotes public education and awareness of renewable energy through various campaigns and initiatives. These initiatives aim to educate the public about the benefits of renewable energy, and to encourage the adoption of sustainable energy practices.

The increasing demand for clean and sustainable energy solutions among Swiss consumers and businesses.

The prevalence of environmental and sustainability certifications in Switzerland, such as the Swiss Energy Agency's "Naturemade" and the Swiss Federal Office of Energy's "Minergie" labels, which promote energy-efficient and sustainable building practices.

Legal

The Swiss Energy Act (EnG) provides the legal framework for the promotion of renewable energy in Switzerland. The law requires that a certain percentage of electricity consumed in Switzerland come from renewable sources and sets targets for the increase in renewable energy production. The act includes measures such as energy labelling requirements for buildings and appliances, and financial incentives for energy efficiency improvements (Swiss Federal Office of Energy).

The Swiss Electricity Supply Ordinance, which mandates that a certain percentage of electricity sold in Switzerland must come from renewable sources. The ordinance sets a target of 4,400 gigawatt-hours (GWh) of renewable energy by 2035, which is equivalent to around 11% of Switzerland's electricity consumption (Swiss Federal Office of Energy).

The Swiss government provides various financial incentives for the development of renewable energy, including feed-in tariffs, investment subsidies, and tax credits.

The Swiss Federal Energy Research Commission, which advises the government on energy policy and research priorities. The commission provides recommendations on issues such as renewable energy, energy efficiency, and nuclear energy, and plays a key role in shaping Switzerland's energy policy (Swiss Federal Energy Research Commission).

The Swiss government has implemented a carbon tax, which places a price on carbon emissions from fossil fuels. The revenue from the tax is used to support renewable energy and energy efficiency projects (Swiss Federal Office of Energy).

A system of emissions trading has been implemented, which places a cap on emissions from large industrial facilities and allows for the trading of emissions permits.

Environmental

Switzerland's abundant natural resources, including hydro power potential and high levels of solar radiation in some regions.

The country's commitment to reducing greenhouse gas emissions and transitioning towards a more sustainable future.

But there are some potential environmental impacts of renewable energy projects, such as the impact on wildlife and habitats, as well as the need to effectively manage and dispose of end-of-life materials from renewable energy systems.

Local Flexibility Markets and electricity services for local flexibility markets

Switzerland is transitioning to a more decentralised and sustainable energy system with a growing number of solar PV installations, energy storage systems, and electric vehicles. Local flexibility markets are becoming increasingly important as a solution to better integrate these resources into the grid and ensure efficient usage.

Several pilot projects are currently underway in Switzerland to evaluate local flexibility markets, including incentivising local businesses and households to reduce electricity consumption during peak periods, and developing a platform for small-scale electricity producers to sell excess energy to nearby consumers.

These projects aim to increase the reliability and resilience of the Swiss electricity grid by allowing local resources to provide grid services and provide economic benefits to local communities by monetising their energy resources and supporting the growth of renewable energy.

In addition, specific projects related to electricity services for local flexibility markets are also underway in Switzerland. The "Zurich West" project aims to create a virtual power plant from a network of distributed energy resources, utilising block chain technology to coordinate and optimize the use of these resources. The "Energie 360°" initiative involves the installation of a large-scale battery storage system to provide grid services, while Swissgrid has launched a pilot project to test the use of block chain technology for the settlement of ancillary services.

Another key initiative in Switzerland is the "Smart Grid Switzerland" project, which aims to develop and implement a nationwide smart grid infrastructure to support the integration of renewable energy sources and electric vehicles. This project is set to provide enhanced grid management and optimisation capabilities, including the ability to manage and balance distributed energy resources in real-time.

Another important aspect of local flexibility markets in Switzerland is the involvement of energy cooperatives and community-based projects. For instance, the "Energy Scouts" programme in the Canton of Bern trains young people to become energy experts and develop projects for reducing energy consumption and promoting renewable energy at the local level.

Moreover, the Swiss government has established various funding schemes and support mechanisms for local energy projects, including the Clean Energy Cooperatives programme, which provides financial support for the establishment and operation of energy cooperatives.

5. Benchmarking of Good Practice

Local flexibility markets are a relatively recent development and represent an emerging and growing field (Eid *et al.*, 2016). Many new developments and projects still have an experimental character and would benefit from the identification of benchmarks and good practices (Jin, Wu and Jia, 2020).

When it comes to the identification of good practices in Europe, these can be grouped into four general categories which are illustrated in Figure 3 and discussed in more detail in the following sections.

Figure 4 Benchmarking criteria for Local Flexibility Markets

Source: The analyses of the country tables in Annex I

Benchmarking of local flexibility markets can be linked to the PESTLE analysis by:

- Considering the external factors affecting the markets in respective countries
- Evaluating the internal factors that affect the performance of the markets.

In the first step, the political, economic, social, technological, legal, and environmental factors that affect local flexibility markets in the countries under consideration were analysed through the PESTLE analysis. This analysis was then used to evaluate the performance of local flexibility markets. Criteria were a range of factors such as the number of active participants, the level of competition, the degree of standardisation and interoperability, the effectiveness of regulatory frameworks, and the level of innovation and technological advancement.

Benchmarking the performance of local flexibility markets can help identify best practices that can be adopted to enhance the performance of the markets. When it comes to the identification of good practices in Europe, these can be grouped into four general categories. These are (a) Collaboration,

Coordination and Customer Engagement, (b) Standardisation and Interoperability, (c) Flexibility Services and Regulatory Support, and (d) Data Management and Security. These are illustrated in Figure 3.

When benchmarking local flexibility markets in Europe, the four categories of Collaboration, Coordination and Customer Engagement, Standardisation and Interoperability, Data Management and Security, and Flexibility Services and Regulatory Support were linked to the PESTLE analysis as described in the next section.

Collaboration, Coordination and Customer Engagement: This category focuses on the level of collaboration among stakeholders in the local flexibility market and how well the market engages with customers. To link this to the PESTLE analysis, we particularly considered the political and social factors (P and S) that impact collaboration and customer engagement. For example, government policies that encourage stakeholder collaboration or societal values that prioritise customer satisfaction may positively impact this category.

Standardisation and Interoperability: This category examines the extent to which standards and protocols are aligned across different markets and how easily they can interoperate. To link this to the PESTLE analysis, we mainly evaluated the economic and technological factors (E and T) that could influence standardisation and interoperability. This includes the availability of technological infrastructure and the level of investment in the energy sector may impact this category.

Flexibility Services and Regulatory Support: This category focuses on the availability and quality of flexibility services and the level of regulatory support for the local flexibility market. To link this to the PESTLE analysis, the political and legal factors (P and L) were of relevance. Examples are government policies that incentivise the adoption of flexibility services, or regulatory frameworks that facilitate their implementation.

Data Management and Security: This category evaluates how data is managed and secured in the local flexibility market. To link this to PESTLE analysis, we considered the legal and environmental factors (L and E) as they may impact data management and security. For example, privacy laws and environmental regulations might regulate how data is collected and stored.

Overall, linking these categories to the PESTLE analysis enables a comprehensive benchmark analysis of the local flexibility market because it considers the various external factors that determines development and success.

5.1 Collaboration, coordination, and customer engagement

Effective collaboration and coordination between stakeholders such as energy companies, regulators, and consumers are essential for the success of local flexibility markets. This can help to ensure that local flexibility markets are designed to meet the needs of all stakeholders and thus allow for building trust and support for these markets. Engaging customers in the development and operation of local

flexibility markets can help build awareness as well. Customers are expected to deliver feedback on the design and implementation of LFM so that initial design flaws can be detected and rectified early.

Local flexibility markets benefit from active participation of consumers, e.g., through demand response programmes, dynamic pricing, and home energy management systems. Encouraging consumer participation can help to balance energy supply and demand, reduce energy costs, and support the integration of renewable energy sources.

An example of how engaging customers represents good practices for local flexibility markets is the provision of information about consumers' energy use. This can then be the starting point for offering incentives for reducing demand during periods of peak consumption. In Italy, the company Enel has established programmes which allows customers to monitor their energy usage and offers incentives for reducing consumption during peak periods (e.g., Demand Response by Enel X). This service is offered in other European markets as well. For example, Enel's advanced energy services business line, through its local subsidiary Enel X Polska, was awarded 696 MW of demand response (DR) capacity to be delivered in 2024 in Poland's Capacity Market.

Collaboration is an essential activity towards a situation where the market is aligned with the needs of all parties and can help identify areas for improvement. Another example is the Energy Networks Association and its Open Networks Project that has brought together nine electricity grid operators in the UK and Ireland to work together to standardise customer experiences and align processes. The focus is on increasing participation and volume in the local flexibility market. This is coordinated with initiatives from the UK government and the Office of Gas and Electricity Markets [Department for Business, Energy & Industrial Strategy; Ofgem, United Kingdom (2021), transitioning to a net-zero energy system (Smart Systems and Flexibility Plan 2021)[218].

A further benchmark for such activities is the Spanish SME R2M Solution that provides consulting services to local governments, distribution system operators, and other stakeholders on the design and implementation of local flexibility markets. This includes the development of regulatory frameworks, business models, and market mechanisms that incentivise the participation of different actors in the market. An example for this is their involvement in the EU-funded Lightness project on energy communities and the empowerment of citizens to generate, share and sell renewable energy and thereby contribute to making the European energy sector more sustainable and democratic (Lightness Project).

[218] https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021

5.2 Standardisation and interoperability

Standardisation and interoperability are critical for the development of local flexibility markets. Standardised interfaces and protocols can help to ensure that different systems can communicate with each other. Linked to this is interoperability that enables the integration of different technologies and systems.

Interoperability and standardisation of technologies and systems are critical for the development of local flexibility markets. This can help to ensure compatibility between different technologies, facilitate data sharing, and support market integration.

Standardisation and interoperability for local energy markets can be achieved through various measures, such as common communication protocols, open interfaces, and shared data models. The OpenADR Alliance is a non-profit organisation that promotes the adoption of the OpenADR (Open Automated Demand Response) standard for demand response programmes. The OpenADR standard provides a common language for communicating information between utilities, grid operators, and building automation systems, enabling automated demand response actions.

The European Network of Transmission System Operators for Electricity (ENTSO-E) develops and maintains common network codes and guidelines for the European electricity transmission system. The network codes and guidelines cover topics such as balancing and settlement, capacity allocation and congestion management, and interoperability between transmission system operators.

Advances in technology, such as battery storage, smart grid systems, and block chain, can support the development of local flexibility markets. These technologies provide the necessary flexibility to balance energy supply and demand, enable peer-to-peer trading, and enhance grid stability and resilience.

A positive example in this context are the activities of the De-Risk project partner QUE Technologies, Greece which was involved in the development of block chain technology for a platform for the transactive electricity markets. This activity is linked to the EU-funded PARITY project that specifically works towards local flexibility market platforms that that integrates IoT and block chain technologies (CORDIS EU research results, Pro-sumer AwaRe, Transactive Markets for Valorisation of Distributed flexibility enabled by Smart Energy Contracts, 1 October 2019)[219].

The project also includes active network management tools to address the present 'structural inertia' of the distribution grid and aims to increase grid durability for markets where renewable energy sources in the electricity energy mix have a majority share.

[219] https://cordis.europa.eu/project/id/864319

5.3 Data management and security

Effective data management is critical for the operation of local flexibility markets (Torbaghan *et al.*, 2018). Robust data management systems can help to ensure that data is accurate and reliable while also protecting customer privacy. Data privacy and security are important considerations for local flexibility markets, particularly with the increasing use of digital technologies and data analytics. Ensuring appropriate data protection measures can help to build consumer trust, reduce risks of cyberattacks, and support market growth.

Data security is a central issue for local flexibility markets because they rely on the collection, sharing, and analysis of large amounts of sensitive data related to energy consumption, production, and distribution. For example, data breaches are a threat that can compromise the functioning of the entire market. Local flexibility markets involve the collection and storage of large amounts of data that are vulnerable to cyberattacks. Hackers may try to steal or manipulate data for financial gain or to disrupt the functioning of the market.

Local flexibility markets collect sensitive information about energy consumption patterns, which may be linked to individual consumers. This raises concerns about privacy, and the risk of misuse of personal data (Liu *et al.*, 2012).

One of the most basic and essential practices for securing data is to encrypt it. This involves converting the data into a code that can only be deciphered with a key. Encryption helps to prevent unauthorised access to data, as even if the data is intercepted, it cannot be read without the key (Apricorn Data).

It is important to control access to data by implementing appropriate authentication and authorisation mechanisms. This involves verifying the identity of users and ensuring that they have the necessary permissions to access the data. Access control can help to prevent unauthorised access and data breaches. Best practises in this context are established by the European Network for Cyber Security (ENCS). ENCS is a non-profit member organisation that brings together critical infrastructure owners and security experts to deploy secure European critical energy grids and infrastructure. ENCS provides cyber security solutions and counsel dedicated to the needs of national Distribution System Operators (DSO) and regulators (WP-057-2022: Update on the Network Code on Cybersecurity, ENCS)[220].

Data minimisation reduces the risk of data breaches. This means that only data should be collected that is necessary for the operation of the local flexibility market and to ensure that the data is deleted when it is no longer needed. Data minimisation can help to reduce the impact of data breaches and increase the efficiency of data management. It is important to ensure that these minimised data set

[220] https://encs.eu/resource/wp-057-2022-update-on-the-network-code-on-cybersecurity/

are transferred via secure communication protocols to protect against eavesdropping and interception.

Local flexibility markets should also implement proactive measures to monitor for threats and vulnerabilities. This involves using advanced threat intelligence and monitoring tools to detect and respond to potential threats before they can cause damage. The European Union Agency for Cybersecurity (ENISA) is engaged with all relevant stakeholders and informed the European Commission's policy initiatives towards the electricity network code and the CEN/CENELEC Mandate 490. To ensure effective information flows on evolving threats and to facilitate the response to cyber incidents, Information Sharing and Analysis Centres (ISACs) should be encouraged to engage with all relevant bodies[221].

Local flexibility markets are subject to data protection regulations, such as the EU's General Data Protection Regulation (GDPR). Compliance with these regulations can be complex, and failure to comply may result in legal and financial penalties. To address these data security issues, local flexibility markets need to implement robust data security protocols and standards. This includes measures to protect data against cyberattacks, establishing clear data ownership and sharing agreements, and complying with data protection regulations. It is also important to ensure that all stakeholders are aware of the data security risks and are trained to follow data security best practices.

5.4 Flexibility services and regulatory support

Flexibility services such as demand response, energy storage, and electric vehicle charging, can help to meet the diverse needs of customers and help to support the integration of renewable energy sources. This needs to be framed by regulatory support and the development of clear and supportive policies and regulations. Regulators can also help ensure that local flexibility markets are designed to meet the needs of all stakeholders and can help promote the growth and development of these markets.

A practical example for such consumer-oriented work is the engagement of the SME MIWEnergia with energy communities Murcia (Spain) since 2017. Householders from this district have been involved in several EU-funded projects (UtilitEE, DRIMPAC and now also DE-RISK) and have over time supported the creation and implementation of digital tools for higher renewable energy integration and grid stabilisation[222].

[221] https://www.enisa.europa.eu/topics/critical-information-infrastructures-and-services/energy-sector
[222] https://ec.europa.eu/research-and-innovation/sites/default/files/kvp/files/kvp-integration-residences-energy-markets.pdf

Local flexibility markets should also encourage the development of a variety of flexibility services, such as energy storage, and electric vehicle charging. For example, in Denmark, the company Energinet has established flexible platforms that allow for the integration of various flexibility services to support the integration of renewable energy into the grid. A central element for this is the market simulation tool SIFRE (Simulation of Flexible and Renewable Energy sources. An innovative element is that it includes circles in the system such as electrolysis where electricity is converted to gas, which can be converted back to electricity. This enables highly flexible and integrated energy systems[223].

Developing supportive policies and regulations via government policies can play a crucial role in the development of local flexibility markets. Supportive policies and regulations can provide incentives for investment, remove barriers to market entry, and ensure fair competition. Regulatory support is critical for the success of local flexibility markets. This requires the development of clear rules and regulations, as well as the establishment of incentives and funding mechanisms. For example, in Germany, the government has established the SINTEG programme, which provides funding and support for the development of innovative solutions for the integration of renewable energy into the grid [224].

In summary, by following these best practices, stakeholders can help ensure the success of local flexibility markets in Europe. These best practices can help inform the development and implementation of new local flexibility markets and can help promote the growth and integration of renewable energy sources.

6. Mapping of Stakeholders

Mapping of stakeholders involved in the Project is of key importance in this DE-RISK report as this highlights the main actors that are of the highest relevance in works on the deliverables, but also the impact of their participation in work scopes onto the entirety of the project.

In line with the Horizon grant and the Strategic Plan, the DE-RISK project and the PESTLE Analysis and Benchmarking of LFMS Implementations with Stakeholder Mapping deliverable focus on the following impacts of the local flexibility markets deployment:

[223] SIFRE: Simulation of Flexible and Renewable Energy sources, https://energinet.dk/media/35uhcwjh/sifre-dokumentation.pdf
[224] https://www.bmwk.de/Redaktion/DE/Dossier/sinteg/

Figure 5. DE-RISK Stakeholders

Stakeholder	DE-RISK strategic objective	Dissemination tool/channel
Consumers and Prosumers	Build trust via easy and transparent information about the DE-RISK features and benefits	Presentation of results from DE-RISK demonstration; General communication; Training and educational workshops
Building owners and facility managers	Opening new exploitation channels for creating and leading flexibility	Fairs and exhibitions; DE-RISK demos; Website. Newsletter, Business cases; One-to-one meetings
Energy coops and other association	Access to various platforms, extending DE-RISK impact at EU level	Networking activities; Fairs and exhibitions and other events; Project website, newsletter, press release
Aggregators, BRP	Opening new exploitation channels for use of flexible load enabled by implementation of DE-RISK solution in buildings	Fairs and exhibitions and other events; Presentation of results from DE-RISK demonstration; Support to policy and regulation making
TSO, DSO, System Operators	Establishing of mutually beneficial interaction to accelerate DE-RISK market uptake	Fairs and exhibitions and other events; Technical workshops and tables; One-to-one communication
EMS and control system producers	Faster interaction, seeking new applications and partnerships, ensuring interoperability	Fairs and exhibitions and other events; Technical workshops; Case studies technical demonstrations
Regulatory bodies and policymakers	Establishing of mutually beneficial interaction to accelerate DE-RISK market uptake	Contribution to EU initiatives' Contribution to Smart Grid Task Force work; Feedback from DE-RISK demos
Governments, municipalities	Awareness about the potential successes and impact of the DE-RISK in the communities	Presentation of DE-RISK results; General communication; Training and educational courses
Science community	Ensure knowledge transfer	Presentation of DE-RISK results; General communication; Training and educational courses
Wider public and specialised media	Awareness of DE-RISK social and environmental benefits and impact on life	Public events; General communication (website, newsletter, press-release); DE-RISK contact point

Source: Based on the DE-RISK Deliverable 2.1.2 Dissemination and Communication (D&C) figure

Summary

This part of the report is basing on the country-specific broad PESTLE (Italy, Greece, Spain, Türkiye, Bulgaria, Romania, France, Portugal, Ireland, The Netherlands) analyses, as well as the benchmarking exercise conducted in relation to the Associated Benchmarking Markets (The United Kingdom, Norway, Switzerland).

The following are the possible impacts of the stakeholder DE-RISK mapping:

I. Availability of disruptive renewable energy and renewable fuel technologies and systems in 2050 to accelerate the replacement of fossil-based energy technologies.
II. Reduced cost and improved efficiency of renewable energy and renewable fuel technologies and their value chain.
III. De-risking of renewable energy and fuel technologies with a view to their commercial exploitation and net zero greenhouse gas (GHG) emissions by 2050.
IV. Better integration of renewable energy and renewable fuel-based solutions in energy.
V. Reinforced European scientific basis and European export potential for renewable energy technologies through international collaboration.
VI. Enhanced sustainability of renewable energy and renewable fuels value chains, taking fully into account social, economic, and environmental aspects in line with the European Green Deal priorities.
VII. More effective market uptake of renewable energy and fuel technologies.

The above stakeholder map will develop in time in line with the upcoming further deliverables of the DE-RISK project. However, they provide the entry point of reference for further action taken to develop the local flexibility markets across EU and Associated Benchmarking Markets.

7. Summary of PESTLE analysis from EU-wide perspective

The DE-RISK project involves the development of local flexibility market and electricity services across the European Union and the Associated Benchmarking Markets. This PESTLE analysis focused on the six dimensions of the PESTLE (Political, Economic, Social, Technological, Legal and Environmental) factors.

Below all six dimensions will debate the differences between markets and assess their market maturity and risks and opportunities that they face whilst working on their local flexibility market and electricity services as to enable a smooth and just transition to the net-zero future where key stakeholders will boost local market conditions for newer and cleaner technologies supporting local flexibility services.

The below assessment also analyses countries' approaches to the war in Ukraine and their dependence on Russian hydrocarbons and the need of diversifying from those in the nearest future if want to be energy-independent and have a continuity of electricity supply so desperately needed in the times of energy crises as we witness now.

It also assesses the steps that each country has made to improve its local flexibility market conditions and make them diverse and more accessible to the key stakeholders involved in the electricity services and the energy transition.

Political

All countries under investigation are politically under pressure to scrutinise their energy politics. The drivers for this are concerns about climate change and the need to decarbonise their energy system. All countries under investigation have respond to this with ambitious targets from RES which in turn increases the need for LFM as the market share of RES increases.

A complementing political factor is the war in Ukraine which led to a dramatic increase of energy prices, their inflationary effects, and associated energy poverty crisis. This created substantial political pressure. Again, this dynamic can be observed for all countries that were analysed in this report.

More heterogeneous is the role that discussion about energy security played, due to the pre-2021 dependency of many countries on gas from Russia.

Bulgaria and Greece relied heavily on gas imports, with approximately 50% and 60%, respectively, coming from Russia. Lower, but nevertheless substantial, dependence existed in Spain, Italy, Romania, and Türkiye, with between 20% and 40% of their gas coming from Russia. Most of these countries have responded to these dependencies with a shift to import LNG from otter markets.

On the other the Netherlands, France, and Portugal import less than 10% of their gas from Russia and debates about energy security play a less prominent role in the energy debate.

However, despite the varying threat to energy security due to the war in Ukraine, it can be stated that the political factors across Europe create a strong positive and favourable role for the growth and development of LFM for all countries involved in DE-RISK.

Economic

Across Europe, local flexibility market is influenced by economic factors such as the price of electricity, the cost of infrastructure development, and the level of investment in the energy sector. This was observed for all countries under investigation. What varies, however, is how well individual countries can respond to economic challenges. In Spain, the government implemented policies that have

reduced the financial incentives for renewable energy production. This can negatively impact the development of local flexibility markets.

Greece has, like all analysed countries, set ambitious targets for the development of renewable energy sources, which could have a positive impact on the local flexibility market. At the same time, Greece also faces high levels of debt and a lack of investment in the energy sector. Both Romania and Bulgaria are affected by similar challenges such as a limited investments in the energy sector and a continued reliance on imported natural gas.

The war in Ukraine and its impact on very high energy prices are in general a particular problem for countries with high imports of fossil fuels and the inflationary pressures that are introduced into the national economies. Annual inflation rates of above 10% and rising interest rates are limiting economic growth and provide a less favourable investment climate. This is something that negatively affects the development and growth of LFM.

France, on the other hand, has a well-developed nuclear power sector which has somewhat insulated it from imported energy inflation. At the same time, the focus on nuclear energy has created a very centralised energy infrastructure. This constitutes a challenge for LFM on local level. But there is growing trend towards decentralisation and local energy production and the associated development of LFM.

It interesting to note that the benchmarking countries the United Kingdom, Norway, and Switzerland have on a relative level, more developed and mature local flexibility markets compared to other European countries. The United Kingdom has a competitive retail market and a strong regulatory framework, which has enabled the growth of local flexibility markets. Norway and Switzerland have the advantage of abundant hydroelectric resources which provide flexibility in electricity generation and storage.

In summary, the Ukraine war has resulted in high energy prices, inflation, and rising interest rates have which in combination have created more difficult economic conditions for the investment in local flexibility markets.

Social

The impact of social factors on the development of LFM varies substantially across different countries. This has to do with the diverse cultural and social heritage across Europe. A wide range of aspects affect local flexibility markets. This includes cultural norms and values, attitudes towards energy consumption, sustainability, and renewable energy. Demographic trends, education (i.e., energy literacy), and levels of social activism are also relevant when it comes to social factors.

Substantial variation of social factors and their impact on LFM was observed. One example is Romania that has a significant rural population with limited access to modern energy infrastructure. This presents both a challenge and an opportunity for the development of local flexibility markets, particularly in the context of community-based energy projects. A similar situation was observed for Greece where there is a strong tradition of community involvement in decision-making processes. This could be leveraged to promote local flexibility markets. However, there is also a lack of trust in the government and public institutions, which could hinder the adoption of new energy initiatives.

France on the other hand has a strong tradition of state intervention in energy markets, with a centralised energy system and limited opportunities for community-based projects. In Spain and Portugal here is a growing interest in citizen participation in energy projects. However, there is also a significant socio-economic divide in both countries which could limit the success local flexibility markets for remote communities.

In Türkiye, there is a growing interest in renewable energy and energy efficiency, driven in part by concerns about energy security and rising energy costs. However, there are also significant social and economic challenges, including a high level of income inequality and a lack of trust in public institutions.

One unifying social factor, however, is the high level of public awareness of climate change and the importance of renewable energy sources. This could be observed for all countries under investigation, including the benchmarking countries.

Technological

They are the factors that impact local flexibility markets include smart grids, energy storage technology, renewable energy technology and their respective market maturity, electric vehicle infrastructure, and distributed energy resources.

The availability and presence of renewable energy resources across the analysed countries directly impact the relevance of technological factors as it determines the levels of renewable electricity that can be generated, their inherent variability and the resulting need for grid stability and LFM.

A group of countries such as Ireland, the Netherlands, and the United Kingdom plan to draw mainly on their excellent wind resources both onshore and offshore. At the same time, they have limited hydropower facilities and their potential for storage. Other countries such as Türkiye, France, Spain, and Greece have a combination of wind and solar resources which offers the opportunity to leverage the complementarity for these resources.

Despite the differences in underlying resources and the need for storage, it has been observed that similar efforts have been undertaken to invested in smart grid technology, largely being implemented via pilot projects focused on demand response, energy storage, and blockchain technology.

It can also be stated that that electric vehicle charging infrastructure in nearly all countries under investigation is not well developed and lacking density and market maturity. The only exception for this is Norway which has the largest per capita of electric vehicles in the world and where 25% of all cars are now electric. Norway can therefore serve as an excellent benchmark country from which best practices for the build-up charging infrastructure can be deducted.

Legal

The legal factors that impact local flexibility markets for electricity include a wide range of elements. These are regulation and policy where countries have different regulatory frameworks and policies that impact the development and operation of local flexibility markets. For example, each country has different regulations that govern the grid connection, the conditions for market participation.

Contractual frameworks: The legal agreements and frameworks that govern the relationships between different market participants, such as aggregators, retailers, and distribution system operators, can impact the development and operation of local flexibility markets.

In Italy, the government has implemented policies to promote the development of smart grids and encourage the deployment of renewable energy sources. The country has also implemented a legal framework for demand response programs and has established regulations for the participation of demand response providers in the electricity market.

In Spain, there are specific regulations in place to facilitate the deployment of distributed energy resources, such as rooftop solar panels and battery storage. The country has also implemented a legal framework for demand response programs and has established a system for compensating demand response providers for their services. Similar regulations are in place in Ireland as well.

Data protection issues are also important legal factors for local flexibility markets. LFM require the exchange of data among different stakeholders, and it is essential to ensure that personal data is protected. Data protection themes are less country specific as in the EU it is the General Data Protection Regulation (GDPR) sets out rules on how personal data should be processed, stored, and transferred. Companies that collect and process personal data must comply with GDPR requirements to protect the privacy of individuals. This means that only non-EU members. Norway as EEA member is bound by the GDPR as well and the UK has not yet diverted its data protection laws since leaving the EU. Only Switzerland and Türkiye have the option to divert from the GDPR practices. However, it is difficult to judge what impact this will have on the development of LFM.

Environmental

There are range of environmental factors that can impact local flexibility markets for electricity in the observed countries. This includes renewable energy potential, i.e., the availability and potential for renewable energy sources like solar, wind, and hydroelectric power can influence the development of local flexibility markets. This has been discussed already in Technology section and will not be repeated here.

Climate and weather patterns also affect energy demand and supply, as well as the performance of renewable energy technologies. Examples are extended droughts that can lead to both an increased power demand due to use of air condition and the decrease of energy supply because of lulls and lower levels in hydropower reservoirs. Extended lulls are a particular problem for wind dependent countries such as the UK, the Netherlands and Ireland and create the need for longer-term storage. This clearly provides an incentive for LFM developments.

Droughts and water scarcity are a problem for countries with hydropower facilities in more arid climates. Examples are France, Greece, and Türkiye. These countries might face challenges in this context. The threat of such challenges creates a supportive condition for the growth of their LFM.

Wider climate change aspects such as the threat of rising sea levels, the rise in temperatures and the higher frequency of extreme weather events are issues that are shared by all countries of investigation. This is a cross-cutting issue that the entire continent.

In summary, the DE-RISK project could have a significant positive impact on the European Union and the Associated Benchmarking Markets if properly implemented. It could lead to increased energy security, improved energy access and affordability, and reduced air pollution. Additionally, it could create jobs and reduce the need for expensive energy imports.

In the tables below the general Local Flexibility Markets development factors have been assessed to the best of the Project Leaders' industry knowledge, but also, following the Market Experts' judgment believed to be crucial while working on this project.

It is also crucial to stress that politically, the DE-RISK project could benefit the European Union's commitment to increase the share of renewable energy consumption and reduce greenhouse gas emissions. The DE-RISK and other similar projects are contributing to EU energy policymaking by delivering research and analyses needed for an increase in knowledge-share amongst the EU policy experts and other stakeholders involved in EU public affairs focused on Local Flexibility Markets. This could lead to increased investments and support for the similar projects, allowing for the development of the necessary infrastructure needed for the development of Local Flexibility Markets for electricity services, including Renewable Energy Sources (RES).

From the economic point of view, the DE-RISK Project could have a positive effect as it could reduce the need for expensive energy imports and improve the competitiveness of the European and Associated Energy Markets. The project could also create numerous jobs in the energy sector and increase the economic security of the European Union and the Associated Benchmarking Markets which are still not performing to the best of their capacities having given current market volatility caused partially by the escalation of the war in Ukraine, but also, the economic uncertainty the countries are currently facing.

From the society point of view, the project could lead to improved energy access and affordability for consumers, as well as improved energy security for the European Union and the Associated Benchmarking Markets. Additionally, it could also lead to a reduction in air pollution and improved public health that is said contributed to hundreds of thousands of excess deaths annually.

Technologically, the project could benefit from the development of new technologies, such as smart grids and improved storage solutions, which could lead to increased efficiency and reliability in the energy sector.

To summarise the legal aspect, the project could benefit from the European Union's commitment to energy liberalisation and the development of a single energy market. This could lead to increased competition and improved energy security. Environmentally, the project could have a positive impact as it could reduce the need for fossil fuels and lead to a decrease in air pollution and greenhouse gas emissions.

Overall, the DE-RISK project could have a significant positive impact on the European Union and the Associated Benchmarking Markets if properly implemented. It could lead to increased energy security, improved energy access and affordability, and reduced air pollution. Additionally, it could create jobs and reduce the need for expensive energy imports.

In the tables below the general Local Flexibility Markets development factors have been assessed to the best of the Project Leaders' industry knowledge, but also, following the Market Experts' judgment believed to be crucial while working on this project.

8. Context Factors Overall Evaluation

The below tables summarise the overall level of the Context Factors for the PESTLE Analysis and Benchmarking of Best Practices Implementation of LFMs (Local Flexibility Markets) in Participating Countries and EU.

All political, economic, social, technological, legal, and environmental factors for each analysed country have been estimated to the best knowledge of the Authors of the report, where the scale from 1 to 4 assesses the strength of the impact for the PESTLE factors for each country that is subject to this report:

1 = negative impact,
2 = neutral impact,
3 = visible improvement in impact,
4 = positive impact.

The level of impact for each country was proposed by the Authors of the report to the best of their technical knowledge, and according to their expertise in the PESTLE analyses.

While it is difficult to achieve fully accurate impact results at this stage of the DE-RISK project, as well as this deliverable while the project will move towards other stages, the Authors believe that in its current form, the impact provides an overall good judgement for the actors willing to examine the possible directions for future Local Flexibility Markets' implementations with stakeholder mapping across 10 core: Italy, Greece, Spain, Türkiye, Bulgaria, Romania, France, Portugal, Ireland, the Netherlands and 3 Associated Benchmarking Markets: the United Kingdom, Norway and Switzerland.

Also, it is crucial to understand that different markets have different internal conditions impacting the assessment provided in this report. Some of them are more mature, while other, less mature, and less willing/able to upscale their local flexibility markets and attract the stakeholders interested in investments in the RES deployment in those markets due to excessive political and regulatory environments, economic conditions, social acceptance, and participation in LFMs, technological opportunities, legal frameworks, and environmental conditions.

Table 2 Italy context factors overall evaluation

DE-RISK Task 3.1 Pestle Analysis and Benchmarking of Best Practices Implementation of LFMs in Participating Countries and EU - Context Factor Overall Country Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
ITALY	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	2
Economic	2
Social	2
Technological	2
Legal	2
Environmental	2

Table 3 Greece context factors overall evaluation

Context Factor Overall Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
GREECE	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	2
Economic	2
Social	2
Technological	2
Legal	2
Environmental	3

Table 4 Spain context factors overall evaluation

Context Factor Overall Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
SPAIN	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	3
Economic	3
Social	2
Technological	2
Legal	2
Environmental	3

Table 5 Turkey context factors overall evaluation

Context Factor Overall Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
TURKEY	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	1
Economic	2
Social	1
Technological	2
Legal	2
Environmental	2

Table 6 Bulgaria context factors overall evaluation

Context Factor Overall Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
BULGARIA	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	3
Economic	3
Social	3
Technological	3
Legal	3
Environmental	3

Table 7 Romania context factors overall evaluation

Context Factor Overall Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
ROMANIA	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	2
Economic	3
Social	2
Technological	2
Legal	3
Environmental	2

Table 8 France context factors overall evaluation

Context Factor Overall Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
FRANCE	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	3
Economic	4
Social	2
Technological	3
Legal	3
Environmental	3

Table 9 Portugal context factors overall evaluation

Context Factor Overall Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
PORTUGAL	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	3
Economic	3
Social	3
Technological	3
Legal	3
Environmental	3

Table 10 Ireland context factors overall evaluation

Context Factor Overall Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
IRELAND	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	3
Economic	3
Social	3
Technological	3
Legal	3
Environmental	3

Table 11 The Netherlands context factors overall evaluation

Context Factor Overall Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
THE NETHERLANDS	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	3
Economic	3
Social	4
Technological	3
Legal	3
Environmental	3

Table 12 The United Kingdom context factors overall evaluation

Context Factor Overall Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
THE UNITED KINGDOM	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	3
Economic	4
Social	3
Technological	4
Legal	3
Environmental	3

Table 13 Norway context factors overall evaluation

Context Factor Overall Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
NORWAY	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	3
Economic	3
Social	3
Technological	3
Legal	3
Environmental	3

Table 14 Switzerland context factors overall evaluation

Context Factor Overall Evaluation	
<< INSTRUCTIONS >>	
For each of the PESTLE context factors, rate how the factors impact on the LFMs development in your country	
SWITZERLAND	**Overall evaluation of the factor impact on LFMs development. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Political	2
Economic	1
Social	2
Technological	2
Legal	2
Environmental	2

9. Conclusions and Further Action Recommendations

This PESTLE analysis & benchmarking exercise of LFMs implementations is the first step in the DE-RISK project and therefore serves as a staring platform from which the remainder of the project activities can be developed.

The report provided a market knowledge for 10 core, and 3 benchmarking markets that vary as their maturity differs depending on the various PESTLE (Political, Economic, Social, Technological, Legal, Environmental) factors affecting those markets.

It should be noted that the results are mainly based on a combination of desk-based research and qualitative validation by country partners. Given the complexity of the research and the tight time frame in which this analysis had to be carried out, it should be noted that this evaluation only represents intermediate results. Nevertheless, can be stated that some countries are the true pioneers in the LFMs deployment whilst others are still at the start of their journey towards a more integrated and flexible energy market.

The country-based PESTLE analyses highlighted that there are significant differences concerning the deployment of LFMs in Europe. This is due to very varying political, legal, economic, social, technological, and environmental conditions in each country. Many of these differences will likely continue to affect the markets in the upcoming years. However, the work that has been already done

by the European Union and national governments on the transposition of the legal framework easing the LFMs deployment with sufficient frameworks allowing a smooth running of the electricity services by the main stakeholders provides a solid background for the future development of the LFMs. But as to assess the future needs in a wider context, this report also focuses on the benchmarking of the best practices in the Associated Benchmarking Markets (the United Kingdom, Norway, Switzerland) as to analyse the wider trends in the LFMs deployment in the European context.

Understanding these factors and how they impact the development and success of local flexibility markets is essential for market participants and policymakers seeking to promote the growth of these markets.

Local flexibility markets for energy in the analysed countries are shaped by their different regulatory frameworks, market structures, and energy policies. However, there are some general observations that can be made based on the current state of these markets:

- Italy, Spain, and Portugal have a high penetration of renewables in their energy mix, which creates opportunities for demand response and flexibility services. Italy and Spain have implemented regulatory frameworks to incentivize participation in demand response programs, while Portugal is exploring new models of aggregators and flexibility services.
- Greece has a relatively undeveloped flexibility market, but there are initiatives to promote demand response and energy storage technologies. The country is also exploring the potential of digital tools such as block chain technology to facilitate energy transactions.
- Türkiye has a rapidly growing energy demand, and the government is promoting renewable energy and energy efficiency measures. However, there is a lack of regulatory framework for demand response and flexibility services, which creates barriers for market development.
- Bulgaria and Romania have a high dependence on coal and other fossil fuels in their energy mix, which limits the potential for flexibility services. However, recent initiatives to promote energy efficiency and renewable energy do create new opportunities for demand response and flexibility services.
- France has a well-developed capacity market and regulatory framework for demand response and flexibility services. The country is also exploring the potential of block chain technology and peer-to-peer trading.
- Ireland and the Netherlands have a high penetration of wind energy in their energy mix, which creates opportunities for demand response and flexibility services. Both countries are exploring new models of aggregators and flexibility services, and the Netherlands is also promoting the development of hydrogen as an energy carrier.

Overall, the main differences and commonalities between local flexibility markets in the EU are related to the level of renewable energy penetration, the regulatory frameworks and incentives for demand response and flexibility services, and the potential of new technologies such as block chain and hydrogen.

The PESTLE analysis of LFMs in selected EU member states was complemented by a benchmarking exercise that looked at three non-EU LFMs. We identified the UK, Norway, and Switzerland for this as they represent examples of established local flexibility markets with well-developed regulatory frameworks and significant investments in renewable energy. Examples are that the UK has undergone significant regulatory and market reforms to introduce flexibility and decarbonisation in the electricity sector. Norway has a high share of hydropower and has been investing in demand-side management and energy storage. Switzerland, on the other hand, has a liberalised electricity market with a focus on demand response and distributed generation. Therefore, these countries may offer useful insights and lessons for other European countries considering local flexibility markets.

One initiative to highlight from the UK is the introduction of the Smart Systems and Flexibility Plan which aims to encourage the development of new markets and business models that facilitate the integration of renewable energy sources into the grid. Additionally, the UK has launched several demonstration projects, such as the Cornwall Local Energy Market and the Energy Superhub Oxford that test new technologies and business models for local flexibility markets.

Norway, on the other hand, has considerable experience in the integration of hydropower and wind power, with an overall very high market share of renewables. The country has also implemented a robust regulatory framework for local flexibility markets, with policies and initiatives such as the Norwegian Smart Grid Centre and the Regulation on System Operation.

Switzerland implemented several initiatives to promote local flexibility markets, such as the Swissgrid Flexibility Pilot Project which tests new flexibility services and technologies. The country also has a well-established regulatory framework, with policies such as the Energy Strategy 2050 and the Federal Energy Act, which promote the development of renewable energy and local flexibility markets.

In summary, it is important to note that each country's context and local conditions play a significant role in shaping the design and effectiveness of their local flexibility markets. Therefore, it is essential to consider factors such as the local energy mix, regulatory framework, market structure, and consumer behaviour when evaluating the relevance and applicability of benchmarks.

There are several ways in which European local flexibility markets could be improved, including:
Standardisation and Interoperability: Standardisation of technical and operational procedures, data management, and communication protocols across the various local flexibility markets in Europe could help to improve interoperability and facilitate the smooth integration of distributed energy resources.

(i) **Regulatory Frameworks:** An effective regulatory framework can help to ensure a level playing field for all market participants and provide the necessary incentives for the development of local flexibility markets. This framework could include policies that

encourage the deployment of smart grids, the integration of renewables, and the adoption of energy storage solutions.

(ii) **Demand Response:** The stronger integration of demand response mechanisms into local flexibility markets could help to manage demand and supply imbalances, reduce energy costs, and increase the overall flexibility of the grid.

(iii) **Technology:** Advancements in technology, such as block chain and artificial intelligence, could help to increase the efficiency and transparency of local flexibility markets. **Collaboration:** Collaboration between stakeholders, including energy providers, regulators, and technology providers, could help to overcome the challenges faced by local flexibility markets and accelerate their development.

(iv) **Data Security:** Ensuring the security and integrity of data generated by local flexibility markets is crucial to building trust and confidence among market participants and customers.

Overall, improving local flexibility markets in Europe will require a combination of regulatory, technical, and collaborative efforts. It will also require a shift towards a more customer-centric approach, where consumers are empowered to actively participate in the energy system. This is something the DE-RISK project aims to explore in much more detail.

10. Appendix

ANNEX-I

Instructions

DE-RISK Task 3.1 - Pestle Analysis and Benchmarking of Best Practices Implementation of LFMs in Participating Countries and EU
<< INSTRUCTIONS >>
PESTLE is a strategic planning tool used to evaluate the impact of political, economic, social, technological, environmental, and legal factors might have on a project. It involves considering the external environment before starting a project. It is a good way of ensuring one has captured all potential risks and issues. PESTLE Analysis is therefore an analytical tool for strategic planning, defining the strategic framework for understanding external influences on any project. Considering this specific task 3.1 of the DERISK project, the objective is to analyse the contextual factors at country level that affect the development and market uptake of the Local Flexibility Markets (LFMs). In the sheet "PESTLE" find the instructions and fill the required cells. In the sheet "Context Factors Overall Evaluation", For each of the PESTLE context and BENCHMARKING factors, rate how the factors impact on the LFMs development in your country. In the sheet "PESTLE-examples" find a not-complete list of factors that may serve as starting point to perform the analysis.

PESTLE

DE-RISK Task 3.1 PESTLE Analysis and Benchmarking of Best Practices Implementation of LFMs in Participating Countries and EU - Pestle Assessment									
<< INSTRUCTIONS >>									
Identify country-specific context factors that positively or negatively impact the development and market uptake of LFMs. In column A (Factor - Title) --> enter a title that briefly describes the factor. In Column B (Factor - Description) --> describe the factor that impacts the LFMs in the country. In Column C (Impact for LFM development in the country) --> describe how the factor impacts the future development and market up-take of LFMs in the country. In Column from D to I select the specific context (Politic; Economic; Social; Technological; Legal; Environmental). Please note that one factor may have an impact on one or more context dimensions. In Column J (Impact evaluation of the factor) provide an evaluation on the positive or negative impact of the factor respect to the energy community development. In Column K (Comments), if necessary, add any relevant comment. In Column L (References) provide the bibliographic references (together with web links if available).									
Country:	**Italy**								
Factor (title)	**Factor (Description)**	**Impact for LFM development in the country**	**Political**	**Economic**	**Social**	**Technological**	**Legal**	**Environmental**	**Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Market structures that support centralised energy production/local flexibility markets	Italy's new right-wing coalition to focus on nuclear power amid risk of further gas market volatility caused by Russia. Italy's new right-wing coalition to focus on nuclear power amid risk of further gas market volatility caused by Russia. Government signed the EU energy market intervention consisting of a 5% electricity use cut during peak hours and a windfall tax on excess energy company profits with a plan to reintroduce them to struggling households	Renewables might be pushed away in the next few years having given Italy's priority with nuclear energy development. Renewables might be pushed away in the next few years having given Italy's priority with nuclear energy development. Energy market intervention will boost renewable energy investment as windfall tax will support new RES ventures	x	x					1
Security of energy supply	One of the main Italian security concerns is the risk of cyber-attacks on the local flexibility markets and electricity grid. The increasing digitalization of the energy sector has made it more vulnerable to cyber threats, and any breach of security could have severe consequences for the reliability and stability of the system. To address this risk, robust cybersecurity measures must be put in place to ensure the integrity of the local flexibility markets and the wider electricity grid. Another security concern is the potential for supply disruptions due to extreme weather events, natural disasters, or other unforeseen circumstances. Italy is particularly vulnerable to these risks due to its geographic location and exposure to weather-related hazards such as floods, landslides, and earthquakes. To address this risk, measures must be put in place to ensure that the local flexibility markets and electricity infrastructure can withstand and recover from any such events. The security of energy supply in the local flexibility markets and electricity sector is also closely linked to the availability of fuel and other resources. In the case of Italy, this includes natural gas, which is a critical source of energy for both electricity generation and heating. Any disruption to the supply of natural gas could have significant consequences for the reliability and stability of the energy system. To address this risk, efforts must be made to diversify the energy mix and reduce dependence on any single source of energy.	The security of energy supply in Italy's local flexibility markets and electricity sector is also impacted by geopolitical factors, including the availability and affordability of energy imports. Italy is heavily reliant on imported energy, particularly natural gas, and any disruption to these imports could have significant consequences for the energy system's security. To address this risk, efforts must be made to diversify energy sources and increase the resilience of the energy system to external shocks. Robust cybersecurity measures, resilience planning, diversification of the energy mix, and efforts to reduce dependence on energy imports are all critical components of a strategy to ensure the reliability and stability of the energy system	x	x	x	x	x		2
Innovation capacity and digital independence	Italy has shown significant progress in the development of local flexibility markets and the digitalization of its electricity sector in recent years. However, the country still faces challenges in the areas of innovation capacity and digital independence. However, Italy still lags the focus the other European countries have in terms of innovation capacity in the electricity sector. According to the European Innovation Scoreboard, Italy ranks 16th among EU member states in terms of innovation performance, with particular weaknesses in the areas of research and development and innovation-friendly environment. In terms of digital independence, Italy faces challenges in the development of digital platforms for the management of local flexibility markets. The country has made progress in the deployment of smart grid technologies, but the development of digital platforms for the management of local flexibility markets has been slower than in other European countries. Italy has implemented measures to promote the development of local flexibility markets, including the creation of a regulatory framework that allows for the participation of multiple actors. However, the lack of interoperability between different digital platforms and the absence of a common data exchange standard have hindered the development of local flexibility markets in Italy	Italy's dependence on external sources for the development of digital technologies is a barrier to digital independence in the electricity sector. The country has been slow to invest in research and development in digital technologies, which has limited its ability to develop and implement digital solutions for the management of local flexibility markets	x	x	x	x	x		2

Attitudes towards energy efficient products, services, technologies, and appliances	In Italy, there is a growing interest in promoting the use of energy-efficient Attitudes towards energy-efficient products, services, technologies, and appliances in the context of local flexibility markets and electricity in Italy can be characterized by the following key points: products, services, technologies, and appliances, particularly in the context of local flexibility markets and electricity. The country has recognized the importance of reducing energy consumption and emissions and has implemented various policies and programs to incentivize the use of energy-efficient products. Cost-Effectiveness - energy-efficient products are increasingly recognized as cost-effective solutions for reducing energy consumption and lowering energy bills. In Italy, where electricity prices are among the highest in Europe, consumers and businesses are particularly interested in reducing energy costs. As such, there is a growing demand for energy-efficient products that can help to reduce energy consumption and lower energy bills. Sustainability - there is a growing awareness of the need to reduce carbon emissions and promote sustainability in Italy. Energy-efficient products, services, technologies, and appliances can help to reduce energy consumption and emissions, which is important for achieving climate goals. In addition, the Italian government has implemented various policies and programs to promote sustainability, including tax incentives for the purchase of energy-efficient products. Innovative Technology - Italy is known for its innovative and technological advances, and there is a growing interest in energy-efficient products and services that incorporate the latest technologies. Smart homes and energy management systems are becoming increasingly popular, as they allow consumers to monitor and control their energy consumption in real-time. Government Support - the Italian government has implemented various policies and programs to promote energy efficiency, including tax incentives, subsidies, and energy audits. These policies have helped to increase awareness and adoption of energy-efficient products in the country. Energy Security - Italy is heavily dependent on energy imports, particularly of natural gas, which is used for electricity generation. As such, there is a growing interest in promoting energy efficiency as a means of reducing dependence on imports and improving energy security	Overall, attitudes towards energy-efficient products, services, technologies, and appliances in the context of local flexibility markets and electricity in Italy are positive. Consumers and businesses are recognizing the benefits of energy efficiency and are increasingly looking for products and services that can help to reduce energy consumption and emissions. With the support of government policies and programs, it is likely that the adoption of energy-efficient products and services will continue to increase in Italy	x	x	x	x	x		2
Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	The Italian government has implemented several policies and incentives to encourage investment in renewable energy and energy efficiency. For example, the "Conto Termico" program provides financial incentives for energy efficiency improvements in buildings, and the "Superbonus" program offers tax breaks for energy efficiency upgrades and the installation of renewable energy systems. These policies have helped to increase investment in the energy transition. Italy has also implemented the European Union's Clean Energy Package, which includes provisions for local flexibility markets. This package aims to create a more integrated and flexible energy system, which is better equipped to handle the challenges posed by the increasing use of renewable energy sources. The decreasing cost of renewable energy technologies has made them more competitive with traditional fossil fuel sources, which has also contributed to the growing willingness to invest in energy transition in Italy	There is a positive trend towards investment in energy transition in Italy, particularly in the context of local flexibility markets and electricity. This trend is driven by a combination of environmental, economic, and policy factors, and is likely to continue as the country seeks to achieve its ambitious emissions reduction targets. However, there are still challenges to be addressed, such as the need for grid infrastructure upgrades and the integration of different energy systems, which will require continued effort, time, and resources	x	x	x	x	x		4
Smart grids deployment	Smart grid deployment in Italy is a crucial aspect of the country's energy transition, as it offers multiple benefits such as improving energy efficiency, reducing greenhouse gas emissions, and increasing the integration of renewable energy sources. One of the key components of smart grid deployment in Italy is the integration of local flexibility markets. Local flexibility markets are platforms where electricity suppliers and consumers can trade electricity in real-time. They allow for the dynamic management of electricity supply and demand, enabling more efficient use of energy resources and the integration of renewable energy sources. Italy has been proactive in promoting smart grid deployment and local flexibility markets. In 2018, the Italian government launched the "National Plan for the Development of Smart Grids," which aims to accelerate the deployment of smart grids and promote the development of local flexibility markets. The plan includes several initiatives, such as the installation of smart meters in households and businesses, the deployment of electric vehicle charging infrastructure, and the development of energy storage systems. These initiatives will help facilitate the integration of local flexibility markets by providing the necessary infrastructure and technologies.	In addition to the national plan, several pilot projects have been launched to test the deployment of smart grids and local flexibility markets in Italy, e.g., the "MUSE Grid" project, which is being carried out in the city of Bolzano, aims to test the integration of renewable energy sources and energy storage systems into the grid. The project also includes the deployment of a local flexibility market to manage the energy supply and demand in the area	x	x	x	x	x		3
Demand response infrastructure deployment (smart metering)	In Italy, the deployment of smart metering technology has been ongoing for several years, driven by regulatory mandates and the need to enhance grid flexibility and efficiency. The deployment of smart metering technology in Italy has been divided into two phases. The first phase, which began in 2001, aimed to install smart meters for large industrial and commercial customers. The second phase, which started in 2015, focused on the deployment of smart meters for residential and small commercial customers. By the end of 2020, around 80% of Italian households had a smart meter installed, surpassing the European Union's target of 80% by 2020. The deployment of smart metering technology has provided utilities with greater visibility and control over electricity supply and demand, enabling the development of local flexibility markets in Italy. These markets are designed to allow distributed energy resources, such as solar panels, battery storage, and electric vehicles, to participate in electricity markets and provide grid services. Smart meters play a crucial role in enabling the participation of distributed energy resources in local flexibility markets. With real-time data on electricity consumption, utilities can create dynamic pricing signals to incentivize customers to shift their electricity usage to off-peak hours. This can help reduce peak demand and improve the reliability and stability of the grid	In Italy, local flexibility markets are still in the early stages of development, but several initiatives have been launched to promote their growth. For example, in 2020, Enel, Italy's largest utility, launched a pilot project to test the feasibility of local flexibility markets. The project allowed customers with rooftop solar panels and battery storage to sell excess electricity back to the grid during periods of high demand. The deployment of smart metering technology in Italy has enabled the development of local flexibility markets and provided greater visibility and control over electricity supply and demand. While Italy has made significant progress in deploying smart meters, further investment is needed to ensure full coverage and the integration of distributed energy resources into local flexibility markets. The implementation of these markets can help promote a more sustainable and efficient electricity system	x	x	x	x	x		3
Decentralised energy system and storage	Local flexibility markets in Italy can provide opportunities for decentralised energy systems and storage to participate in the energy market, providing flexibility services to the grid and generating revenue. These markets allow for smaller, local energy resources to participate in the market, providing increased flexibility to the grid and contributing to overall grid stability and reliability. The deployment of renewable energy sources in Italy has been increasing in recent years, and energy storage systems can provide a solution to the challenges posed by their variability and intermittency. By storing excess energy generated by renewable sources, energy storage systems can ensure that energy is available when needed, reducing the need for fossil fuel-based generation, and improving the overall reliability of the grid	The deployment of decentralised energy systems and storage can also provide opportunities for local communities in Italy to participate in the energy market and benefit from the deployment of renewable energy sources. For example, households and businesses can install solar panels and battery storage systems and participate in local flexibility markets, providing flexibility services to the grid and generating revenue. The deployment of decentralized energy systems and storage can also help the country achieve its renewable energy targets and reduce greenhouse gas emissions. The Italian government has set ambitious targets for the deployment of renewable energy, with a goal of 55% of the country's energy coming from renewable sources by 2030	x	x	x	x	x		3

TSO and DSO regulation	Italian TSO (Transmission System Operator) and DSO (Distribution System Operator) regulations play a critical role in the operation of local flexibility markets and the electricity sector. The TSO is responsible for operating and managing the high-voltage electricity transmission grid, which enables the transfer of electricity between regions and countries. The TSO is also responsible for ensuring the security and stability of the grid by balancing supply and demand in real-time. The DSO, on the other hand, operates and manages the low-voltage distribution grid, which delivers electricity to end-users. The DSO is responsible for ensuring that the distribution grid is stable and reliable, and that electricity is delivered to customers in a safe and efficient manner. In the context of local flexibility markets, the TSO and DSO regulations are critical because they determine the rules and procedures for accessing the grid and participating in local flexibility markets. For example, the TSO and DSO may establish requirements for connecting to the grid, such as technical specifications for equipment and procedures for obtaining permits and licenses. Additionally, the TSO and DSO may establish rules for participating in local flexibility markets, such as requirements for aggregators and flexibility providers. These rules may include requirements for data reporting, contractual arrangements, and market participation fees. In Italy, the TSO is represented by Terna, which is responsible for managing the high-voltage transmission grid and promoting the development of local flexibility markets. Terna is also responsible for ensuring the security and stability of the grid, and for integrating renewable energy sources into the grid	The DSOs in Italy are responsible for managing the low-voltage distribution grid and delivering electricity to end-users. There are several DSOs operating in Italy, including Enel Distribuzione, Acea Distribuzione, and Edison Distribuzione. The DSOs in Italy are responsible for managing the low-voltage distribution grid and delivering electricity to end-users. There are several DSOs operating in Italy, including Enel Distribuzione, Acea Distribuzione, and Edison Distribuzione	x	x	x	x	x		3
Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	In Italy, there has been a growing interest in developing local flexibility markets and promoting the adoption of renewable energy. Peer-to-peer (P2P) energy trading and virtual power plants (VPPs) are seen as promising technologies that could enhance the flexibility and resilience of the Italian electricity system. However, the availability of information and communication technology (ICT) solutions for P2P energy trading and VPPs in Italy is currently limited. While there are some companies and startups in Italy that offer ICT solutions for P2P energy trading and VPPs, they are still relatively few and may not be widely accessible to all consumers. Additionally, there is a lack of a clear regulatory framework to support the development and deployment of these technologies. As such, the adoption of P2P energy trading and VPPs in Italy has been slower than in some other European countries. There have been some initiatives to promote the adoption of P2P energy trading and VPPs in Italy, however. For example, the Italian government has launched a pilot program to test the feasibility of these technologies and explore the regulatory framework required to enable their widespread adoption. The pilot program is focused on a specific region, and aims to test the technical and economic viability of P2P energy trading and VPPs in the Italian context	The availability of ICT solutions for P2P energy trading and VPPs in Italy is currently limited, but there are some promising initiatives underway. To enable widespread adoption of these technologies, it will be important to develop a clear regulatory framework and ensure that ICT solutions are widely accessible to all consumers. In addition to government initiatives, there are also some private sector initiatives to develop ICT solutions for P2P energy trading and VPPs in Italy. For example, Enel, one of the largest utilities in Italy, has developed a platform for P2P energy trading that allows consumers to buy and sell renewable energy. Local flexibility markets are emerging in Spain to optimize the use of renewable energy sources and reduce the need for expensive grid upgrades. These markets allow customers to offer their flexibility services to the grid, such as the ability to increase or decrease their energy consumption in response to changing grid conditions. In exchange, customers receive financial incentives, which can help offset the cost of energy bills	x	x	x	x			3
Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	In Spain, the electricity market is regulated by the Spanish National Commission of Markets and Competition (CNMC). The CNMC has implemented several measures to ensure the active participation of customers in the electricity markets, including local flexibility markets. Guaranteed grid access is a fundamental right of all electricity consumers in Spain. The CNMC has established regulations to ensure that all consumers have equal and non-discriminatory access to the electricity grid. This allows customers to choose their energy supplier and to participate in local flexibility markets by offering their flexibility services to the grid. Remuneration for energy fed into the grid is also guaranteed in Spain. The CNMC has established regulations that require grid operators to purchase excess energy from customers who generate their own electricity through renewable sources. This means that customers who generate their own electricity through renewable sources such as solar panels or wind turbines can sell any excess energy back to the grid, providing a financial incentive for renewable energy production. Demand response is another important tool for active customer participation in the electricity market. In Spain, demand response programs allow customers to reduce their energy consumption during peak demand periods, in exchange for financial incentives. These programs are designed to balance supply and demand on the grid, while also reducing the overall cost of electricity for consumers		x	x			x		1
Schemes and incentives that give advantage to big energy firms	The government introduced several incentives and subsidies to encourage the development of renewable energy projects, including feed-in tariffs, tax credits, grants for research and development	The right-wing coalition has set no goals for renewables beyond what is required under EU law though. Instead, all three parties in the right-wing coalition have called for increased exploration and production of natural gas in Italy	x	x			x		3
Grid connection costs	Associated with high costs in the context of local connections	On February 25, 2022, the Italian Government enacted law-decree no. 23 (Decree), which entirely repeals and replaces article 16 of law-decree no. 4 of January 27, 2022 (known in Italian as the Decreto Sostegni-ter), which had introduced an obligation for renewable energy producers to transfer extra profits generated from the exceptionally high electricity prices to the Gestore dei Servizi Energetici (GSE) to help fund the reduction in the cost of electricity.	x	x		x			3
Uncertainty and limitations in feed-in-tariff levels and schemes	Italy introduced a 'spalma incentivi' procedure aiming at reduction of current feed-in tariffs to below 17% and distribution over a 24-year period to begin with the grid connection date	The policy significantly reduces prospective solar investments of above 200kW in capacity in Italy as they become too expensive to build	x				x		2
Legislative frameworks that make setting up LFM ventures difficult	Legal framework for renewable energy is complex and can be difficult for developers to navigate	New investments likely to be delayed due to framework complexity	x				x		2
Lack of support from local representatives/local energy agencies	A draft framework for CfD (contracts for difference) requiring developers to complete environmental permitting to participate in CfD. Visible support for wind and solar projects	Other than wind and solar projects might face delays due to their non-urgent nature	x		x		x		2

Lack of a policy framework for LFM investments	The government does not aim for geothermal energy investments despite country's enormous potential	Energy planning not effective enough to support geothermal energy	x				x		1
Not mentioning LC as a relevant actor	The government does not prioritize local projects supported by local communities, unless they are associated in non-profit associations	Difficult to enforce with no support of the local authorities, only support for non-profit associations	x		x		x		2
Complex and changeable policies regarding LFM development	Italy has implemented various policies to encourage the development of renewable energy sources	May delay new investments	x				x		3
Lack of rules regarding the opportunity to operate micro-grids	Government promotes the adoption of smart grid technology as a way of improving the efficiency of national grid	They might not be enforced locally; it means not enough opportunities in the local context	x			x	x		2
Lack of regional focus on renewable energy projects with LFM	Italy lacks a comprehensive regional strategy for the development and implementation of renewable energy projects	The government should prioritize the local context	x	x			x		2
Energy policies may have unwanted negative connotations	Energy policies in Italy can be seen as a form of governmental overreach by some citizens	The government prioritizes wrong policies	x	x	x	x	x	x	2
Lack of cooperation between local authorities and local communities	Too slow progress being made on the talks	Both sides should cooperate more on the energy transition and renewables	x		x				1
Difficulties for energy communities to generate enough surplus to cover organisational costs	No support if they are not associated in non-profit associations	Delays in the local RES context	x	x	x				2
Lack of long-term government funding	Lack of long-term funding for LFMs in Italy has inhibited their growth and sustainability	Associations have more financial incentives for new projects rather than individuals	x	x	x				3
Initial financing problems at local government level	A change shift at the national government level that champions alternatives to renewables such as nuclear	Less support for renewables in the LFMs	x	x	x				3
National energy policy change and shift from RES to HYD	The war in Ukraine impacted Italy's RES ambitions and forced the government to invest more in alternative gas supplies	Not enough local project support resulting in slowing down new projects	x	x			x		3
Difficulty in accessing loans/contracts/funding for LFM projects	Too many rules at the national level, often dictated by the region it is addressed at	Not enough financial support at the local level due to changing priorities	x	x		x	x	x	3
Lack of tax exemptions or incentives unlocking new investment opportunities	This lack of support has limited the ability of Italian businesses and households to invest in renewable energy sources, and has inhibited the development of a competitive market for renewable energy	The lack of tax exemptions and incentives can discourage potential investors from investing in renewable energy projects, thus further limiting the growth of the sector	x	x	x				1
Investment incentives for hydrocarbons instead of RES	The government championing gas and shifted towards coals in order to secure energy supplies nationally	Delays in RES deployment in the LFMs context - shift in priorities caused by the war in Ukraine	x	x	x		x		2
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	Policy planning at the federal level with a mismatch between the expectations and the reality	Lower than expected investments for the right technologies	x	x	x		x	x	2
Lack of experience with LFM	Might be not enough outreach to energy communities as to learn about their direct energy needs	Possible delays in project planning			x	x			3
Low trust in renewable energy technologies	The government is sceptical about introducing more renewables than gas to energy grid amid high costs of new investments	Change in the energy complex paradigm resulting in lower RES ambitions on this occasion	x		x		x		2
Possible loss of support if the projects exceed certain size	Government funding can only support required project size	It might slow down climate neutrality ambitions and bigger renewable capacity ambitions	x		x	x	x	x	2

Lengthy grid connection procedures	Not sufficient planning at national and local levels	Delays in connecting new RES plants to the grid	x	x	x	x	x		2
Lack of interest and engagement in the promotion of LFM	Strong public support for renewable energy in Italy, with many citizens concerned about the impact of climate change and the country's dependence on fossil fuels	Too much scope being put onto fossil fuels	x		x			x	1
Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	Too long relationship with fossil fuels resulting in national dilemma	Might affect country's net-zero targets due to fewer RES projects	x		x		x		1
Lack of experience in commissioning and managing RES projects	In recent years, Italy has seen a rapid growth in renewable energy projects, with the majority of new projects being implemented by inexperienced developers. This lack of experience has resulted in a number of issues, including delays in project implementation, challenges in obtaining financing, and difficulties in meeting regulatory requirements	Affects local context projects			x	x			2
Lack of accessible area for new renewable plants	Too many highly urbanized areas where conditions for renewables are sufficient	High urbanization requires the shift in project area planning	x		x	x			2
Lack of sufficient requalification/training for potential LFM technology staff	The government does not invest enough in requalification of the workforce	Fewer experts that can work on the RES projects	x	x	x	x	x	x	2
Difficulty in securing labour for LFM projects	People prefer to work in low-labour settings where they do not need to requalify	Affects project capacities as not enough workforce		x	x	x			2
Rigid legal, bureaucratic, and administrative procedures	National and local policies championing hydrocarbons instead of renewables	Can disturb the LFMs context		x	x				2
Insufficient regulation regarding smart metering	An outdated regulation regarding smart metering	Might affect the integration of smart metering with the plants	x	x	x		x		2
Strong aversion to risk towards larger RES projects	The authorities in some instances, prefer smaller projects due to lower operational and financial risk	Can affect large project ambitions	x				x		2
Lack of cooperation with other local communities to share expertise/knowledge/resources	The dialogue between the parties is difficult to reach	Might affect local LFMs projects			x			x	2
Low citizen involvement in decision making activities	The government should organize public consultations on the future of renewables in Italy as society in some parts of the country do not pay attention to renewables issues	No to little citizen involvement has a negative impact onto attracting smaller developers, the country is focused on large operators	x	x	x				2

Country:	Greece								
Factor (title)	Factor (description)	Impact for LFM development in the country	Political	Economic	Social	Technological	Legal	Environmental	Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)
Market structures that support centralised energy production/local flexibility markets	Centralised energy production in renewable energy in Greece is supported by a variety of market structures. These include the Renewable Energy Sources (RES) Law, the Feed-in Tariff (FiT) system, the Renewable Energy Obligation (REO) scheme, and the RES Auction system. Greece has been investing heavily in renewable energy in recent years, and the market structures that support centralised energy production/local flexibility markets are key to this transition. These markets allow for the trading of renewable energy among different producers, allowing them to capitalize on the fluctuations in demand. Additionally, they provide a platform for energy storage technologies, such as batteries, to be used to store excess energy produced by renewable sources. Although the comment is correct, the reference provided is general and not specific to Greece. Environmental concerns are mostly directed to the best of our knowledge to wind farms in wildlife protected areas. These drives (along with the decreasing capital costs) to increasing investments in solar PV at the expense of wind power. Local flexibility markets: Especially the recovery and resilience facility provide funding for grid capacity investments, island interconnections but also for buildings renovation and energy efficiency (reference: greece2020.gov.gr). Not only big firms are benefited from this funding	The RES Law provides support for renewable energy investments and sets out the obligations and incentives that energy producers must comply with. The FiT system encourages renewable energy production by providing a fixed price for electricity produced from renewable energy sources. The REO scheme requires electricity suppliers to purchase certain amounts of renewable energy. Finally, the RES Auction system allows energy producers to bid for long-term contracts to produce renewable energy. Facilitate the integration of renewables into the grid, allowing for a smoother transition away from traditional sources and create a platform for the development of new technologies and services, such as smart grids and demand response initiatives, which are essential for a successful transition to a more sustainable energy system	x	x		x	x		3
Security of energy supply	The security of energy supply is an important concern in the context of local flexibility markets and electricity in Greece. In recent years, the country has faced significant challenges in ensuring a reliable and secure supply of energy due to a variety of factors, including geopolitical tensions, aging infrastructure, and a heavy dependence on imported fossil fuels. Local flexibility markets can play an important role in enhancing the security of energy supply in Greece by increasing the resilience and flexibility of the local energy system. By enabling local communities to generate and store their own electricity and to participate in demand response programs, local flexibility markets can help to reduce dependence on the centralized grid and increase the reliability and security of the energy supply. However, the development of local flexibility markets in Greece is still in its early stages, and there are several challenges that need to be addressed to ensure their effectiveness in enhancing energy security. These challenges include Technical challenges - the development of local flexibility markets requires advanced technologies, such as smart meters and energy storage systems, that can be expensive and difficult to deploy. Furthermore, the integration of distributed energy resources (DERs) into the grid can present technical challenges related to grid stability and reliability. Regulatory challenges - the regulatory framework in Greece is still evolving, and there is a need for clear and consistent policies to support the development of local flexibility markets. This includes policies related to grid interconnection, metering and billing, and market design. Financial challenges - the upfront costs of deploying local flexibility technologies can be a significant barrier to adoption, particularly for low-income communities. There is a need for innovative financing models that can help to make these technologies more affordable and accessible	Policymakers in Greece should prioritize the development of clear and consistent policies that support the deployment of local flexibility technologies, as well as innovative financing models that can help to make these technologies more accessible to all communities	x	x	x	x	x		2
Innovation capacity and digital independence	Greece has made progress in recent years in the adoption of innovative technologies and the development of a digital infrastructure for the electricity system. The country has launched several initiatives to support the development of local flexibility markets, including the deployment of smart grids and the establishment of virtual power plants (VPPs). One of the key benefits of these initiatives is their potential to increase the digital independence of the electricity system in Greece. By deploying advanced digital technologies such as block chain, artificial intelligence, and the Internet of Things (IoT), Greece can reduce its reliance on external suppliers of energy and digital services, improving its resilience and sustainability. However, there are also challenges to the innovation capacity and digital independence of the electricity system in Greece. One of the key challenges is the lack of a comprehensive regulatory framework for local flexibility markets. Without clear rules and standards, it can be difficult for innovative technologies to be deployed at scale and for new business models to emerge. Another challenge is the need for significant investments in digital infrastructure and communication technologies. This can be a barrier to entry for smaller players and may require significant public and private investment to overcome	The innovation capacity and digital independence of the electricity system in Greece are important factors in the development of local flexibility markets and the modernization of the grid. The adoption of innovative technologies and the development of a comprehensive regulatory framework can help to overcome the challenges to deployment and ensure that Greece's electricity system is more efficient, reliable, and sustainable in the future							3
Attitudes towards energy efficient products, services, technologies, and appliances	There has been a growing trend towards energy-efficient products, services, technologies, and appliances in Greece, particularly in the context of local flexibility markets and electricity. This is primarily due to the country's commitment to reducing its carbon footprint and meeting its climate goals. Additionally, there has been an increasing awareness among consumers about the benefits of energy efficiency, such as reduced energy bills and a more sustainable lifestyle. One of the most significant drivers of energy efficiency in Greece is the implementation of local flexibility markets. These markets allow consumers to participate in the energy market by generating and selling renewable energy, as well as by reducing their consumption during peak periods. This has led to a significant increase in the adoption of energy-efficient appliances and technologies, such as smart meters, which allow consumers to monitor and control their energy usage more effectively. In addition to local flexibility markets, the Greek government has also introduced various incentives to encourage consumers to adopt energy-efficient products and services and they include tax breaks, subsidies, and low-interest loans for homeowners and businesses that invest in energy-efficient appliances, renewable energy technologies, and energy-efficient building design	The attitudes towards energy-efficient products, services, technologies, and appliances in Greece are generally positive, driven by a combination of government incentives, environmental concerns, and the potential for cost savings. As an expert, I would recommend that the Greek government continue to prioritize energy efficiency in its policy decisions, including by promoting the adoption of renewable energy technologies and supporting the development of local flexibility markets. This will not only help to reduce Greece's carbon footprint but also stimulate economic growth and job creation in the energy sector	x	x	x	x	x		3

Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	Greece has made significant progress towards the transition to a cleaner and more sustainable energy system. The country has set ambitious targets for renewable energy deployment, energy efficiency, and emissions reduction, and has implemented several policies and initiatives to support the transition. In the context of local flexibility markets and electricity, Greece has shown a strong willingness to invest in the energy transition. The country has introduced policies that promote the adoption of renewable energy, such as the "Renewable Energy Communities" scheme, which enables citizens to participate in renewable energy projects and benefit from the sale of excess electricity to the grid. Greece has also invested in the development of energy storage systems to enhance the flexibility of the electricity grid. For example, the country has launched a pilot project to install batteries in residential buildings to store excess solar energy, which can be used during periods of high demand. Furthermore, Greece has introduced policies to support the development of local flexibility markets, such as the "Virtual Power Plant" initiative, which aims to integrate distributed energy resources, such as rooftop solar panels and battery storage systems, into the electricity grid. The initiative incentivizes the participation of households and businesses in the electricity market and promotes innovation in the energy sector. In addition to financial investments, Greece has also demonstrated a strong commitment to the energy transition through efforts to reduce bureaucracy and streamline the regulatory framework. For instance, the country has introduced simplified procedures for the licensing of renewable energy projects, which has reduced the time and effort required to obtain the necessary permits	Overall, Greece has shown a strong willingness to invest in the energy transition, both financially and in terms of effort, time, and resources. The country has implemented several policies and initiatives to support the adoption of renewable energy, energy storage, and local flexibility markets, and has streamlined the regulatory framework to facilitate the transition. Continued efforts in this direction are necessary to achieve Greece's ambitious energy and climate targets and to ensure a sustainable future for the country	x	x		x	x		3
Smart grids deployment	Smart grid deployment in Greece is a critical step in the country's transition towards a more sustainable and efficient energy system. Greece is a country with a high potential for renewable energy generation, including wind, solar, and biomass. Smart grid deployment can help maximize the utilization of these resources and reduce the country's dependence on fossil fuels. The Greek government has recognized the importance of smart grids and local flexibility markets, and they are actively promoting their deployment. One example of this promotion is the "Horizon 2020" project, which aims to deploy a smart grid in the Greek island of Kythnos. The project includes the installation of advanced technologies such as smart meters, energy storage systems, and renewable energy sources. The smart grid will enable the deployment of a local flexibility market, allowing for the dynamic management of electricity demand and supply on the island	Smart grid deployment and local flexibility markets are crucial for the transition towards a more sustainable and efficient energy system in Greece. The country has significant potential for renewable energy generation, and the integration of advanced technologies can help maximize its utilization. The Greek government's support for smart grid deployment and local flexibility markets is a positive step towards achieving these goals	x	x	x	x	x		3
Demand response infrastructure deployment (smart metering)	Demand response infrastructure deployment, particularly smart metering, is an essential component of modern electricity systems, and its deployment in the context of local flexibility markets is becoming increasingly important. In Greece, the deployment of smart metering technology has been progressing steadily in recent years, driven by regulatory requirements and the need to modernize the electricity grid. In Greece, the deployment of smart metering infrastructure has been driven by the EU's Third Energy Package, which requires Member States to roll out smart meters to at least 80% of consumers by 2020. Greece has made significant progress towards meeting this target, with smart meters currently installed in around 60% of households. The deployment of smart metering technology is also expected to play a key role in the development of local flexibility markets in Greece. These markets aim to enable the participation of distributed energy resources, such as rooftop solar panels and battery storage systems, in the electricity market, by allowing these resources to provide services such as balancing and frequency response	Smart metering technology is essential for enabling the participation of distributed energy resources in local flexibility markets, as it allows for real-time monitoring of energy flows and the aggregation of these resources into virtual power plants. In Greece, the development of local flexibility markets is still in its early stages, but the deployment of smart metering infrastructure is expected to accelerate the growth of these markets in the coming years. While significant progress has been made towards meeting regulatory targets, further investment is needed to ensure that smart meters are deployed to all households and businesses, and to enable the full participation of distributed energy resources in the electricity market	x	x	x	x	x		3
Decentralised energy system and storage	In Greece, decentralised energy systems and storage can provide significant benefits to the electricity grid by enabling the integration of renewable energy sources, improving energy security, and reducing greenhouse gas emissions. In Greece, the deployment of renewable energy sources has been increasing in recent years, driven by supportive policies and the country's favorable solar and wind resources. However, the integration of these intermittent sources into the grid presents challenges related to grid stability and reliability. Energy storage systems can provide a viable solution to these challenges, by allowing excess energy from renewable sources to be stored and used when needed. In the context of Greece, the use of energy storage systems can help reduce the curtailment of renewable energy sources, improve grid stability and reliability, and reduce reliance on fossil fuel-based generation	The deployment of decentralised energy systems and storage can also provide opportunities for local communities to participate in the energy market and benefit from the deployment of renewable energy sources. For example, households and businesses can install solar panels and battery storage systems and participate in local flexibility markets, providing flexibility services to the grid and generating revenue	x	x	x	x	x		3
TSO and DSO regulation	The Transmission System Operator (TSO) and Distribution System Operator (DSO) regulations are critical to the effective functioning of local flexibility markets and the broader electricity system. The TSO is responsible for the management of the high-voltage transmission network, while the DSO manages the low-voltage distribution network. The TSO and DSO regulations have been updated to accommodate DERs and local flexibility markets, e.g., the TSO has developed a new market mechanism for the integration of renewable energy sources into the grid, known as the Day Ahead Market (DAM). The DAM allows renewable energy producers to bid into the energy market and receive payment for the energy they generate	The DSO has developed new regulations to enable the integration of local flexibility markets into the distribution network. These regulations require DSOs to provide access to their networks for local flexibility providers, such as aggregators or demand response providers. This enables flexibility providers to participate in the local energy market and provide services such as demand response or energy storage. The government should continue to prioritize the development of these regulations, including by promoting the adoption of smart grid technologies and supporting the development of local energy communities. This will help to create a more resilient and flexible electricity system, which can better respond to the challenges of climate change and energy transition	x	x	x	x	x		3
Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	In recent years, there has been a growing interest in peer-to-peer (P2P) energy trading and virtual power plants (VPPs) as a means of enhancing local flexibility markets and promoting renewable energy adoption. In Greece, there has been a significant focus on developing local flexibility markets, which could potentially benefit from the adoption of P2P energy trading and VPPs. The availability of information and communication technology (ICT) solutions for P2P energy trading and VPPs in Greece is currently relatively limited, but there are some promising developments. For instance, the Greek Regulatory Authority for Energy (RAE) has launched a pilot program to explore the potential of P2P energy trading and VPPs in the country. The program aims to test the feasibility of these technologies and determine the regulatory framework required to enable their widespread adoption	There are still several challenges to overcome before P2P energy trading and VPPs can be widely adopted in Greece. One of the primary challenges is the lack of a clear regulatory framework for these technologies. The pilot program launched by RAE aims to address this issue, but it may take some time before a comprehensive regulatory framework is in place. Another challenge is the limited availability of ICT solutions for P2P energy trading and VPPs in Greece. While there are some companies and startups that offer these solutions, they are still relatively few in number and may not be widely accessible to all consumers	x	x		x	x		2

Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	In Greece, the regulatory framework for customer participation in the electricity markets is set by the Energy Regulator (RAE) and the Ministry of Environment and Energy. Guaranteed grid access is an essential right for customers seeking to participate in the electricity markets. All customers have the right to connect to the distribution or transmission grid, subject to compliance with technical and safety standards. This allows customers to participate in local flexibility markets by providing or consuming energy when it is needed by the system. Customers with distributed energy resources, such as solar panels or batteries, can also feed excess energy into the grid and receive remuneration for their contributions. Remuneration for energy fed into the grid is an important incentive for customers to invest in distributed energy resources and participate in local flexibility markets. In Greece, the feed-in tariff scheme provides a fixed price for energy fed into the grid by small-scale renewable energy producers. This scheme has helped to drive the deployment of solar panels and other distributed energy resources in Greece	The demand response is supported by the Interruptible Load Program (ILP), which allows large industrial customers to reduce their electricity consumption during periods of high demand in exchange for compensation. This helps to balance supply and demand in the system and avoid the need for expensive peaking power plants	x	x			x		3
Schemes and incentives that give advantage to big energy firms	Big energy firms in Greece have the advantage of being able to receive various incentives and benefits from the government, including subsidies for renewable energy projects, tax exemptions, and access to capital	Firms are able to benefit from the low cost of renewables compared to traditional energy sources. This allows them to reduce their costs and increase their profits, while also providing a more sustainable energy solution to the country	x	x			x		4
Grid connection costs	The cost of connecting renewable energy sources to the grid in Greece is relatively high due to the need to upgrade existing infrastructure and the cost of connecting new renewable energy sources	Additional costs such as permitting, land-use, and grid interconnection fees also add to the overall cost of connecting renewable energy sources to the grid. This is causing difficulty for renewable energy projects in Greece, as the high costs may not be justified by the potential savings from the renewable energy sources.	x	x		x			2
Uncertainty and limitations in feed-in-tariff levels and schemes	Feed-in-tariff (FIT) schemes have been used in Greece to promote the development of renewable energy sources (RES) and support the transition to a more sustainable energy system. However, there are several uncertainties and limitations associated with FIT levels and schemes, particularly in the context of local flexibility markets and electricity. One major uncertainty is the unpredictability of electricity prices and demand. Electricity prices can fluctuate significantly over time, which can affect the profitability of RES projects that rely on FIT schemes. Additionally, changes in electricity demand can impact the value of RES production, particularly if the supply of RES exceeds demand. This uncertainty can make it challenging for investors to predict the financial performance of RES projects and can limit the attractiveness of FIT schemes. Another limitation of FIT schemes is their inflexibility. FIT schemes typically provide a fixed payment rate for RES production over a set period, which can limit the ability of RES producers to respond to changes in electricity demand or market conditions. This inflexibility can also limit the potential for RES producers to participate in local flexibility markets, which rely on the ability to adjust electricity production or consumption in response to grid conditions. In the context of local flexibility markets, there are also uncertainties related to the availability and technical capabilities of DERs. The participation of DERs in local flexibility markets can be limited by technical factors, such as the ability of DERs to provide reliable and predictable flexibility services. Additionally, the availability of DERs can vary depending on factors such as weather conditions and the availability of storage capacity, which can limit the potential for local flexibility markets to provide reliable and predictable services	Greek regulatory environment is complex and ever-changing, leading to unpredictability and risk for potential investors and limited infrastructure and lack of access to funding nationally can often hinder the development of renewable energy projects. Finally, the availability of renewable energy resources in Greece is low making it difficult for the investors to work on the new projects	x				x		2
Legislative frameworks that make setting up LFM ventures difficult	Legal framework for renewable energy is complex and can be difficult for developers to navigate	New investments likely to be delayed due to framework complexity	x				x		2
Lack of support from local representatives/local energy agencies	Local representatives and Greek energy agencies play a critical role in shaping the policies and programs that govern the local energy system. Without their support, it can be challenging to secure the necessary funding, regulatory approvals, and community engagement needed to develop local flexibility markets and integrate renewable energy sources, energy storage, and demand response programs into the local grid. One reason for the lack of support from local representatives and energy agencies may be a lack of awareness or understanding of the potential benefits of local flexibility markets and renewable energy technologies. For example, local representatives may be more focused on other priorities, such as economic development or public safety, and may not fully appreciate the role that local flexibility markets and renewable energy technologies can play in achieving these goals. Another reason may be a lack of resources or expertise to develop and implement local flexibility markets and renewable energy programs. Local energy agencies may not have the staff or technical capacity needed to evaluate and implement new programs or may face bureaucratic obstacles that limit their ability to act. To address these challenges, policymakers in Greece could consider providing additional resources and support to local energy agencies, including funding for technical assistance and training programs	Policymakers could work to engage with local representatives and community leaders to build awareness and support for local flexibility markets and renewable energy technologies. Furthermore, establishing partnerships and collaborations between local energy agencies and external stakeholders such as universities or industry associations could facilitate the sharing of knowledge and expertise and promote the development of best practices	x		x		x		2
Lack of a policy framework for LFM investments	The government does not aim for geothermal energy investments despite country's enormous potential. There is significant potential for geothermal in Greece, but we should keep in mind that this technology competes with solar PV and wind which are currently much more economically attractive	Energy planning not effective enough to support geothermal energy	x				x		1
Not mentioning LC as a relevant actor	The government does not prioritize local projects supported by local communities unless they are associated in non-profit associations. According to the Law 4513/2018, profit organizations are also considered	Difficult to enforce with no support of the local authorities, only support for non-profit associations	x		x		x		3
Complex and changeable policies regarding LFM development	Greece has implemented various policies to encourage the development of renewable energy sources in recent years with an increasing more progress happening now, however, still sicks to coal and gas generation in some areas when needed	May delay new investments	x				x		3
Lack of rules regarding the opportunity to operate micro-grids	Greece lacks a unified set of rules and regulations that would allow for the operation of micro-grids in renewable energy	They might not be enforced locally; it means not enough opportunities in the local context	x			x	x		2

Lack of regional focus on renewable energy projects with LFM	The government has not provided sufficient incentives to encourage the development of renewable energy projects in the regions and the limited financial resources available in the regions to invest in renewable energy projects is a major obstacle for investors	The lack of clear policies and regulations governing renewable energy projects in the regions has made it difficult to attract investors and to upscale the projects	x	x			x		2
Energy policies may have unwanted negative connotations	Energy policies in Greece can be seen as a form of governmental overreach by some citizens	The government prioritizes wrong policies	x	x	x	x	x	x	2
Lack of cooperation between local authorities and local communities	The lack of cooperation between local authorities and local communities can be a significant obstacle to the development of local flexibility markets and the transition to a more sustainable and resilient electricity system in Greece. One reason for the lack of cooperation may be a lack of trust between local authorities and local communities. Local communities may feel that their interests and concerns are not being heard or addressed by local authorities, while local authorities may feel that local communities are resistant to change or are not sufficiently engaged in the policymaking process. Another reason may be a lack of resources or technical expertise on the part of local communities. Local communities may not have the resources or technical capacity needed to develop and implement effective energy programs, while local authorities may not have the necessary knowledge or understanding of local energy needs and opportunities. To address these challenges, policymakers in Greece could consider promoting greater collaboration and engagement between local authorities and local communities. This could include initiatives such as community-based energy planning, where local communities are actively involved in identifying local energy needs and opportunities and developing energy programs that are tailored to their specific needs	Policymakers could consider providing resources and support to local communities to help them develop the technical capacity needed to implement local energy programs effectively. This could include funding for training and technical assistance programs or establishing partnerships with universities or industry associations to facilitate the sharing of knowledge and expertise.	x		x				1
Difficulties for energy communities to generate enough surplus to cover organisational costs	No support if they are not associated in non-profit associations	Delays in the local RES context	x	x	x				2
Lack of long-term government funding	Lack of long-term funding for LFMs in Greece has inhibited their growth and sustainability	Associations have more financial incentives for new projects rather than individuals	x	x	x				3
Initial financing problems at local government level	A change shift at the national government level that champions alternatives to renewables such as nuclear	Less support for renewables in the LFMs	x	x	x				3
National energy policy change and shift from RES to HYD	Policy change could discourage investments in renewable energy development, and reduce the incentives for businesses and individuals to invest in renewable energy projects	Likely to slower growth in renewable energy generation, an increase in energy-related emissions, and a greater dependency on hydrocarbons for energy production	x	x			x		2
Difficulty in accessing loans/contracts/funding for LFM projects	Too many rules at the national level, often dictated by the region it is addressed at	Not enough financial support at the local level due to changing priorities	x	x		x	x	x	3
Lack of tax exemptions or incentives unlocking new investment opportunities	The lack of support has limited the ability of Greek businesses and households to invest in renewable energy sources, and has inhibited the development of a competitive market for renewable energy	The lack of tax exemptions and incentives can discourage potential investors from investing in renewable energy projects, thus further limiting the growth of the sector	x	x	x				1
Investment incentives for hydrocarbons instead of RES	The government championing gas and shifted towards coals to secure energy supplies nationally	Delays in RES deployment in the LFMs context - shift in priorities caused by the war in Ukraine	x	x	x		x		2
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	Despite the high return on investment associated with renewable energy sources, there is still a degree of contradiction between their nature and the current energy policy level/planning in Greece. Thermal power plants are subject to CO2 pricing according to the emissions trading scheme. High CO2 prices together with high gas prices (as a result of the war in Ukraine) made the cost of electricity generation by gas plants unaffordable. Huge subsidies were required to support electricity demand. The penetration of RES is significant (approximately 40 %) but not sufficient to substitute natural gas as base load	The government continues to prioritize fossil fuels, which are not only unsustainable but are also more expensive in the long run	x	x	x		x	x	1
Lack of experience with LFM	The government is not adequately prepared to deal with the complex nature of renewable energy projects, and the potential local opposition they could face from affected communities	Leads to delays in project implementation and a lack of public understanding and acceptance of the benefits of renewable energy			x	x			2
Low trust in renewable energy technologies	Traditionally relies heavily on fossil fuels as a source of energy, leading to a lack of trust in renewable energy technologies	limited capacity of local renewable energy infrastructures and the perception of high costs associated with renewable energy investments	x		x		x		2
Possible loss of support if the projects exceed certain size	Government funding can only support required project size	It might slow down climate neutrality ambitions and bigger renewable capacity ambitions	x		x	x	x	x	2
Lengthy grid connection procedures	Not sufficient planning at national and local levels	Delays in connecting new RES plants to the grid	x	x	x	x	x		2
Lack of interest and engagement in the promotion of LFM	There is a lack of public awareness and understanding of the benefits associated with renewable energy sources, e.g., solar, wind. This has led to national scepticism in investing in renewables. The country's economic crisis has had a significant impact on the promotion of RES and further government investments in them	Too much scope being put onto fossil fuels	x		x			x	1

Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	Fear of displacement is a common concern among local communities in Greece who may perceive the introduction of RES as a threat to their way of life or their economic interests. For example, residents living near proposed wind farms may be concerned about the potential visual impact of the turbines on their landscape or the potential impact on property values. Similarly, fossil fuel-based energy producers may be concerned about losing market share and revenue as RES become more prevalent in the local energy mix. Beliefs and lack of knowledge can also play a role in unreasonable opposition to RES. Some people may hold misconceptions about the reliability or affordability of renewable energy technologies, while others may lack the technical knowledge needed to evaluate the potential benefits of RES in their local context	People may hold beliefs that renewable energy is too expensive or will damage the environment. Thus, these concerns are understandable, they can be addressed through education and community engagement. By providing accurate and accessible information about the potential benefits of RES, policymakers and community leaders can help to dispel myths and misconceptions and build support for the development of local flexibility markets and the transition to a more sustainable and resilient energy system in Greece	x		x		x		2
Lack of experience in commissioning and managing RES projects	No consistent and clear policy framework, inadequate resources and technical capacity, and limited access to finance making it difficult to expand the RES portfolio in Greece	Greece has been slow to develop its renewable energy sector, limiting its potential to reduce carbon emissions and benefit from the economic opportunities provided by renewables			x	x			2
Lack of accessible area for new renewable plants	Too many highly urbanized areas where conditions for renewables are sufficient	High urbanization requires the shift in project area planning	x		x	x			2
Lack of sufficient requalification/training for potential LFM technology staff	The government does not invest enough in requalification of the workforce	Fewer experts that can work on the RES projects	x	x	x	x	x	x	2
Difficulty in securing labour for LFM projects	People prefer to work in low-labour settings where they do not need to requalify	Affects project capacities as not enough workforce		x	x	x			2
Rigid legal, bureaucratic, and administrative procedures	National and local policies championing hydrocarbons instead of renewables	Can disturb the LFMs context		x	x				2
Insufficient regulation regarding smart metering	Greece is behind most of the EU Member States in the adoption of smart metering technology to monitor and control renewable energy sources due to not implementing any policies or regulations to encourage its adoption	Lack of regulation has limited the development of smart metering technology and has hampered the growth of the renewable energy sector in Greece	x	x		x	x		1
Strong aversion to risk towards larger RES projects	The authorities in some instances, prefer smaller projects due to lower operational and financial risk	Can affect large project ambitions	x				x		2
Lack of cooperation with other local communities to share expertise/knowledge/resources	Sharing expertise, knowledge, and resources can be particularly important in the context of local flexibility markets, which rely on the participation of multiple stakeholders, including energy producers, consumers, and grid operators. By sharing knowledge and expertise, local communities can learn from each other's experiences and identify best practices for integrating renewable energy sources, energy storage, and demand response programs into the local grid. Sharing resources can help to improve the cost-effectiveness of local flexibility markets by reducing the need for individual communities to invest in expensive equipment or infrastructure. For example, communities could collaborate to develop shared energy storage facilities or to jointly purchase and manage demand response programs. However, despite the potential benefits of cooperation, there are several factors that can hinder the development of collaborative local flexibility markets in Greece. One challenge is the lack of awareness and understanding of the benefits of collaboration among local stakeholders. Some communities may be hesitant to share their expertise or resources due to concerns about competition or a lack of trust. Another challenge is the absence of supportive policies and regulations that encourage collaboration among local communities. Existing policies and regulations may be focused on individual communities, which can create disincentives for cooperation and limit the potential for shared benefits. Additionally, administrative, and bureaucratic obstacles may hinder the development of collaborative local flexibility markets, such as difficulties in obtaining permits or financing for joint projects	Might affect local LFMs projects while the lack of cooperation with other local communities to share expertise, knowledge, and resources can limit the potential benefits of local flexibility markets and hinder the development of a more sustainable and resilient electricity system in Greece, there are opportunities for policymakers to incentivize and facilitate collaboration among local stakeholders	x	x	x				2
Low citizen involvement in decision making activities	A lack of awareness and understanding of renewable energy technologies, a lack of political will and support, and the limited access to relevant information, as well as incentives and resources to encourage citizens to engage in decision-making activities related to renewable energy	The development and implementation of renewable energy policies in Greece have been largely driven by government and industry, rather than by citizens due to their no o little involvement in the process	x	x	x				2

Country:	Spain								
Factor (title)	Factor (description)	Impact for LFM development in the country	Political	Economic	Social	Technological	Legal	Environmental	Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)
Market structures that support centralised energy production/local flexibility markets	Spain supports centralised energy production through regulated tariffs available for the market participants. These include a regulated electricity market, a competitive electricity market, and an integrated wholesale electricity market. A blend of the traditional centralized system and the new decentralized system. The market structures that support centralized energy production and local flexibility markets in the context of renewable energy sources are mainly based on the Spanish Energy Market Law (LME), which provides the framework for the electricity market, as well as the Renewable Energy Sources Act (LRES). Self-consumption model of RES has traditionally faced great opposition from big DSO. The sector is still struggling with a rigid energy grid	Regulated electricity market, electricity is produced by large utilities and sold to customers at regulated prices. In the competitive electricity market, electricity is produced by independent power producers and sold to customers at competitive prices. ensure an efficient, reliable, and cost-effective supply of electricity for Spanish consumers. The Spanish government has implemented several policies to promote renewable energy sources, such as the National Plan for Energy and Climate Change (PNIEC), the National Energy Strategy (ENE), and the National Renewable Energy Action Plan (REN,) which provide a comprehensive strategy for the development of RES nationally. The new negotiations between the customer and retailer prices likely to unlock new RES opportunities within LFMs	x	x					3
Security of energy supply	The security of energy supply in Spain's local flexibility markets and electricity sector is a critical issue that requires careful analysis and attention. Local flexibility markets are becoming an increasingly important tool for managing the integration of renewable energy sources into the grid, which is critical to meeting Spain's energy and climate targets. However, these markets also present certain security challenges that must be addressed. One of the key security concerns is the risk of cyber-attacks on the local flexibility markets and the electricity grid. The increasing digitization of the energy sector has made it more vulnerable to cyber threats, and any breach of security could have severe consequences for the reliability and stability of the system. To address this risk, robust cybersecurity measures must be put in place to ensure the integrity of the local flexibility markets and the wider electricity grid. Another security concern is the potential for supply disruptions due to extreme weather events, natural disasters, or other unforeseen circumstances. Spain is particularly vulnerable to these risks due to its geographic location and exposure to weather-related hazards such as heat waves, droughts, and wildfires. To address this risk, measures must be put in place to ensure that the local flexibility markets and electricity infrastructure can withstand and recover from any such events	The security of energy supply in the local flexibility markets and electricity sector is also closely linked to the availability of fuel and other resources. In the case of Spain, this includes natural gas, which is a critical source of energy for both electricity generation and heating. Any disruption to the supply of natural gas could have significant consequences for the reliability and stability of the energy system. To address this risk, efforts must be made to diversify the energy mix and reduce dependence on any single source of energy	x	x	x	x	x	x	2
Innovation capacity and digital independence	In recent years, Spain has shown significant progress in the development of local flexibility markets and the digitalization of its electricity sector. This progress has been driven by the country's commitment to meeting its energy transition goals and reducing greenhouse gas emissions. In this context, the analysis of innovation capacity and digital independence is crucial to ensure the success of these initiatives. Innovation capacity is the ability of an organization or a country to develop and implement new ideas, processes, and products. Spain has demonstrated a strong innovation capacity in the electricity sector, particularly in the area of renewable energy. The country has set ambitious targets to increase the share of renewable energy in its electricity mix, with a goal of achieving 74% by 2030. To achieve this, Spain has implemented a range of policies and incentives to promote the deployment of renewable energy technologies, such as solar and wind power. In addition to promoting renewable energy, Spain has also implemented measures to support the development of local flexibility markets. These markets allow consumers and producers of electricity to sell and buy energy based on real-time prices, which can help to balance the grid and reduce energy costs. Spain has implemented a range of measures to promote the development of local flexibility markets, including the creation of a regulatory framework that allows for the participation of multiple actors, such as aggregators and prosumers. Digital independence, on the other hand, refers to a country's ability to develop and use digital technologies without relying on external sources. In the context of the electricity sector, digital independence is becoming increasingly important as the sector becomes more reliant on digital technologies such as smart grids and digital platforms. Spain has made significant progress in this area, particularly in the development of digital platforms for the management of local flexibility markets	Spain has implemented a range of digital platforms to enable the participation of multiple actors in local flexibility markets, such as aggregators and prosumers. These platforms use advanced algorithms and machine learning techniques to optimize the dispatch of energy based on real-time data on supply and demand. The development of these platforms has been supported by public and private investment, as well as collaboration between different actors in the electricity sector	x	x	x	x	x		3
Attitudes towards energy efficient products, services, technologies and appliances	Spain has made significant progress in promoting energy-efficient products, services, technologies, and appliances. The country has recognized the importance of reducing energy consumption and emissions, particularly in the context of combating climate change. As such, the Spanish government has implemented various policies and programs to incentivize the use of energy-efficient products, services, technologies, and appliances. In the context of local flexibility markets and electricity, there has been a growing interest in promoting the use of energy-efficient products, services, technologies, and appliances. This is because energy-efficient products can help to reduce overall energy consumption, which can help to balance the electricity grid and reduce the need for new infrastructure investments. There are several key attitudes towards energy-efficient products, services, technologies, and appliances in the context of local flexibility markets and electricity in Spain. These include: Cost-Effectiveness- where consumers and businesses are increasingly recognizing the cost-effectiveness of energy-efficient products, services, technologies, and appliances. By reducing energy consumption, these products can help to lower energy bills, which is particularly important in the context of electricity prices in Spain. Sustainability - where is a growing awareness of the need to reduce carbon emissions and promote sustainability. Energy-efficient products, services, technologies, and appliances can help to reduce energy consumption and emissions, which is important for achieving climate goals. Convenience - where is a growing demand for energy-efficient products, services, technologies, and appliances that are easy to use and integrate into daily life. Consumers are increasingly looking for products that are convenient and do not require significant changes to their daily routines. Government Support - The Spanish government has implemented various policies and programs to incentivize the use of energy-efficient products, services, technologies, and appliances. These policies have helped to increase awareness and adoption of energy-efficient products in the country	The attitudes towards energy-efficient products, services, technologies, and appliances in the context of local flexibility markets and electricity in Spain are positive. Consumers and businesses are recognizing the benefits of energy efficiency and are increasingly looking for products and services that can help to reduce energy consumption and emissions. With the support of government policies and programs, it is likely that the adoption of energy-efficient products and services will continue to increase in the future	x	x	x	x	x		3

Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	The willingness to invest in energy transition in Spain is increasing, particularly in the context of local flexibility markets and electricity. There are several reasons for this trend, including the need to reduce carbon emissions, increase energy efficiency, and improve energy security. The Spanish government has set ambitious goals to reduce greenhouse gas emissions, including a target of 74% reduction by 2030 and net-zero emissions by 2050. To achieve these goals, significant investments in renewable energy and energy efficiency will be required. One of the key drivers for investment in local flexibility markets is the increasing penetration of renewable energy sources, such as wind and solar power. These sources are intermittent, and their output varies depending on weather conditions. Local flexibility markets can help balance the grid by allowing small-scale energy producers, such as households with solar panels, to sell excess energy back to the grid when demand is high. Another important factor is the decreasing cost of renewable energy technologies, which has made them more competitive with traditional fossil fuel sources. This, coupled with supportive policies and incentives from the government, has led to an increase in renewable energy investments in Spain	The implementation of the European Union's Clean Energy Package, which includes provisions for local flexibility markets, has also spurred investment in this area. This package aims to create a more integrated and flexible energy system, which is better equipped to handle the challenges posed by the increasing use of renewable energy sources. Also, there is a growing willingness to invest in energy transition in Spain, particularly in the context of local flexibility markets and electricity. This trend is driven by a combination of environmental, economic, and policy factors, and is likely to continue as the country seeks to achieve its ambitious emissions reduction targets	x	x	x	x	x		3
Smart grids deployment	One of the primary drivers for the deployment of smart grids in Spain is the need to integrate renewable energy sources into the grid. Spain is a country with significant potential for renewable energy generation, including solar, wind, and hydroelectric power. The deployment of smart grids can help maximize the utilization of these resources by managing their variability and intermittency. The Spanish government has taken a proactive approach to support the deployment of smart grids and local flexibility markets. For example, in 2019, Spain passed the "National Energy and Climate Plan," which set a target of 74% of electricity generation from renewable energy sources by 2030. This ambitious target requires significant investment in smart grids and local flexibility markets to integrate renewable energy sources and ensure grid stability. Several smart grid projects are currently underway in Spain, which demonstrate the country's commitment to this technology. For example, the "Integrating Distributed Energy Resources in Distribution Grids" project aims to deploy smart grids in several regions across Spain. The project includes the installation of advanced technologies such as smart meters, energy storage systems, and renewable energy sources. The smart grids will enable the deployment of local flexibility markets, allowing for the dynamic management of electricity demand and supply in these regions	Smart grid deployment and local flexibility markets are crucial for the transition towards a more sustainable and efficient energy system in Spain. The country has significant potential for renewable energy generation, and the integration of advanced technologies can help maximize its utilization. The Spanish government's support for smart grid deployment and local flexibility markets is a positive step towards achieving the country's renewable energy targets and ensuring grid stability	x	x	x	x			3
Demand response infrastructure deployment (smart metering)	In Spain, the deployment of smart metering technology has been ongoing for several years, driven by regulatory mandates and the need to enhance grid flexibility and efficiency. Spain has been one of the most active countries in Europe in the deployment of smart metering infrastructure. In 2015, the Spanish government mandated the installation of smart meters for all electricity consumers, with the target of achieving full deployment by 2018. By the end of 2018, over 70% of households in Spain had a smart meter installed, surpassing the European Union's goal of reaching 80% by 2020. The deployment of smart metering technology has provided utilities with greater visibility and control over electricity supply and demand, enabling the development of local flexibility markets in Spain. These markets are designed to allow distributed energy resources, such as solar panels, battery storage, and electric vehicles, to participate in electricity markets and provide grid services. Smart meters play a key role in enabling the participation of these distributed energy resources in local flexibility markets. With real-time data on electricity consumption, utilities can create dynamic pricing signals to incentivize customers to shift their electricity usage to off-peak hours. This can help reduce peak demand and improve the reliability and stability of the grid.	Local flexibility markets are still in their early stages, but significant progress has been made. In 2018, the Spanish government launched a pilot project to test the feasibility of local flexibility markets, and several utilities have already launched their own initiatives to allow distributed energy resources to participate in the electricity market. The deployment of smart metering technology in Spain has enabled the development of local flexibility markets and provided greater visibility and control over electricity supply and demand. While Spain has made significant progress in deploying smart meters, continued investment is needed to ensure full coverage and the integration of distributed energy resources into local flexibility markets. The implementation of these markets can help promote a more sustainable and efficient electricity system in Spain	x	x	x	x	x		3
Decentralised energy system and storage	Decentralised energy systems and energy storage are increasingly seen as key components of a more sustainable and resilient energy system, and this is also true in Spain. The deployment of these technologies can provide several benefits to the Spanish electricity system, including increased flexibility, reliability, and the integration of renewable energy sources. The emergence of local flexibility markets in Spain has provided an opportunity for the integration of decentralised energy systems and storage into the grid. These markets allow for the participation of smaller, local energy resources in the market, enabling them to provide flexibility services to the grid and generate revenue. By participating in local flexibility markets, decentralized energy systems and storage can contribute to the overall stability and reliability of the electricity system. The use of decentralised energy systems and storage can help the country achieve its renewable energy targets, reduce greenhouse gas emissions, and increase energy security. The Spanish government has set ambitious targets for the deployment of renewable energy, with a goal of 74% of the country's electricity coming from renewable sources by 2030. Energy storage systems can play a crucial role in the integration of renewable energy sources into the grid by providing the necessary flexibility to manage the variability and uncertainty of these sources. By storing excess energy generated by renewable sources, energy storage systems can ensure that energy is available when needed, reducing the reliance on fossil fuel-based generation	The deployment of decentralised energy systems and storage can provide opportunities for local communities in Spain to participate in the energy market and benefit from the deployment of renewable energy sources. For example, households and businesses can install solar panels and battery storage systems and participate in local flexibility markets, providing flexibility services to the grid and generating revenue. The decentralised energy systems and storage, in combination with local flexibility markets, can play a significant role in the transition towards a more sustainable and resilient energy system in Spain. The deployment of these technologies can enable the integration of renewable energy sources, improve grid stability and reliability, and provide opportunities for local communities to participate in the energy market	x	x	x	x	x		3
TSO and DSO regulation	The Transmission System Operator (TSO) and Distribution System Operator (DSO) regulations are crucial to the effective functioning of local flexibility markets and the broader electricity system. The TSO is responsible for managing the high-voltage transmission network, while the DSO manages the low-voltage distribution network. The TSO and DSO regulations have been updated to accommodate the increasing penetration of distributed energy resources (DERs) into the electricity system in Spain. DERs are typically small-scale, renewable energy sources that are located close to the point of consumption, such as rooftop solar panels or small wind turbines. These resources can provide a significant source of flexibility to the electricity system, but their integration requires changes to the existing regulatory framework. The TSO has developed a new market mechanism for the integration of renewable energy sources into the grid, known as the Spanish Electricity Market (MIBEL). MIBEL is a joint market between Spain and Portugal, which enables renewable energy producers to bid into the energy market and receive payment for the energy they generate. Similarly, the DSO has developed new regulations to enable the integration of local flexibility markets into the distribution network. These regulations require DSOs to provide access to their networks for local flexibility providers, such as aggregators or demand response providers. This enables flexibility providers to participate in the local energy market and provide services such as demand response or energy storage	The Spanish government has also introduced various incentives to encourage the adoption of energy-efficient products and services, including tax breaks, subsidies, and low-interest loans. Additionally, Spain has developed a National Renewable Energy Plan, which sets targets for the deployment of renewable energy technologies such as solar and wind power	x	x	x	x	x		4

Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	Spain has been at the forefront of the European Union's efforts to develop local flexibility markets and promote the adoption of renewable energy. Peer-to-peer (P2P) energy trading and virtual power plants (VPPs) are seen as promising technologies that could enhance the flexibility and resilience of the Spanish electricity system. As such, there has been a significant focus on developing ICT solutions for P2P energy trading and VPPs in Spain. There are several ICT solutions available for P2P energy trading and VPPs in Spain. These solutions are offered by a variety of companies and startups, ranging from established utilities to innovative technology companies. For example, Acciona Energy is one of the largest renewable energy companies in Spain, and it has developed a P2P energy trading platform that allows consumers to buy and sell energy from each other. In addition to private sector initiatives, the Spanish government has also taken steps to promote the development of ICT solutions for P2P energy trading and VPPs. The government's National Energy and Climate Plan (NECP) includes provisions to promote the adoption of these technologies and support their integration into the Spanish electricity system. One of the primary challenges is the need for a clear regulatory framework that supports the development and deployment of these technologies. The government is working to address this issue through initiatives such as the NECP, but there is still work to be done to ensure that the regulatory environment is supportive of P2P energy trading and VPPs. Another challenge is the need for greater public awareness and education about these technologies. While some consumers are already familiar with P2P energy trading and VPPs, many others are not. As such, there is a need for public education campaigns to help consumers understand the benefits of these technologies and how they can participate in them	The availability of ICT solutions for P2P energy trading and VPPs in Spain is relatively high compared to many other countries. However, there are still some challenges to overcome before these technologies can be widely adopted, including the need for a clear regulatory framework and greater public awareness and education							
Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	In Spain, the electricity market is regulated by the Spanish National Commission of Markets and Competition (CNMC). The CNMC has implemented several measures to ensure the active participation of customers in the electricity markets, including local flexibility markets. Guaranteed grid access is a fundamental right of all electricity consumers in Spain. The CNMC has established regulations to ensure that all consumers have equal and non-discriminatory access to the electricity grid. This allows customers to choose their energy supplier and to participate in local flexibility markets by offering their flexibility services to the grid. Remuneration for energy fed into the grid is also guaranteed in Spain. The CNMC has established regulations that require grid operators to purchase excess energy from customers who generate their own electricity through renewable sources. This means that customers who generate their own electricity through renewable sources such as solar panels or wind turbines can sell any excess energy back to the grid, providing a financial incentive for renewable energy production. Demand response is another important tool for active customer participation in the electricity market. In Spain, demand response programs allow customers to reduce their energy consumption during peak demand periods, in exchange for financial incentives. These programs are designed to balance supply and demand on the grid, while also reducing the overall cost of electricity for consumers	Local flexibility markets are emerging in Spain as a way to optimize the use of renewable energy sources and reduce the need for expensive grid upgrades. These markets allow customers to offer their flexibility services to the grid, such as the ability to increase or decrease their energy consumption in response to changing grid conditions. In exchange, customers receive financial incentives, which can help offset the cost of energy bills	x	x	x	x	x		3
Schemes and incentives that give advantage to big energy firms	In place are access to government subsidies, tax incentives, and preferential access to renewable energy projects. Big companies have teams dedicated in getting the maximum number of subsidies possible from the government. RES are becoming more democratic to small investors in Spain specially in the self-consumption model, but big investment funds are promoting large RES plants have more resources (legal, technical, financial capacities) to face long and bureaucratic processes. RES is becoming more democratic to small investors in Spain specially in self-consumption, but big investment funds promoting big RES plants have more resources (legal, technical, financial…) to face long and bureaucratic processes	Large energy firms can leverage their existing infrastructure, customer base, and relationships to help drive the adoption of renewable energy sources. More likely to support Spain's energy ambitions than smaller firms due to larger entry capital	x	x		x	x		3
Grid connection costs	Vary, depending on the type of technology and the size of the installation used. Usually higher for larger installations, and for certain technologies, such as solar photovoltaics and onshore wind. Cost for connections are high due to high bureaucracy within the Public Administration and DSOs	The cost of connection may be reduced through certain incentives or subsidies provided by the government; however, the lengthy bureaucratic procedures may delay the new projects, especially those of smaller size	x	x		x			2
Uncertainty and limitations in feed-in-tariff levels and schemes	Largely based on the country's changing energy policies and regulations. The introduction of the Royal Decree Law in 2015 created a framework for renewable energy production and consumption, which includes the FiT scheme, however the scheme was phased out recently. Retroactive legislative changes have also created the uncertainty for the investors. Retroactive legislative changes have created uncertainty in investors	The FiT scheme is limited to certain types of renewable energy, such as wind and solar, and is not applicable to other renewable sources. The FiT scheme is subject to market changes, which can have a significant impact on the overall FiT levels. The investors may be pushed away by constantly changing legislative amendments	x	x		x			2
Legislative frameworks that make setting up LFM ventures difficult	Legal framework for renewable energy is complex and can be difficult for developers to navigate, but since the last 5 years and the change in the government, the legislation is favouring more and more the implementation of RES in the country. This has increased drastically the number of ventures in this sector	New investments likely to be delayed due to framework complexity	x				x		2
Lack of support from local representatives/local energy agencies	A draft framework for CfD (contracts for difference) requiring developers to complete environmental permitting to participate in CfD. Visible support for wind and solar projects through such programs as the previous Sun Tax is history currently, this has changed in the last 5 years and has led to rising support of these initiatives	Other than wind and solar projects might face delays due to their non-urgent nature	x		x		x		2
Lack of a policy framework for LFM investments	The government does not aim for geothermal energy investments despite country's enormous potential	Energy planning not effective enough to support geothermal energy	x				x		1
Not mentioning LC as a relevant actor	The government does not prioritize local projects supported by local communities, unless they are associated in non-profit associations	Difficult to enforce with no support of the local authorities, only support for non-profit associations. A reduction of environmental permits to boost the deployment of RES can affect new project ambitions	x		x		x		2
Complex and changeable policies regarding LFM development	Government is focused on the promotion of private investment in renewables through incentives and subsidies, such as tax exemptions; introduction of favourable regulation and administrative procedures e.g., as streamlined licensing and permitting processes, introduction of Solar Plan. A lot of grants are available (under Resilience European Funds post Covid-19 pandemic)	Likely to significantly boost new investments and upscale the capacities	x			x	x		4

Lack of rules regarding the opportunity to operate micro-grids	Government promotes the adoption of smart grid technology as a way of improving the efficiency of national grid	They might not be enforced locally; it means not enough opportunities in the local context	x			x	x		2
Lack of regional focus on renewable energy projects with LFM	Spain lacks a comprehensive regional strategy for the development and implementation of renewable energy projects; however, the regions are competing among them to achieve the greatest installed power capacities	The government should prioritize the local context amid rising public interest in RES, clean energy projects	x	x			x		2
Energy policies may have unwanted negative connotations	Spain's energy policies are heavily reliant on fossil fuels, with over 85% of electricity being generated from them. This means that the country's energy sector is not as diverse as it could be, leaving it vulnerable to price fluctuations in the international markets. The current policy began to slightly incentivize the production of renewable energy, with incentives for renewable energy projects being limited or non-existent. This means that there is an increase in investments in renewable energy sources, which could have positive implications for local flexibility markets and energy in Spain. However, current policy does not take into account the potential of energy storage technologies and other emerging technologies that could potentially reduce demand, helping to stabilize and improve the local flexibility markets and energy in Spain. The current policy does also not adequately address the issue of energy efficiency which means that the use of energy is not optimized, leading to increased costs and higher emissions	The government prioritizes wrong policies by incentivizing less environmentally-friendly resources over clean energy	x	x	x	x	x	x	2
Lack of cooperation between local authorities and local communities	Lack of resources, a lack of political will, and a lack of understanding of the importance of renewable energy	Local authorities and local communities need to work together to create a more sustainable energy mix in Spain	x	x	x	x			1
Difficulties for energy communities to generate enough surplus to cover organisational costs	Largely due to the lack of access to reliable and competitively priced financing options, the limited technical know-how and the lack of regulatory support	Delays in the local RES context within LFMs	x	x	x				2
Lack of long-term government funding	There was a reduction of investments in renewable energy technologies in the past years, making it difficult to reach the government's target of having 42% in final energy consumption by 2030. However, the Spanish government released the Next Generation Funds that have unlocked the national long-term funding for cleaner and greener energy projects within LFMs	Past regulatory framework in Spain did not provide enough incentives for energy communities to invest in renewable energy sources, which was further complicated due to their little ability to generate enough surplus of renewable energy. Current Next Generation Funding secures enough cash flows for the upcoming long-term RES projects across Spain	x	x	x		x		3
Initial financing problems at local government level	A change shift at the national government level that champions alternatives to renewables such as nuclear	Less support for renewables in the LFMs	x	x	x				3
National energy policy change and shift from RES to HYD	Policy change could reduce the incentives and funding available for renewable energy projects, thus making it more difficult for Spain to meet t its renewable energy targets. But since the emerging of the covid-19 pandemic, Spain is promoting hydrogen as a successor of its natural gas usage, the government heavily subsidizes all hydrogen-related projects as they are strategic for the national energy security. Since the regulatory change in 2018, there has been a surge in interest and RES projects	Hydrogen-focused projects with a visible rising government support and funding as Spain works on moving away from hydrocarbons	x	x			x		3
Difficulty in accessing loans/contracts/funding for LFM projects	Since the end of Feed-in Tariffs, in recent years banks have increased their funding of RES projects. Funding is not an issue so far, but increasing interests are a risk. There are more and better financial options for RES introduced by the government year-on-year	New RES investments can be affected by rising interest rates that can slow down or impact the commissioning of the new RES projects within LFMs	x	x		x	x	x	2
Lack of tax exemptions or incentives unlocking new investment opportunities	There are tax incentives for RES. For LC, it could be up to 50% of the Capex, thus this is a more difficult since the local administrations are slower in giving the subsidies needed for the new projects	The lack of tax exemptions and incentives can discourage potential investors from investing in renewable energy projects, thus further limiting the growth of the sector. Slow financial distribution also likely to affect projects	x	x	x				1
Investment incentives for hydrocarbons instead of RES	The government championing gas and shifted towards coals to secure energy supplies nationally. The recent support to coal is punctual, small in scale (less than 3% of the energy mix) and it is due to the need for energy security in the context of the domestic natural gas prices	Delays in RES deployment in the LFMs context due to complex market changes	x	x	x		x		2
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	Spain has a very high-RES potential, especially in the solar energy production, making the Spanish ventures one of the most competitive in Europe	High solar PV competitiveness making solar ventures across Spain profitable	x	x	x		x		3
Lack of experience with LFM	Might be not enough outreach to energy communities as to learn about their direct energy needs. Very few and recent experience of Local Energy Communities	Possible delays in project planning			x	x			3
Low trust in renewable energy technologies	The government began to trust renewable energy technologies more since the 2018, it is when the Solar Tax has been phased out in October 2018. The government began introducing more renewables than gas to energy grid amid high costs of new investments	Change in the energy complex paradigm resulting in higher RES ambitions due to increasing government trust in the RES ventures	x		x		x		3
Possible loss of support if the projects exceed certain size	Government funding can only support required project size. The bigger the project, the easier it is to obtain funding	It might slightly slow down climate neutrality ambitions as lower renewable capacities will be taken over by large RES infrastructure projects which can be delayed due to their complexity	x		x	x	x	x	3

Lengthy grid connection procedures	Not sufficient planning at national and local levels. The grid needs to have the capacity to absorb the new energy produced from RES. The government body, Red Electric Española, has a sole right to determine where there is the capacity to connect the new RES projects to the grid. This capacity can be later distributed to the whole country. The delays in connection to the grid is hindering higher deployment of small RES promoted by individuals, SMEs, etc	Possible delays in connecting new RES plants to the grid amid extended grid connection procedures	x	x	x	x	x		2
Lack of interest and engagement in the promotion of LFM	The objective of Spain to become carbon-neutral in 2050 is driving the government towards promoting RES initiatives, and there is surge in engagement due to the Next Generation funds available for energy communities at local level	Increasing research and development funding unlocking new forms of collaboration between the public and the private sectors resulting in a surge in the RES ventures in the LFMs	x		x			x	3
Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	Too long relationship with fossil fuels resulting in national dilemma, but solar PV witnessed a change-making growth in interest in solar due to great social support for solar energy	Might affect country's net-zero targets due to fewer RES projects	x		x		x		1
Lack of experience in commissioning and managing RES projects	IDAE (Instituto para la Diversification y Ahorro de la Energía) has many experts in this subject that help the government in their decisions and goals related to the energy transition and energy management	More expertise available at the government organizations and private sector companies in terms of identifying and structuring large-scale RES projects	x		x	x	x		3
Lack of accessible area for new renewable plants	Spain's population is very sparse outside population centres, this is an opportunity for large-scale projects to develop in the outskirts of the population centres as to supply the decentralized energy produced away from the cities	The national planning should include the decentralization of the power grid unlocking new RES production capacities in more remote areas, such as solar PV and wind	x		x	x			3
Lack of sufficient requalification/training for potential LFM technology staff	The government does not invest enough in requalification of the workforce. Scarcity of RES professionals	Fewer experts that can work on the RES projects	x	x	x	x	x	x	2
Difficulty in securing labour for LFM projects	People prefer to work in low-labour settings where they do not need to requalify. The companies have to hire workers with minimal experience and then train them on this subject, making this process very costly	Affects project capacities as not enough workforce is available on the new RES projects		x	x	x			1
Rigid legal, bureaucratic and administrative procedures	National and local policies championing hydrocarbons instead of renewables	Can disturb the LFMs context		x	x				2
Insufficient regulation regarding smart metering	An outdated regulation regarding smart metering. There is a lack of regulation in that the electrical companies to foster the implementation of the LFMs	Might affect the integration of smart metering with the plants amid rising LFMs' security concerns	x	x	x		x		2
Strong aversion to risk towards larger RES projects	It is easier for the government to work on bigger projects but on the other hand there is opposition of environmental activists due to the scale of those projects	Can affect large domestic RES project ambitions	x				x		2
Lack of cooperation with other local communities to share expertise/knowledge/resources	The dialogue between the parties is improving in recent years as there is a lot of collaboration among the partners	Might improve local LFMs projects due to an increase in external collaboration about the RES deployment			x			x	3
Low citizen involvement in decision making activities	The government should organize public consultations on the future of renewables in Spain as society in some parts of the country do not pay attention to renewables issues. Thus, with new regulations in force, there is always a period where the public can contribute. Spanish citizenship does not consider energy policy a priority as others (health policy, unemployment, etc.)	slightly improving citizen involvement might have a positive impact onto attracting smaller developers, while the government is focused on large project deployment	x	x	x				3

Country:	Turkey								
Factor (title)	Factor (description)	Impact for LFM development in the country	Political	Economic	Social	Technological	Legal	Environmental	Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)
Market structures that support centralised energy production/local flexibility markets	Türkiye implemented several market structures to support centralised energy production from renewable energy sources, such as through Feed-in Tariff (FiT) system, the creation of an Energy Stock Exchange, and the establishment of renewable energy support funds. The government introduced several incentives and subsidies to encourage the development of renewable energy projects, including feed-in tariffs, tax credits, grants for research and development. feed-in-tariffs (FiT) should be considered as acute treatment. FiTs do provide stable and predictable market structure for investors, but they are required for investors to act in an unpredictable market structure as well as when renewable energy resources (solar and wind) were not competitive enough in the beginning. With this perspective, the FiT mechanism offered a framework for the investors at the first stage. However, in the current situation, renewable energy investors are asking FiT with price and purchasing guarantee since competitive landscape is not supportive. If there were a predictable and stable market structure, FiTs would not be that necessary. Reason: The Turkish power market is strongly affected by natural gas (NG) market, due to the portion of NG in the primary sources. As the local NG prices determined by Incumbent (BOTAŞ), they are unpredictable in the mid and long-term, which causes unpredictability in electricity prices. The investor decides to benefit from feed-in-tariff for a year (YEKDEM), the prices occurred in the local flexibility market would not affect the operation of the power plants. Investors or plant operators must make the decision on whether to benefit from FiT or not before the calendar year starts.	The Turkish BOTAŞ as key natural gas market player that regulates domestic natural gas market which makes it unpredictable in the mid and long-term. This causes unpredictability in electricity prices as well as it is the greatest obstacle for RES investments. We may also claim that investors may not want competition, which is a common investor reflective across Türkiye	x	x	x	x	x		4
Security of energy supply	Türkiye's security of energy supply is regulated by the Energy Market Regulatory Authority (EMRA), which oversees the activities of the electricity sector and ensures the sustainability and efficiency of the energy supply. In the context of local flexibility markets, the security of energy supply becomes even more critical, as the integration of distributed energy resources can create additional challenges for the stability of the grid. The local flexibility markets enable the active participation of customers in the electricity markets, providing flexibility services to balance the supply and demand of electricity. However, the integration of distributed energy resources into the grid can cause technical challenges, such as voltage fluctuations and grid instability. To ensure the security of energy supply in the context of local flexibility markets, Türkiye has taken several measures. One of the measures is the deployment of smart grid technologies, which enable the monitoring and control of the electricity grid in real-time, facilitating the integration of distributed energy resources and ensuring the stability of the grid. Another measure taken by Türkiye is the development of demand response programs, which enable customers to adjust their electricity consumption based on market signals, such as prices or grid stability. By doing so, customers can reduce their electricity bills and contribute to the stability of the grid, ensuring the security of energy supply. Moreover, Türkiye has also developed a regulatory framework to support the integration of distributed energy resources into the grid, ensuring the compatibility of these resources with the existing electricity infrastructure and minimizing the technical challenges that they may create. The regulatory framework also encourages the development of local flexibility markets, promoting the active participation of customers in the electricity markets and providing additional flexibility to balance the supply and demand of electricity	The security of energy supply is crucial in the context of local flexibility markets, ensuring the reliability and stability of the electricity supply. In Türkiye, the security of energy supply is ensured through the deployment of smart grid technologies, the development of demand response programs, and the regulatory framework that supports the integration of distributed energy resources into the grid. These measures ensure that the local flexibility markets operate efficiently, providing additional flexibility to balance the supply and demand of electricity and contributing to the sustainability of the energy sector	x	x	x	x	x		3
Innovation capacity and digital independence	Türkiye has taken significant steps towards promoting innovation and digital independence in the electricity sector, particularly in the context of local flexibility markets. Local flexibility markets enable the integration of renewable energy sources and demand-side response mechanisms into the electricity grid, thereby enhancing system flexibility and reducing the need for expensive infrastructure investments. Türkiye has established several initiatives and policies to promote innovation in the electricity sector, including the Renewable Energy Resource Zone (YEKA) tenders, which aim to increase the share of renewable energy in the country's electricity mix. These tenders incentivize innovation by awarding contracts to companies that offer the lowest electricity price while meeting specific technological requirements. Türkiye has launched several research and development projects to support digitalization in the electricity sector, such as the "Smart Grids and Digital Energy Management System" project, which aims to develop intelligent systems for managing energy distribution networks. These projects not only promote innovation but also enhance Türkiye's digital independence by reducing its dependence on foreign technology. Türkiye has implemented regulatory frameworks to support the development of local flexibility markets. For example, the Electricity Market Law introduced in 2013 facilitates the participation of distributed energy resources in the electricity market, while the Regulation on Unlicensed Electricity Generation enables small-scale renewable energy producers to sell their excess electricity to the grid. These regulations create a level playing field for all participants and promote innovation in the electricity sector	There is still room for improvement in Türkiye's innovation capacity and digital independence in the electricity sector. For instance, Türkiye could increase its investment in research and development to foster the development of new technologies and solutions that are tailored to local needs. Furthermore, the country could promote greater collaboration between academia, industry, and government to ensure that research and development efforts are aligned with the country's strategic priorities	x	x		x	x		3
Attitudes towards energy efficient products, services, technologies, and appliances	One of the main drivers of positive attitudes towards energy-efficient products and services in Türkiye is the rising awareness of the environmental and economic benefits of energy efficiency. Consumers and businesses are becoming more aware of the environmental impact of their energy use and the financial benefits of reducing energy consumption. As a result, they are increasingly interested in energy-efficient products and services that can help them save energy and reduce their carbon footprint. The Turkish government has implemented policies and regulations that promote energy efficiency, such as the National Energy Efficiency Action Plan and the Energy Efficiency Law. These policies and regulations aim to reduce energy consumption and promote the use of energy-efficient products and technologies. As a result, consumers and businesses are more likely to prioritise energy efficiency in their purchasing decisions. Local flexibility markets and electricity, energy-efficient products and technologies are particularly important for facilitating the integration of renewable energy sources and managing peak demand. For example, energy-efficient appliances and building technologies can help to reduce energy consumption during periods of high demand, which can reduce the need for expensive and carbon-intensive peaking power plants. Additionally, energy-efficient technologies such as demand response and energy storage can provide flexibility to the grid and support the integration of renewable energy sources	There is a positive attitude towards energy-efficient products, services, technologies, and appliances in Türkiye, particularly in the context of local flexibility markets and electricity. The increasing awareness of the environmental and economic benefits of energy efficiency, along with government policies and regulations, are driving the adoption of energy-efficient products and technologies, which can support the transition to a sustainable and reliable electricity system	x	x	x	x	x		3

Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	One of the key tools for facilitating the energy transition in Türkiye is the implementation of local flexibility markets. These markets provide a platform for the integration of distributed energy resources (DERs) such as rooftop solar panels, battery storage systems, and electric vehicles into the electricity grid. The willingness to invest in the energy transition in Türkiye, including in local flexibility markets, is driven by several factors. One of the primary drivers is the country's growing demand for energy, which is expected to increase significantly in the coming years. With this increased demand comes the need for new energy infrastructure, and many investors see renewable energy as a key growth area. Another factor driving investment in the energy transition in Türkiye is the increasing cost competitiveness of renewable energy technologies. In recent years, the cost of renewable energy has fallen significantly, making it increasingly competitive with traditional fossil fuels. This has led to a growing interest among investors in renewable energy projects, including those in local flexibility markets. In addition to financial considerations, there is also a growing awareness of the importance of sustainability and environmental responsibility. This has led many companies and individuals to prioritize investments in clean energy, including those in local flexibility markets, as a means of reducing their carbon footprint and contributing to the fight against climate change	One of the key challenges is the regulatory environment, which is still evolving in many areas. Investors may face uncertainties around regulations, tariffs, and market structures, which can make it difficult to assess the financial viability of renewable energy projects. Another challenge is the lack of infrastructure in some areas, which can make it difficult to connect renewable energy projects to the grid. This can result in higher costs and longer project development times, which can discourage some investors	x	x	x	x	x	x	2
Smart grids deployment	The deployment of smart grids is an important element in the development of local flexibility markets and the modernization of the electricity grid in Türkiye. In the context of local flexibility markets, smart grids are a key tool for integrating distributed energy resources (DERs) into the electricity system. These resources include renewable energy sources such as solar and wind power, as well as energy storage systems and electric vehicles. Smart grids enable the real-time monitoring and control of these resources, allowing them to be integrated into the grid in a flexible and efficient manner. Türkiye has made significant progress in deploying smart grids in recent years. The country's smart grid development plan, launched in 2015, aims to modernize the electricity grid and improve its efficiency and reliability through the deployment of advanced digital technologies. One of the key benefits of smart grids in the context of local flexibility markets is their ability to enable demand response programs. These programs allow customers to adjust their electricity usage in response to changes in energy prices or system conditions. By incentivizing customers to reduce their electricity consumption during times of high demand or when renewable energy generation is low, demand response programs can help to balance the grid and reduce the need for additional generation capacity. In addition to enabling demand response, smart grids can also help to reduce losses in the electricity grid with advanced metering infrastructure (AMI). AMI enables real-time monitoring of electricity usage and enables utilities to identify and address issues such as leaks and theft	One of the key challenges is the cost of implementation, which can be significant. Additionally, there may be technical challenges associated with integrating new digital technologies into the existing electricity infrastructure. By enabling the integration of distributed energy resources and the implementation of demand response programs, smart grids can help to improve the efficiency, reliability, and sustainability of the electricity system. However, there are also challenges to deployment, and ongoing investment and policy support will be needed to overcome these challenges and fully realise the potential of smart grids in Türkiye	x	x	x	x	x	x	2
Demand response infrastructure deployment (smart metering)	In recent years, Türkiye has made significant strides towards modernizing its electricity grid and infrastructure. One of the key aspects of this modernisation is the deployment of smart metering technology, which has enabled the creation of local flexibility markets that can help balance the supply and demand of electricity. The deployment of smart meters in Türkiye has also enabled the creation of local flexibility markets, which allow utilities to incentivize customers to reduce their electricity usage during peak demand periods. By participating in these markets, customers can receive financial rewards for reducing their electricity consumption, which can help alleviate strain on the grid and prevent blackouts	There are still challenges to overcome in terms of regulatory frameworks and market design, the potential benefits of local flexibility markets and smart metering technology are significant and warrant further exploration and investment	x	x	x	x	x		2
Decentralised energy system and storage	In the context of local flexibility markets and electricity in Türkiye, decentralized energy systems and storage solutions can play a crucial role in improving energy security, reducing reliance on fossil fuels, and increasing flexibility in the electricity grid. Türkiye has significant potential for renewable energy generation, particularly solar and wind power, and decentralized energy systems can facilitate the integration of these intermittent sources of energy into the grid. The Turkish government has implemented several policies to promote the adoption of decentralised energy systems and storage solutions, e.g., the Regulation on Unlicensed Electricity Generation enables small-scale renewable energy producers to sell their excess electricity to the grid, thereby incentivising the development of decentralised energy systems. Additionally, the Turkish government has introduced net metering schemes, which allow households and businesses to offset their electricity bills by feeding excess solar energy into the grid. The government has initiated a "Distributed Solar Power Generation" project as to support the development of decentralised solar power systems. This project aims to install solar panels on rooftops and other suitable surfaces in residential and commercial buildings, enabling households and businesses to generate their electricity and sell excess energy to the grid. Also, energy storage technologies such as batteries and pumped hydro storage can play a crucial role in improving the flexibility and reliability of decentralised energy systems. Energy storage systems can store excess energy generated during times of high renewable energy generation and discharge it during times of high demand. This helps to balance the grid and reduce the need for expensive infrastructure investments	Decentralised energy systems and storage solutions have significant potential to improve the flexibility, reliability, and sustainability of the electricity sector in Türkiye. The Turkish government has already implemented several policies to support the development of these systems, and continued efforts in this direction are necessary to enhance energy security, reduce carbon emissions, and increase flexibility in the electricity grid	x	x	x	x	x		3
TSO and DSO regulation	The Transmission System Operator (TSO) and Distribution System Operator (DSO) regulations in Türkiye play a crucial role in enabling the development and operation of local flexibility markets for electricity. The TSO is responsible for the high-voltage transmission system, while the DSO manages the low-voltage distribution grid. Both entities are responsible for ensuring the reliable and secure operation of the electricity system in Türkiye. The TSO and DSO regulations in Türkiye support the participation of DERs in local flexibility markets through several mechanisms. For example, the regulations establish technical requirements for the connection of DERs to the grid, such as standards for communication protocols and data exchange. They also define the terms and conditions for DER participation in local flexibility markets, such as payment mechanisms and performance requirements. Also, the TSO and DSO regulations in Türkiye support the integration of local flexibility markets into the broader electricity market. For example, the regulations establish rules for the coordination of local flexibility markets with the national balancing market, which is operated by the TSO. This coordination is critical for ensuring that the local flexibility markets do not disrupt the overall operation of the electricity system. The TSO and DSO regulations in Türkiye also play a critical role in ensuring the safety and reliability of the electricity system. They establish technical standards and safety protocols for the operation of the grid, and define the responsibilities of the TSO and DSO in maintaining the system's stability and security	The TSO and DSO regulations in Türkiye play a crucial role in enabling the development and operation of local flexibility markets for electricity. These regulations establish the technical requirements, terms and conditions, and coordination mechanisms necessary for the participation of DERs in local flexibility markets, which can provide valuable flexibility to the grid and avoid costly grid upgrade	x	x	x	x	x		3

Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	There are a few ICT solutions available for peer-to-peer energy trading and VPPs. These solutions include digital platforms that enable the buying and selling of energy among participants in a local energy market. These platforms allow customers with DERs to sell their excess energy to other customers in the same area, creating a decentralized energy system that is more resilient and sustainable. Despite the availability of ICT solutions, there are also challenges to the widespread adoption of peer-to-peer energy trading and VPPs in Türkiye. One of the key challenges is the lack of regulatory framework for these markets. There is a need for clear rules and standards to ensure fair and transparent energy trading and to protect the rights of consumers and producers while another challenge is the technical complexity of integrating DERs into the electricity grid. The deployment of ICT solutions for peer-to-peer energy trading and VPPs requires significant investments in grid infrastructure and communication technologies. This can be a barrier to entry for smaller producers or consumers	The availability of ICT solutions for peer-to-peer energy trading and VPPs in Türkiye is a promising development that can help to improve the efficiency, reliability, and sustainability of the electricity system. However, ongoing policy support and investment in infrastructure and communication technologies will be needed to overcome the challenges to widespread adoption and ensure that these solutions can contribute to the development of local flexibility markets in Türkiye	x	x	x	x	x		2
Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	Regulatory framework for customer participation in the electricity markets is evolving, and various measures have been taken to facilitate the deployment of local flexibility markets and demand response programs across Türkiye. One of the key rights for customer participation in the electricity markets is guaranteed grid access which means that all customers, regardless of their size or location, should have equal access to the electricity grid and be able to connect to it at a fair cost. In Türkiye, the legal framework for grid access is established by the Energy Market Regulatory Authority (EMRA), which regulates the connection and operation of power plants and distribution networks. The EMRA ensures that all customers have equal access to the grid and promotes competition among market players. Remuneration for energy fed into the grid is another important right for customer participation in the electricity markets. In Türkiye, the feed-in tariff (FIT) scheme is used to incentivize the deployment of renewable energy sources, such as solar and wind power. Under this scheme, renewable energy producers are guaranteed a fixed price for their electricity, which is typically higher than the market price. The FIT scheme has been successful in promoting renewable energy deployment in Türkiye, and it has attracted significant investment in the sector. Demand response is a third key right for customer participation in the electricity markets. Demand response programs allow customers to reduce their electricity consumption during periods of high demand, and they can receive incentives for doing so. In Türkiye, demand response programs are mainly targeted at industrial customers, and they are incentivized through a payment mechanism that rewards them for reducing their electricity consumption during peak hours. These programs help to reduce the strain on the grid during times of high demand and can help to avoid blackouts or brownouts	The rights for customer participation in the electricity markets, including guaranteed grid access, remuneration for energy fed into the grid, and demand response, are essential for the efficient and sustainable operation of the power system. Türkiye has made significant progress in establishing a regulatory framework that promotes customer participation, and it is moving towards the deployment of local flexibility markets to enable the integration of DERs	x	x	x	x	x		3
Schemes and incentives that give advantage to big energy firms	Government provides tax exemptions for renewable energy investments, which means that the larger energy firms can benefit from reduced costs associated with investing in wind and solar energy projects. Also, implemented feed-in tariffs for renewables which provides large energy firms with a guaranteed rate of return on their investments in renewable energy projects. Large energy firms can benefit from government-sponsored subsidies for renewable energy projects which means that the cost of investing in renewable energy projects is reduced, allowing big energy firms to obtain a competitive advantage. Türkiye has implemented a series of regulations and standards that provide large energy firms with an advantage when it comes to renewable energy projects. This includes regulations governing the design, construction, operation, and maintenance of renewable energy projects, as well as standards for the quality of renewable energy production. Large scale energy firms may also have shares in privatized DSOs. In some cases, this may be used as a leverage for the RES investments in terms of procedures	Large-scale firms can benefit from a generous list of tariffs supporting their work on renewables, especially in the privatized DSOs	x	x		x	x		4
Grid connection costs	Grid connection costs for renewable energy in Türkiye are high. The cost of connecting a new renewable energy installation to the grid is estimated to be between €1,000 and €2,000/MWh. This is significantly higher than the average cost of connection in the European Union, which is estimated to be around €150/MWh	Very high costs resulting in much fewer RES projects where only the biggest developers can afford to work on. If the distance between the field and the sub-station is long, the cost of power distribution / transmission line is also a burden on the investors willing to invest in LFMs	x	x			x		2
Uncertainty and limitations in feed-in-tariff levels and schemes	The government should introduce a unified and comprehensive renewable energy policy that would govern the setting of Feed-in Tariff levels and schemes. Current system is fragmented and inconsistent, resulting in a high degree of uncertainty when it comes to the long-term stability and reliability of the Feed-in Tariff system. The Turkish government did set any binding targets for the development of RES, which further limits the predictability of the feed-in-tariff levels and schemes. Without such targets, it is difficult to ascertain the true potential of the Turkish renewable energy sector and the associated economic benefits. Thirdly, the feed-in-tariff levels and schemes are currently based on several assumptions regarding the costs associated with the development of renewable energy projects. As these assumptions may be subject to change over time, they introduce a certain degree of uncertainty into the feed-in-tariff system	Only support small-scale projects. Mid and long-term unpredictability of power prices, the tariff system and other economic indicators result in reluctance for Foreign Direct Investments (FDIs) in RES investments	x				x		2
Legislative frameworks that make setting up LFM ventures difficult	Turkish Renewable Energy Law (YEGM) does not provide a clear legal framework for the development of renewable energy projects. The law has also not been updated to include incentives or support schemes which would make renewable energy ventures more attractive to investors. Regulations and policies towards renewable energy are often unclear and difficult to interpret, making it difficult for investors to plan and pursue projects. Due to Parliament composition, the regulations are not discussed in detail so that all aspects are considered. It's usual that another regulation is issued soon after a newly issued regulation, to fix the practical problems	No market unification means that the RES projects are less competitive	x	x			x		2
Lack of support from local representatives/local energy agencies	One of the main reasons for the lack of support from local representatives and local energy agencies is the lack of knowledge about the benefits of renewable energy. Many local representatives and local energy agencies are not aware of the potential of renewable energy sources and the associated economic, environmental, and social benefits and financial resources boosting new RES investments. Local agencies are incapable to move autonomously	A lack of centralized and autonomous government body access to support resulting in very few projects available for investments	x	x	x	x			2
Lack of a policy framework for LFM investments	The Turkish government has made several attempts to introduce a policy framework for renewable energy investment and include the Renewable Energy Law of 2005, the Renewable Energy Action Plan of 2008, and the Renewable Energy Directive of 2012. But these policies are limited in scope and have failed to provide investors with the necessary incentives to make long-term investments in the sector. As a result, the sector remains largely underdeveloped and lacks the necessary support to reach its potential.	Current legislation enables realization of more than 20GW of solar PV and wind power plant installed capacities being a fifth of the total installed capacity	x				x		2
Not mentioning LC as a relevant actor	The government does not prioritize local projects supported by local communities unless they are associated in non-profit associations. Local communities are not informed enough or not interested with the RES investments. The ones who are organised are usually ecologists and are against RES investments, especially hydro. There is lack of organized pro-RES local groups	Not engaging local communities might affect RES development plans as no advocates for the technology can boost new investments	x		x		x		1

Complex and changeable policies regarding LFM development	Financial incentives, such as Feed-in Tariffs and tax exemptions, as well as regulations to facilitate the installation of renewables, such as the Renewable Energy Law. The primary goal is to increase the share of renewables in the country's energy mix. The government has also implemented several regulations to encourage the development of renewable energy projects. This includes the Renewable Energy Investment Incentive Program providing generous incentives to RES investors. Türkiye has also made significant investments in research and development of renewable energy sources. The policies are RES development have been complex and constantly changing	Too complex regulatory environment and a lack of financial coverage might affect local RES project development context. Changeable policies result in uncertainty in long-term power price forecasts, which jeopardizes the financing of the projects	x				x		1
Lack of rules regarding the opportunity to operate micro-grids	Government promotes the adoption of smart grid technology as a way of improving the efficiency of national grid, and whether there exists a strong demand from local communities or companies to be a part of a micro grid. They may not even be aware of such thing. We would not observe development of micro-grids even if there were a full set of rules for it	They might not be enforced locally; it means not enough opportunities in the local context due to actors' lack of thematic knowledge on operating in micro grids	x			x	x		2
Lack of regional focus on renewable energy projects with LFM	The Turkish government has placed a greater emphasis on the development of large-scale conventional energy projects, such as nuclear and coal-fired plants, which are better able to meet the country's energy needs than renewable projects. This has created an environment in which renewable projects, particularly those at the regional level, are often overlooked. Also, the inadequate infrastructure and lack of access to capital have also hindered the development of renewable energy projects in Türkiye. There are locations where RES investments are gathered but it is almost purely geographics. No regional focus is designed and applied by Turkish government	Local focus is non-existent, the government prioritized centralized energy solutions but not necessarily renewables	x	x		x	x		1
Energy policies may have unwanted negative connotations	The energy policies created a system that is heavily reliant on fossil fuels, leading to an overall decrease in the country's renewable energy potential. The government subsidies for fossil fuels have created a market that is unfavourable to renewable energy sources, making it difficult for renewable energy companies to compete, and created an energy market structure that is dominated by large energy companies, making it difficult for independent renewable energy producers to access the market. Especially subsidizing natural gas used for power production for many years disturbed the power market. Moreover, LNG/FSRU facilities would have been built long ago, if there were a proper natural gas market where subsidization would not be necessary that much in Türkiye	Government subsidies prioritising hydrocarbons instead of renewables making it nearly impossible to invest in RES	x	x	x	x	x		1
Lack of cooperation between local authorities and local communities	Present lack of awareness and information about renewable energy amongst local communities. This is mainly due to a lack of education and outreach from local authorities, due to the complexity of renewable energy and the difficulty of communicating its benefits to the public. Also, none- to-little trust between local communities and the government. If local authorities are ruled by opposition parties' cooperation is becoming even harder	Both sides should cooperate more on the energy transition and renewables, however, do not want to	x	x	x	x	x		1
Difficulties for energy communities to generate enough surplus to cover organizational costs	Limited access to finance and resources, making it difficult for energy communities to invest in renewable energy projects. Also, the lack of a reliable legal framework makes it difficult for energy communities to receive incentives or subsidies for renewable energy projects	The high cost of renewable energy infrastructure and technologies in Türkiye cause RES planning delays	x	x	x	x	x		1
Lack of long-term government funding	Lack of long-term funding for LFMs in Turkey has inhibited their growth and sustainability	Associations have more financial incentives for new projects rather than individuals	x	x	x				2
Initial financing problems at local government level	A change shift at the national government level that champions alternatives to renewables such as nuclear	Less support for renewables in the LFMs	x	x	x				2
National energy policy change and shift from RES to HYD	The shift has been largely influenced by the government's plans to reduce country's dependence on imported energy sources, as well as to reduce the costs associated with the use of renewable energy sources	Not enough national project support resulting in slowing down renewable energy technology plans for Türkiye	x	x	x	x	x		1
Difficulty in accessing loans/contracts/funding for LFM projects	The primary difficulty is the lack of a clear regulatory framework dictating the terms, incentives, and conditions for investing in renewable energy projects in Türkiye. With no clear limits or regulations, investors are often hesitant to invest in projects due to the lack of a clear return on investment. Türkiye has limited access to international capital markets which can further complicate accessing loans and funding for RES projects. This is since many international lenders are more hesitant to lend to Turkey due to its high levels of public debt and its recent economic crisis	No external funding and no regulatory framework for the renewable energy technologies make it difficult to invest in renewables in Türkiye	x	x		x	x		1
Lack of tax exemptions or incentives unlocking new investment opportunities	No tax incentives for the investors likely to prevent them from making RES investments due to potential lower returns than those offered by other sources of energy, which decreases the amount of available capital for the development of renewables projects. The lack of tax incentives may also lead to a decrease in the number of large-scale renewable energy projects that can be developed, as they often require large amounts of capital and are more likely to benefit from tax incentives. Without tax incentives, the cost of renewable energy projects may be too high for consumers, which could reduce demand for renewable energy and further impede the development of the industry	The lack of tax exemptions and incentives can discourage potential investors from investing in renewable energy projects, thus further limiting the growth of the sector	x	x	x				1
Investment incentives for hydrocarbons instead of RES	The government championing gas and shifted towards coals to secure energy supplies nationally	Delays in RES deployment in the LFMs context - shift in priorities caused by the war in Ukraine and the traditional approach to the energy sector by the Turkish government	x	x	x		x		2
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	Policy planning at the national level with a mismatch between the expectations and the reality	Lower than expected investments for the right technologies	x	x	x		x	x	2

Lack of experience with LFM	There is a lack of awareness and education about the benefits of renewable energy among energy communities in Türkiye which resulted in a lack of support from these communities for RES projects, which has in turn slowed down the development of renewable energy in Türkiye. There is a lack of financial resources for local communities to develop renewable energy projects which made it difficult for local governments to implement renewable energy projects, as they do not have access to the necessary funding. Also, a lack of understanding among local communities of the potential benefits of renewable energy which resulted in a lack of trust in renewable energy projects, with many communities feeling that they are not being consulted or included in the decision-making process	Low community knowledge and trust resulting in one to little RES investments		x	x	x	x		1
Low trust in renewable energy technologies	The government is sceptical about introducing more renewables than gas, oil, and coal to the energy grid amid high costs of new investments	Change in the energy complex paradigm resulting in lower RES ambitions on this occasion	x		x		x		2
Possible loss of support if the projects exceed certain size	Large projects often require significant investments of public funds, and public opinion can be divided on the merit of such projects. Additionally, the government may become hesitant to fund or support large, expensive projects if they are perceived as too risky or if there is not sufficient public support for them	Projects may face opposition from environmental groups, who may raise concerns about potential impacts on the environment or local communities	x	x	x	x	x	x	2
Lengthy grid connection procedures	Not sufficient planning at national and local levels as the current framework for grid connection is highly complex and requires a significant amount of paperwork and documentation. This includes the need for an environmental impact assessment, a technical grid connection study, a financial grid connection study, and an application for a grid connection. Additionally, the technical requirements for grid connection vary from region to region, and there is a lack of standardization across the country and can lead to additional delays	Delays in connecting new RES plants to the grid at all levels due to new, complex procedures pushing investors away from the Turkish energy market	x	x	x	x	x		1
Lack of interest and engagement in the promotion of LFM	Country's energy policies are largely focused on traditional sources such as coal, natural gas, and oil, while the promotion of renewable energy sources is often seen as a costly and unprofitable venture. The incentives and subsidies for renewable energy projects are limited, making it difficult for businesses and entrepreneurs to invest in RES technologies	Too much scope being put onto fossil fuels as they are much cheaper than renewables. Likely affects all RES projects	x	x	x	x	x		1
Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	People are afraid of renewable energy technologies as they fear job loss, the cost of investing in renewable energy technologies, or the perception that renewable energy is unreliable. The citizens also believe that renewable energy is too expensive and will not cover Türkiye's energy needs. There is a strong opposition against hydro energy plants at the northern part of Türkiye. The opposition is due to environmental concerns or political views. Lack of knowledge and trust among population amplifies the opposition	Might affect country's net-zero targets due to very little public interest in RES projects or unreasonable fear over the practicality of the RES projects	x	x	x	x	x		1
Lack of experience in commissioning and managing RES projects	Turkey is a relatively new entrant to the renewable energy market, and the lack of experienced personnel in the sector has slowed its progress. This has led to a lack of knowledge and experience in the areas of project management, market analysis, technology assessment and financing needed for successful deployment of renewable energy technologies in Türkiye. There are very few heavy industry or machinery factories focused on RES technology, where production and R&D may be practiced together. Kalyon's solar factory may be considered as an example, which has been incentivised by the government	No previous experience in RES project development putting any new projects at risk of delays due to their technological advancement and the funding needed for their deployment. If the investor works with the proper owner's engineering company, experienced EPC and logistics companies may be appointed for the project. However, small investors or prosumers may not be able to work with owner's engineering companies, due to lack of knowledge or budget		x	x	x			2
Lack of accessible area for new renewable plants	Most of Türkiye's land is either mountainous or arid, leaving limited options for potential sites for new renewable plants. Much of the land that is suitable for renewable energy generation is in remote and isolated regions, making it difficult to access and develop	A lack of sufficient and easily accessible area for renewable energy deployment resulting in fewer than potential projects	x	x	x	x			2
Lack of sufficient requalification/training for potential LFM technology staff	The government does not invest enough in requalification of the workforce. Talented and experienced workforce migrates abroad.	Fewer experts that can work on the RES projects	x	x	x	x	x	x	2
Difficulty in securing labour for LFM projects	People prefer to work in low-labour settings where they do not need to requalify. Talented and experienced workforce migrates abroad	Affects project capacities as not enough workforce		x	x	x			2
Rigid legal, bureaucratic, and administrative procedures	National and local policies championing hydrocarbons instead of renewables. This is a fact, and it acts as an entry barrier for the potential investors. Once a large company gathers a team for a certain type of RES investment (wind, for instance), that team is practically an unexperienced team for another type of RES (solar, for instance). For small enterprises or prosumers, the investment phase is too complex. They need to work with an experienced owner's engineering company, which increases the project budget	Can disturb the LFMs context due to their complexity		x	x				2
Insufficient regulation regarding smart metering	Smart metering systems in Türkiye are not adequately regulated in the context of renewable energy. This lack of regulation has led to slow uptake of smart metering technology, leaving Türkiye behind other countries in the region in terms of energy efficiency and renewable energy	Negative impact on consumers' switch to smart metering systems for renewable energy as is nearly impossible	x	x	x	x	x		1
Strong aversion to risk towards larger RES projects	The authorities in some instances, prefer smaller projects due to lower operational and financial risk. Bigger projects take longer time, and it comes with unpredictability. FX rates and prices of goods and services may change drastically during the project phase. There are of course instruments to mitigate those risks, but it is an extra cost for other stakeholders involved	Can affect large project ambitions in the projects of being of a significant importance at national level	x				x		2
Lack of cooperation with other local communities to share expertise/knowledge/resources	The Turkish government has prioritized natural gas and hydroelectric power generation over other renewable energy sources, which has limited the development of renewable energy projects and resulted in fewer citizens interested in establishing a dialogue between local communities	Might affect local LFMs projects due to little public interest in renewables	x	x	x				1

Low citizen involvement in decision making activities	There is a general lack of understanding and a public interest among Turkish citizens about the implications of renewable energy and the benefits of RES technologies, which led to a lack of political will to invest in renewable energy, as well as a lack of public understanding of how renewable energy can help to reduce emissions and improve air quality	No to little citizen involvement due to a lack of knowledge and the fact that Turkish energy sector is dominated by dominated by large corporations and state-owned enterprises, leaving little room for citizen participation in the decision-making process at the local level in the small project context	x	x	x	x			1
Country:	**Bulgaria**								
Factor (title)	**Factor (description)**	**Impact for LFM development in the country**	**Political**	**Economic**	**Social**	**Technol ogical**	**Legal**	**Environmental**	**Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Market structures that support centralised energy production/local flexibility markets	Bulgaria adopted a range of incentive schemes, such as Feed-in Tariffs, Green Certificates, and Energy Auctions. Also, the auctions are a market-based approach to RES procurement allowing electricity suppliers to obtain preferential electricity rates on the market. The primary market structure supports the integration of renewables in Bulgaria is the Centralised Energy Production (CEP) market as it enables the centralised purchase and sale of electricity-by-electricity producers, electricity traders, and electricity consumers. Also, Local Flexibility Market (LFM) that allows local energy producers and consumers to trade electricity within their local area. The structure helps to reduce electricity transmission losses, as well as to support the development of small-scale renewable energy projects. And finally, Renewable Energy Promotion Program, which provides financial incentives for the generation of renewable energy, and the Renewable Energy Law, which sets targets for the percentage of renewables in the energy mix. In 2023 according to the National Restoration Plan, the EUR 30 million subsidies are available for solar PV installations for individuals, and EUR 100 million for legal entities, which may include batteries as the energy produced can be used only for an own consumption. The lack of regular governments and series of parliamentary elections during the last years hinder the RES development and the transposition of RED II (III) in the Bulgarian legislation. In 2023 according to the restoration plan, subsidies are available for PV installations for natural persons - EUR 30 million, and for legal persons - 100 million, which may include batteries as the energy produced can be used only for own consumption. The lack of regular governments and series of parliamentary elections during the last years hinder the RES development and the transposition of RED II in the Bulgarian legislation	High financial incentives for RES projects boosting new investments in RES. Bulgarian government is highly focused on the promotion of renewables thanks to various regulations, schemes and programs supporting new investments in RES	x	x		x	x		4
Security of energy supply	Bulgarian security of energy supply in the context of local flexibility markets and electricity is supported by the Energy and Water Regulatory Commission (EWRC), which has established a regulatory framework that ensures the reliability and stability of the electricity grid. EWRC promotes the deployment of smart grid technologies and the integration of demand response resources, which enhance the flexibility and responsiveness of the electricity system and improve its ability to manage energy demand and supply. However, the integration of RES into the electricity grid also presents several challenges to the security of energy supply. The intermittent nature of RES, such as wind and solar power, can cause fluctuations in the electricity grid, which can affect the stability and reliability of the system. Bulgaria has implemented measures to ensure the security of energy supply, such as the deployment of energy storage systems and the development of backup power plants. Energy storage systems, such as batteries and pumped hydro storage, can store excess energy generated by RES during times of high generation and release it during times of low generation. This helps to balance the supply and demand of energy, ensuring the stability and reliability of the electricity grid. Backup power plants, such as gas-fired power plants, can also provide additional energy supply to the grid during times of high demand or low generation from RES. The country also develops the interconnections with neighbouring countries, which enables the import and export of energy, ensuring the security of energy supply during times of high demand or low generation from RES. Bulgaria is also promoting energy efficiency measures, which can reduce energy demand and improve the security of energy supply	The nature of RES presents challenges to the security of energy supply, which must be addressed through the deployment of energy storage systems, backup power plants, and energy efficiency measures	x	x	x	x	x	x	3
Innovation capacity and digital independence	Bulgaria has made significant strides in recent years in developing its energy infrastructure and increasing its renewable energy capacity. According to the European Commission's 2020 report on Bulgaria's progress towards meeting its energy and climate targets, the country has made progress in increasing its use of renewable energy sources, particularly in the areas of wind and solar power. Bulgaria has also taken steps to improve its energy efficiency, including through the adoption of new building codes and regulations. However, there is still room for improvement when it comes to the development of local flexibility markets in Bulgaria. Local flexibility markets refer to the ability of small-scale energy producers and consumers to participate in the energy market by providing or consuming energy on a local level. This can be achieved using distributed energy resources (DERs) such as solar panels or battery storage systems. While some progress has been made in this area, there are still significant barriers to the development of local flexibility markets in Bulgaria. These include a lack of clear regulatory frameworks and a lack of technical infrastructure to support the integration of DERs into the grid. There is also a need for greater coordination and cooperation between different stakeholders, including energy producers, consumers, and regulators. In terms of digital independence, Bulgaria has made some progress in developing its digital infrastructure and capabilities, particularly in the areas of e-government and cybersecurity. The country has implemented several initiatives aimed at increasing the use of digital technologies in public services and improving cybersecurity, including the establishment of a national cybersecurity centre and the development of a national cybersecurity strategy	The integration of DERs into the grid requires significant investment in digital infrastructure and technologies, including the use of smart grid technologies and advanced metering infrastructure. While there have been some investments in these areas, there is still a need for greater investment and cooperation between different stakeholders to ensure the development of a robust and secure digital infrastructure for the energy sector	x	x	x	x	x		2

Attitudes towards energy efficient products, services, technologies, and appliances	Many consumers may not be aware of the benefits of energy-efficient products and technologies or may not understand how to use them effectively in Bulgaria despite that there have been efforts to increase awareness of energy efficiency through public campaigns and education programs. Another factor that can affect attitudes towards energy efficiency is affordability. While energy-efficient products and technologies can save money in the long run, they may require higher upfront costs, which can be a barrier for some consumers. There have been efforts made as to increase the availability of financing options for energy-efficient products and to provide incentives for their use. The regulatory environment can also play a role in attitudes towards energy efficiency. In Bulgaria, there have been efforts to establish a supportive regulatory framework that encourages investment in energy efficiency and the deployment of local flexibility markets. There are still challenges related to policy uncertainty and regulatory complexity that can make it difficult for companies and individuals to invest in energy efficiency. Finally, the attitudes of stakeholders in the energy sector, including utilities and policymakers, can also affect attitudes towards energy efficiency. In Bulgaria, there have been efforts to engage stakeholders in the development of energy efficiency policies and to build partnerships between the public and private sectors	While there have been some positive developments in recent years, including increased awareness and the establishment of supportive regulatory frameworks, there is still a long way to go to achieve a sustainable and resilient energy system. Continued efforts to increase awareness, affordability, and stakeholder engagement will be critical in driving the transition forward	x	x	x	x	x		2
Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	Bulgaria has shown a growing willingness to invest in the energy transition, not only in financial terms but also in terms of effort, time, and resources. The country has recognized the importance of transitioning to a low-carbon economy and reducing its dependence on fossil fuels. This has led to the adoption of several policies and measures aimed at promoting the development of local flexibility markets and the integration of renewable energy sources (RES) into the electricity grid. One of the key drivers of the energy transition in Bulgaria is the European Union's (EU) climate and energy targets These measures include the development of renewable energy, energy efficiency, and the promotion of electric mobility. The Bulgarian government has also launched several initiatives to support the energy transition. These initiatives include the National Plan for Energy and Climate, which outlines the country's strategy for achieving its climate and energy targets. The plan includes measures such as increasing the share of RES in the country's energy mix, promoting energy efficiency, and investing in energy infrastructure. The government has implemented policies and regulations to promote the development of local flexibility markets. The country has established a regulatory framework that supports the deployment of smart grid technologies, the integration of demand response resources, and the development of energy storage systems. This has helped to create a favourable environment for investment in the energy transition and has attracted investment from both domestic and international investors. Bulgaria has also shown a strong commitment to the development of renewable energy. The country has set a target of generating 25% of its energy from RES by 2030. This target is supported by the implementation of policies such as feed-in tariffs and tax incentives, which have helped to increase the deployment of RES in the country	The adoption of policies and measures aimed at promoting the development of local flexibility markets and the integration of RES into the electricity grid, as well as initiatives to support the energy transition, have created a favourable environment for investment in the sector	x	x	x	x	x	x	4
Smart grids deployment	The government has made significant progress in deploying smart grids over the past decade, with the introduction of smart meters and the integration of renewable energy sources into the grid. The Bulgarian government has also introduced policies and incentives to promote the adoption of smart grids, such as subsidies for renewable energy installations and funding for research and development. However, despite these efforts, there are still challenges to the widespread deployment of smart grids in Bulgaria. One significant obstacle is the lack of a clear regulatory framework for local flexibility markets, which can limit the ability of consumers and producers to trade electricity and limit the potential benefits of smart grid technology	The main challenge is the high cost of deploying smart grids, which can be a significant entry barrier for smaller utilities and renewable energy producers. To overcome this, the Bulgarian government could provide additional incentives for the deployment of smart grids and support the development of local flexibility markets. The government should continue to support the development of smart grid technology and provide clear regulatory frameworks to enable the efficient exchange of electricity between consumers and producers	x	x	x	x	x		2
Demand response infrastructure deployment (smart metering)	One key factor that can affect the deployment of demand response infrastructure is the regulatory environment. In Bulgaria, there have been efforts to establish a supportive regulatory framework that encourages investment in demand response infrastructure and the deployment of local flexibility markets. However, there are still challenges related to policy uncertainty and regulatory complexity that can make it difficult for companies to invest in demand response infrastructure. Another factor that can affect the deployment of demand response infrastructure is the availability of financing options. Deploying demand response infrastructure can require significant upfront investments, which may be difficult for some companies to finance. In Bulgaria, there have been efforts to increase the availability of financing options for energy efficiency and renewable energy projects, which can also support the deployment of demand response infrastructure. The technical feasibility of deploying demand response infrastructure can also be a factor. In Bulgaria, there may be challenges related to the compatibility of different types of demand response technologies and the existing grid infrastructure. Additionally, there may be a lack of technical expertise and trained personnel in certain areas, which can further slowdown the deployment process	While there have been some positive developments in recent years, including efforts to establish a supportive regulatory framework and increase financing options, there is still a long way to go to achieve a sustainable and resilient energy system. Continued efforts to address technical feasibility challenges and engage stakeholders will be critical in driving the deployment of demand response infrastructure forward	x	x	x	x	x		2
Decentralised energy system and storage	The development of a decentralised energy system and energy storage solutions is crucial for the success of local flexibility markets and the transition towards a sustainable and resilient energy system in Bulgaria. While there has been some progress in promoting decentralised energy and energy storage, there are still significant challenges that must be addressed. One key factor that can affect the development of a decentralized energy system and energy storage solutions is the regulatory environment. There have been efforts to establish a supportive regulatory framework that encourages the deployment of renewable energy sources and energy storage solutions by the government. But there are still challenges related to policy uncertainty and regulatory complexity that can make it difficult for companies to invest in decentralised energy and energy storage. Another factor that can affect the development of a decentralised energy system and energy storage solutions is the availability of financing options. Deploying decentralized energy and energy storage solutions can require significant upfront investments, which may be difficult for some companies to finance. In Bulgaria, there have been efforts to increase the availability of financing options for energy efficiency and renewable energy projects, which can also support the deployment of decentralized energy and energy storage. The technical feasibility of deploying a decentralized energy system and energy storage solutions can also be a factor. In Bulgaria, there may be challenges related to the compatibility of different types of renewable energy sources and energy storage technologies with the existing grid infrastructure. Additionally, there may be a lack of technical expertise and trained personnel in certain areas, which can further slowdown the deployment process. The attitudes of stakeholders in the energy sector can also affect the development of a decentralised energy system and energy storage solutions. In Bulgaria, there have been efforts to engage stakeholders in the development of renewable energy policies and to build partnerships between the public and private sectors. However, there may still be a lack of awareness or interest in decentralized energy and energy storage among some	The government was working on a supportive regulatory framework and increase financing options, continued efforts to address technical feasibility challenges and engage stakeholders will be critical in driving the deployment of decentralized energy and energy storage solutions forward	x	x	x	x	x		2

TSO and DSO regulation	In the context of local flexibility markets, the TSO and DSO regulations are essential for enabling the participation of distributed energy resources (DERs) in the electricity system. DERs, such as solar panels, batteries, and electric vehicles, can provide flexibility to the grid by adjusting their electricity production or consumption in response to grid conditions which can be valuable for balancing the grid and avoiding costly grid upgrades. The TSO and DSO regulations in Bulgaria support the participation of DERs in local flexibility markets through several mechanisms, e.g., the regulations establish technical requirements for the connection of DERs to the grid, such as standards for communication protocols and data exchange. They also define the terms and conditions for DER participation in local flexibility markets, such as payment mechanisms and performance requirements. in the context of local flexibility markets, customers' rights for active participation are even more critical. Local flexibility markets enable customers to participate actively in the electricity markets by providing flexibility services, such as demand response or the provision of flexibility from distributed energy resources. In Bulgaria, the local flexibility markets are still under development, but there are several pilot projects in progress. These pilot projects aim to test different local flexibility market models and identify the most appropriate regulatory frameworks to support them	The rights for active participation of customers in the electricity markets are essential for the development of a sustainable and efficient electricity system. In Bulgaria, these rights are guaranteed by the Energy Act, which ensures that all customers have equal access to the grid, receive fair remuneration for the energy fed into the grid, and can participate in demand response programs. In the context of local flexibility markets, these rights become even more critical, as they enable customers to actively participate in the electricity markets and contribute to the stability and sustainability of the grid	x	x	x	x	x		3
Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	There are several factors that can influence the availability of ICT solutions for peer-to-peer energy trading and VPPs in the Bulgarian market. The factors consist of: Regulatory Framework - where the regulatory framework plays a crucial role in enabling the development and deployment of new energy solutions such as peer-to-peer energy trading and VPPs. In Bulgaria, there have been efforts to create a supportive regulatory environment for these solutions, e.g., in 2021, the Bulgarian Energy and Water Regulatory Commission (EWRC) adopted new rules for the operation of local electricity markets, which include provisions for peer-to-peer energy trading. Market Readiness: The availability of ICT solutions for peer-to-peer energy trading and VPPs in Bulgaria may also depend on the readiness of the market. The adoption of these solutions requires a certain level of technological infrastructure and consumer awareness. While Bulgaria is a member of the European Union and has made significant progress in modernizing its energy infrastructure, the country still faces some challenges in terms of energy efficiency and consumer awareness. Technology Solutions: The availability of technology solutions for peer-to-peer energy trading and VPPs is also an important factor. There are several technology providers in the market that offer solutions for peer-to-peer energy trading and VPPs. Some of these solutions are based on block chain technology, which can ensure secure and transparent transactions between energy producers and consumers. However, the availability of these solutions may depend on the market demand and the readiness of the local ICT sector	The availability of ICT solutions for peer-to-peer energy trading and VPPs in Bulgaria depends on several factors, including the regulatory framework, market readiness, and the availability of technology solutions. While there have been some positive developments in terms of regulatory support for these solutions, further efforts are needed to promote consumer awareness and adoption, as well as to encourage the development of the local ICT sector.	x	x	x		x		3
Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	Bulgarian electricity market is regulated by the Energy and Water Regulatory Commission (EWRC). The regulatory framework in the country provides for the active participation of customers in the electricity markets through various mechanisms. Guaranteed grid access is a key component of the regulatory framework in Bulgaria. The country has a comprehensive network of transmission and distribution grids that ensure universal access to electricity. The grid access rules set out by EWRC ensure that all customers, regardless of their size or location, have access to the grid on non-discriminatory terms. This means that customers can participate in the electricity markets without any barriers to entry. Remuneration for energy fed into the grid is another important aspect of the regulatory framework in Bulgaria. The country has a net metering system in place that allows customers with renewable energy installations to feed excess energy into the grid and receive credit for it. This encourages the deployment of renewable energy sources and empowers customers to become active participants in the energy transition. Demand response is also a key mechanism for customer participation in the electricity markets in Bulgaria. EWRC has implemented demand response programs that incentivize customers to adjust their energy consumption during periods of high demand or low supply. By doing so, customers can help balance the grid and reduce the need for expensive peaking power plants. In return, customers receive financial incentives and other benefits. In the context of local flexibility markets, Bulgaria has introduced several initiatives to promote the development of decentralized energy resources and local flexibility services. The country has implemented a regulatory framework for the establishment of virtual power plants (VPPs) that can aggregate distributed energy resources and provide flexibility services to the grid. Additionally, EWRC has launched pilot projects to test the feasibility of peer-to-peer energy trading and other innovative business models	The regulatory framework in Bulgaria provides for the active participation of customers in the electricity markets through various mechanisms such as guaranteed grid access, remuneration for energy fed into the grid, and demand response. The country has also taken steps to promote the development of local flexibility markets and decentralized energy resources. These measures empower customers to become active participants in the energy transition and help create a more sustainable and resilient energy system	x	x	x	x	x		4
Schemes and incentives that give advantage to big energy firms	Green Certificates which are issued to energy producers for every 1MWh of electricity generated from renewable sources, and are traded on a special exchange, and the income from their sale is used to subsidize the production of renewables across Bulgaria. Also, Feed-in Tariff system guaranteeing energy producers a fixed price for their electricity generated from renewables. A Renewable Energy Obligation System requiring energy producers to generate a certain percentage of their electricity from renewables.	Incentives for big energy firms to invest in renewable energy to boost RES development programs across Bulgaria in the coming years	x	x		x	x		4
Grid connection costs	Relatively low compared to other European countries. In 2019, the grid connection fee for solar projects in Bulgaria was approximately €0.12/kW, while the grid connection fee for wind projects was approximately €0.08/kW. This is much lower compared to the EU average of €0.25/kW for solar projects and €0.14/kW for wind projects. The currently available capacity is insufficient to meet the ever-increasing number of customer requests for solar PV installations. The currently available capacity is insufficient to meet the ever-increasing number of customer requests for PV installations. A strategy for the decentralized production, energy efficiency, transportation, etc. should provide the overall road map for the development of the network and its financing	Low grid connection costs having a high economic impact and boost new renewable energy projects. A strategy for the decentralized production, energy efficiency, transportation, etc. should provide the overall roadmap for the development of the network and its financing	x	x		x	x		4
Uncertainty and limitations in feed-in-tariff levels and schemes	Legal and regulatory - no consistent, transparent, and effective legal framework for renewable energy in Bulgaria. The existing legal framework is outdated, vague, and lacks clear guidance on the application of Feed-in Tariffs. This has created uncertainty in the market and has resulted in a lack of investment in the renewable energy sector. Financial - Feed-in-tariffs are subject to fluctuations in energy prices and market forces, which can dramatically affect the return on investment. This has caused uncertainty among investors, as well as a lack of confidence in the sector. Also, high cost of financing renewable energy projects in Bulgaria can limit the feasibility of projects. Technical - grid infrastructure is not well equipped to handle the rapid expansion of renewables as there is a lack of sufficient grid capacity that can limit the amount of electricity that can be produced and sold.	Poor quality installations likely to reduce system efficiency for potential increase in RES capacities across Bulgaria		x		x	x		2

Legislative frameworks that make setting up LFM ventures difficult	The primary legislative framework that makes setting up RES ventures difficult in the context of renewable energy in Bulgaria is the Renewable Energy Sources Act (RESA) adopted in 2007 and is characterized by lack of effective support mechanisms, such as subsidies and tax incentives, for RES projects. The Energy Act -the law sets out the framework for the operation of the Bulgarian energy sector, including the regulation of the electricity market and the adoption of energy efficiency measures and a lack of necessary incentives for RES projects, as well as the lack of a clear regulatory framework for the integration of RES into the energy system. Bulgarian Investment Promotion Act - makes setting up RES ventures difficult as sets out the framework for the promotion of investments in the country, but it does not provide any specific incentives for RES projects. At the beginning of this year some administrative burdens were abolished for example - for smaller installations, of up to 20 kW, the requirement for construction permit is waived if the photovoltaic will be entirely for the personal use of electricity. The only thing that is necessary is to inform the municipality, which is the most common procedure	Lack of Financial Support - Bulgarian government does not provide any kind of incentives or subsidies to businesses that invest in renewable energy. This lack of support makes it difficult for businesses to make the necessary investments in renewables. Low Feed-in Tariffs - the government has set the feed-in tariffs for renewable energy sources such as wind, solar, and geothermal energy at very low levels which makes it difficult for businesses to make a profit from their investments in renewable energy projects. Regulatory Uncertainty - no clear and consistent regulatory framework for renewable energy projects making business project planning difficult. Grid connection delays - government has not provided a streamlined process for connecting renewable energy projects to the grid resulting in lengthy delays when attempting to connect projects to the grid	x	x			x		2
Lack of support from local representatives/local energy agencies	Due to several factors, e.g., little public awareness of the potential of renewable energy sources, the absence of adequate policy incentives, and the lack of collaboration between local authorities and energy agencies. Many active associations and organizations in the energy sector are working on raising the awareness of renewable energy sources in the country. In fact, the energy agencies are the drivers for RES uptake and energy saving policy in Bulgaria, implementing pilot projects in the field.	Result is a visible slow growth of the renewables sector in Bulgaria	x	x	x		x		2
Lack of a policy framework for LFM investments	Difficult for investors to make informed decisions about investing in renewable energy projects, as there is a lack of clarity in terms of incentives, subsidies, and regulations for investors	Difficulties in securing project financing likely to delay renewable energy investments	x	x			x		1
Not mentioning LC as a relevant actor	Local communities are mostly affected by the introduction of renewable energy projects, as they are the ones most immediately impacted by the construction of new infrastructure, such as wind turbines and solar panels, and it is why, the government should listen to their voice. At present there is no definition for RES in the Bulgarian legislation, as the REDII is not transposed yet. There is an approved proposal by the Council of Ministers to be voted by the Parliament when it will be formed after the elections in April 2023	Difficult to enforce with no support of the local authorities, resulting in opposition, delays, and cancellation in RES projects	x	x	x		x		1
Complex and changeable policies regarding LFM development	The Bulgarian government implemented the Renewable Energy Act in 2009, which provided the legal framework for the development of renewable energy sources in the country and created the Feed-in Tariffs allowing RES projects to be funded through a fixed-price payment scheme. Also, created a Renewable Energy Fund, which was used to support the development and deployment of RES-based technologies. In 2013, the Renewable Energy Directive - included several measures, such as the introduction of a Green Certificate System, the establishment of a Renewable Energy Incentive Scheme, and the development of a long-term renewable energy strategy. In 2019, an updated Renewable Energy Law - focused on increasing the share of RES in the country's energy mix and included several measures such as the establishment of a Renewable Energy Development Fund and the introduction of a mechanism for the support of RES projects. There are proposals for changes in the RES Act, in the Energy Act and in the Urban Development Act regarding the uptake of the RES installations for the citizens, business and public authorities. Some of the proposals are already enforced, others are waiting for the new Parliament to adopt them	Will likely boost new renewable energy projects, however, can make it difficult for the investors to navigate through	x	x		x	x		3
Lack of rules regarding the opportunity to operate micro-grids	Contributes to confusion and uncertainty around the legal requirements and cost of establishing and operating micro-grids. This has resulted in a lack of investment in the sector, as investors are unwilling to take on the perceived risk associated with this type of project. No clear regulatory framework for operating micro grids	Insufficient regulatory framework makes it difficult to coordinate and complete renewable energy projects in Bulgaria	x	x		x	x		1
Lack of regional focus on renewable energy projects with LFM	government has yet to develop a comprehensive national energy policy that would provide sufficient incentives and support for renewable energy projects. Also, the Bulgarian energy market is heavily reliant on imports of fossil fuels, which has limited the development of renewable energy sources. The lack of public awareness and education on renewable energy sources has made it difficult for regional projects to attract the necessary stakeholder support	No investment in the sector for the local projects available	x	x	x	x	x		1
Energy policies may have unwanted negative connotations	Numerous legislative and administrative delays, which have been hindering the development of the sector due to a lack of public support and government's ambition and the focus being put onto coal and nuclear power projects instead of renewables	The government prioritizes wrong policies	x	x	x	x	x	x	2
Lack of cooperation between local authorities and local communities	Bulgaria has limited access to renewable energy sources, and the country has historically relied heavily on traditional energy sources such as coal and nuclear power. This has left local authorities with limited resources and options to develop renewable energy sources, which slowed down their RES ambitions. Local authorities can be reluctant to involve citizens in the decision-making process and often fail to provide adequate information about renewable energy projects. There are no local communities but a proposal for changes in order to create one-stop-shops at the municipalities for support in energy issues, mainly for renovation of buildings but for other consultancies in regard of RES and energy	There are no local communities but a proposal for changes to create one-stop-shops at the municipalities for support in energy issues, mainly for renovation of buildings but for other consultancies in regard of RES and energy	x	x	x				1
Difficulties for energy communities to generate enough surplus to cover organizational costs	No adequate financial support as even though the Bulgarian government has taken steps to promote the development and implementation of renewable energy sources, there is still a lack of dedicated funds and incentives for energy communities to invest in renewable energy projects. A lack of public awareness and understanding of renewable energy in Bulgaria can make it difficult for energy communities to secure the necessary support and investments. This can be attributed to the lack of educational resources, as well as the lack of information campaigns to spread the word about the potential benefits of renewable energy. Also, the Bulgarian energy market is heavily regulated, which creates additional hurdles for local communities to generate enough surplus to cover organizational cost	Delays in the local renewable energy project developments due to no to little funding available, complex regulatory environment, and an unawareness and poor communication between the parties are the main reasons for the delays in the RES projects	x	x	x				1
Lack of long-term government funding	Bulgaria currently lags behind many of its European neighbours in terms of renewable energy capacity and usage, and this lack of government funding has been a major factor in this underdevelopment. However, there are a lot of private investments in the country	Not enough government-backed funding resulting in fewer RES projects	x	x					2

Initial financing problems at local government level	Access to capital is a major issue for local governments in Bulgaria due to the country's limited access to international funding sources. This means that local governments must rely on domestic sources of financing, which can be limited. Local governments rely on EU funds and operational programs to finance energy saving activities, EE measures and RES initiatives	Less support for renewables in the LFMs due to fewer government funding opportunities addressed at local governments	x	x	x		x		2
National energy policy change and shift from RES to HYD	Can be seen as a move away from the global trend towards renewable energy sources as has been driven by the country's limited resources and the need to meet its energy demands. Bulgaria has limited access to renewable energy sources such as solar and wind, so the shift in policy is understandable. During the last year, 400 MW of new RES solar projects were implemented. In comparison, the previously available solar capacities in the country totalled less than 1,300 MW, mainly built in the period 2008-2012. Of the new plants, 240 MW are large and are connected directly to the ESO network, and the remaining 160 MW are with the electricity distribution companies. All they are private investments. The expectation is that another 700-800 MW of new capacity will be added, and they alone would add over 1.1 million MWh of electricity per year. This would mean another 40% increase in RES energy in the country's overall mix	Not enough local project support resulting in slowing down new projects	x	x			x		3
Difficulty in accessing loans/contracts/funding for LFM projects	Bulgarian electricity sector is dominated by state-owned companies, with little private investment in the sector. The regulations for renewable energy projects can be complex, making it difficult for private investors to understand the requirements and take advantage of the incentives offered by the government	Higher costs associated with limited funding most likely affect renewable energy projects in the domestic context	x	x		x	x		1
Lack of tax exemptions or incentives unlocking new investment opportunities	The government has not implemented any significant tax relief for renewable energy investments, making it difficult for investors to recoup their investments	The lack of tax exemptions and incentives can discourage potential investors from investing in renewable energy projects, thus further limiting the growth of the sector	x	x	x				1
Investment incentives for hydrocarbons instead of RES	Hydrocarbon investments tend to be more cost-effective than investments in RES. Hydrocarbons are cheaper to produce, and the cost of energy production is more stable due to the availability of hydrocarbon reserves in Bulgaria	The energy security provided by hydrocarbons makes it difficult for the developers to invest in renewable energy sources which are still in abundance across Bulgaria	x	x	x		x		1
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	Often designed to promote sustainability and reduce environmental impacts, while a high return on investment may imply a focus on profit rather than sustainability in the context of Bulgarian RES strategy development	Not enough returns on investments likely to minimize the RES investment rounds	x	x	x		x	x	3
Lack of experience with LFM	A lack of knowledge and awareness among energy communities about renewable energy which can be associated with inadequate public awareness campaigns, as well as a lack of education and training on renewable energy topics making it difficult for the local governments to communicate with them on the RES technologies	Possible delays in project planning due to ineffective communication between both parties	x	x	x				1
Low trust in renewable energy technologies	The lack of governmental support for the development of renewable energy sources has left the general public feeling that the country is not taking the issue seriously and resulted in lower confidence in RES' reliability and triggered affordability concerns. The inconsistent governmental RES policy during the last 20 years is the reason of the lack of trust among the investors and the citizens	The lack of trust towards RES triggered by no government support resulting in low confidence in RES technologies and their sense	x	x	x		x		1
Possible loss of support if the projects exceed certain size	Due to decreased financial incentives, reduced access to public funds, and reduced access to technical expertise needed for renewable energy project development	Ineffective funding rounds might restrict large-scale RES projects. Until 2022 there was no public funding for RES development	x	x	x	x	x		2
Lengthy grid connection procedures	The connection of renewable energy systems to the grid is regulated by the Renewable Energy Sources Act, which sets out the requirements for the connection of renewable energy systems to the electricity grid where connection procedures are lengthy and complex, e.g. through the local Distribution System Operator (DSO)a necessary permit for the construction of renewable plants and their grid connections. Construction permits from the municipality that need to be requested by the developers - includes technical information about the system and its environmental impact. Also, the developer must obtain an operation permit from the State Energy and Water Regulatory Commission (SEWRC). This permit is necessary for the operation of the renewable energy system. REGULATION No. 6 OF FEBRUARY 24, 2014, ON THE CONNECTION OF ELECTRICITY PRODUCERS AND CUSTOMERS TO THE TRANSMISSION OR DISTRIBUTION NETWORKS	Delays in connecting new RES plants to the grid due to lengthy procedures				x	x	x	2
Lack of interest and engagement in the promotion of LFM	A lack of awareness and knowledge among the general population about the potential benefits and applications of RES as no education programs and campaigns that are accessible and available to the public. No presence of the political commitment resulting in limited RES investments. The high renewable energy technology costs compared to traditional sources. Also, lack of incentives and government subsidies for renewables	Wrong government priorities resulting in fewer RES projects. Contradictory governmental and political ideas supporting nuclear and non-renewable energy sources	x	x	x	x	x		1
Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	Fear of displacement is a major factor in the opposition to RES in Bulgaria as many people may be worried that the introduction of renewable energy sources will mean the end of their current jobs. This could be in the form of workers in the coal and nuclear industry, who may feel that the increased use of renewable energy sources will result in the closure of their respective industries	Strong citizen opposition to renewable energy technologies caused by unreasonable fears causing project cancellations, delays, reschedules. Disbelief in the stability of the RES energy, expensive batteries, low ROI	x	x	x	x	x		1
Lack of experience in commissioning and managing RES projects	The lack of experience since the country is relatively new to the renewable energy sector, having only started to make major investments in this sector in the last decade, which resulted in a lack of qualified personnel who possess the necessary knowledge and skills to effectively commission and manage RES projects. In the 2010-2014 years there was a boom in the development of RES installations in Bulgaria as long-term contracts for buying solar energy at preferential prices were signed which led to distortions and conflicts in the field	Not enough highly qualified workforce specialized in commissioning and managing renewable energy projects		x	x	x			2

Lack of accessible area for new renewable plants	Bulgaria has a large agricultural sector which already occupies much of the available land. This limits the potential to develop large-scale renewable projects, leaving large swathes of land unavailable for renewable energy projects. Also, high bureaucratic and legal requirements make it very difficult to develop the renewable energy projects	Too much bureaucracy and legal challenges, in line with an extensive agricultural sector's size make it challenging for new RES projects to be developed. Limitation of the accessible area, mainly because of lack of available capacity of the network	x			x	x	x	2
Lack of sufficient requalification/training for potential LFM technology staff	Bulgaria lacks enough qualified personnel to implement RES technologies while there is a growing demand for these technologies, also the lack of training opportunities and resources means that the potential staff are unable to get involved in RES projects	Educational program gaps result in a slower than anticipated growth in the domestic renewable energy sector. There is a need for training and qualification courses in the country	x	x	x	x			2
Difficulty in securing labour for LFM projects	There is a lack of training and education in the renewable energy sector, which has resulted in a shortage of knowledgeable and experienced workers in the industry	Affects project capacities as not enough workforce that is trained and ready for work in the RES space		x	x	x			2
Rigid legal, bureaucratic, and administrative procedures	Present lack of legal certainty when it comes to renewable energy in Bulgaria as current legal framework is complex and not synchronized with European standards making it difficult for the investors to invest in renewables. Complex bureaucratic procedures associated with renewable energy in Bulgaria are slow and inefficient as investments are delayed. The administrative requirements for obtaining the necessary permits and approvals are cumbersome and time consuming. This makes it difficult for investors to make timely investments, as the administrative procedures can take up to several years to complete	Investors are facing constant bureaucratic challenges making them less likely to invest in the RES technologies. The production of RES energy in case when sold to the network, was accompanied of long administrative and bureaucratic procedures for the companies and for the prosumers as well		x	x				1
Insufficient regulation regarding smart metering	No legal framework in place that allows for the deployment of smart meters in Bulgaria, leading to a lack of incentives for higher adoption of renewable energy technologies. The existing legislation does not properly address the issues of privacy, data security, and consumer protection when it comes to using smart meters. There is no obligation of the DSOs and a deadline for installing smart meters. DSOs are ready to install smart meters at the expense of the consumers	Might affect the integration of smart metering with the plants due to an outdated framework affecting new projects	x	x	x		x		1
Strong aversion to risk towards larger RES projects	Lack of flexibility has made it difficult for RES projects to obtain financing, as banks and other financial institutions are hesitant to lend to projects that have uncertain returns. The Bulgarian legal and regulatory framework for renewable energy projects is still relatively undeveloped, making it difficult for investors to assess the risks. Also, the energy sector is dominated by large state-owned companies which are hesitant to invest in renewable energy projects due to the perceived uncertainty associated with them	Higher operational risk that might slow down certain project phases	x	x		x	x		2
Lack of cooperation with other local communities to share expertise/knowledge/resources	Mainly due to a lack of awareness of the benefits of renewable energy and the technologies available. Bulgaria has a very large amount of renewable energy resources, yet most of the population is unaware of the potential of these resources	A lack of communication between the stakeholders leading to confusion and delays in the RES projects	1	x	x	x	x		1
Low citizen involvement in decision making activities	The government should organize public consultations on the future of renewables in Bulgaria as society in some parts of the country do not pay attention to renewables issues	No to little citizen involvement has a negative impact onto attracting smaller developers, the country is focused on large operators	x	x	x				2
Country:	**Romania**								
Factor (title)	**Factor (description)**	**Impact for LFM development in the country**	**Political**	**Economic**	**Social**	**Technological**	**Legal**	**Environmental**	**Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)**
Market structures that support centralised energy production/local flexibility markets	Tax credits, Feed-in Tariffs, renewable energy certificates. These incentives help in cost reduction of renewable energy production and make it more attractive to producers. The Romanian energy market is liberalised and open to competition which allows renewable energy producers to bid into the market, allowing them to participate in a competitive market. Also, several policies and incentives promoting renewables, such as Feed-in Tariffs providing financial incentives to producers of renewable energy, as well as a Renewable Energy Certificate System which allows renewable energy producers to receive additional income when they sell their electricity, and Green Certificates requiring energy producers to generate a certain amount of renewable energy in order to be eligible for subsidies in the local flexibility market	Subsidies and programs supporting renewable energy investments and project development. Likely to significantly boost new investments and upscale the renewable energy capacities nationally	x	x	x	x	x		4
Security of energy supply	The security of energy supply in the context of local flexibility markets and electricity is supported by the National Energy Regulatory Authority (ANRE), which has established a regulatory framework that ensures the reliability and stability of the electricity grid. ANRE promotes the deployment of smart grid technologies and the integration of demand response resources, which enhance the flexibility and responsiveness of the electricity system and improve its ability to manage energy demand and supply. But the integration of RES into the electricity grid also presents several challenges to the security of energy supply. The intermittent nature of RES, such as wind and solar power, can cause fluctuations in the electricity grid, which can affect the stability and reliability of the system. To address this issue, Romania has implemented measures to ensure the security of energy supply, such as the deployment of energy storage systems and the development of backup power plants. Energy storage systems, such as batteries and pumped hydro storage, can store excess energy generated by RES during times of high generation and release it during times of low generation. This helps to balance the supply and demand of energy, ensuring the stability and reliability of the electricity grid. Backup power plants, such as gas-fired power plants, can also provide additional energy supply to the grid during times of high demand or low generation from RES. In addition, Romania is developing interconnections with neighbouring countries, which enables the import and export of energy, ensuring the security of energy supply during times of high demand or low generation from RES. Romania is also promoting energy efficiency measures, which can reduce energy demand and improve the security of energy supply	The deployment of energy storage systems, backup power plants, and interconnections with neighbouring countries also ensures the stability and reliability of the electricity grid. However, the intermittent nature of RES presents challenges to the security of energy supply, which must be addressed through the deployment of energy storage systems, backup power plants, and energy efficiency measures	x	x	x	x	x		3

Innovation capacity and digital independence	The innovation capacity and digital independence in the context of local flexibility markets and electricity are supported by the National Energy Regulatory Authority (ANRE) in Romania, which has established a regulatory framework that encourages the deployment of smart grid technologies and the integration of demand response resources. ANRE also promotes the participation of small-scale producers and storage operators in the electricity market, which enables the deployment of innovative and digital solutions. The deployment of smart grid technologies, such as advanced metering infrastructure (AMI) and distribution automation (DA), enables real-time monitoring and control of energy consumption and production, which enhances the efficiency and reliability of the electricity system. AMI and DA also enable the integration of RES and demand response resources, which improves the flexibility and responsiveness of the electricity system. In addition, the deployment of digital solutions, such as block chain and artificial intelligence (AI), enables the optimization of energy production and consumption by facilitating the trading of energy and the management of energy flows. Block chain enables the creation of peer-to-peer energy trading platforms, which enables small-scale producers and consumers to trade energy directly with each other. AI enables the development of energy management systems that can predict energy demand and optimize energy production and consumption accordingly	Romania faces several challenges, including the lack of technical expertise and awareness among consumers, the lack of interoperability between different smart grid technologies, and the limited availability of digital solutions in the market	x	x	x	x	x		3
Attitudes towards energy efficient products, services, technologies, and appliances	Romania has made significant progress in promoting energy efficiency in recent years. The country has developed a comprehensive strategy for promoting energy efficiency, which includes measures to improve building energy efficiency, promote renewable energy sources, and promote energy-efficient appliances and equipment. The country has also implemented several incentive programs to encourage the adoption of energy-efficient technologies and appliances. One of the key challenges facing the promotion of energy efficiency in Romania is consumer awareness and education. Many consumers in Romania may not be aware of the benefits of energy-efficient products, services, technologies, and appliances, or may not understand how to use them effectively. To address this challenge, the country has implemented education and awareness-raising campaigns, which aim to educate consumers on the benefits of energy efficiency and provide guidance on how to use energy-efficient products and services. Another challenge facing the promotion of energy efficiency in Romania is the availability and affordability of energy-efficient products and services. While there is a growing market for energy-efficient products and services in the country, these products and services may not always be readily available or affordable for all consumers. To address this challenge, Romania has implemented incentive programs, such as energy efficiency grants and subsidies, to make energy-efficient products and services more accessible to consumers	There are still challenges to promoting energy efficiency in Romania, the country has made significant progress in recent years. Through education and awareness-raising campaigns, incentive programs, and the development of comprehensive strategies, Romania has been able to promote the adoption of energy-efficient products, services, technologies, and appliances. This has contributed to a more efficient and sustainable energy system, which is essential for the country's long-term economic and environmental sustainability	x	x	x	x	x		2
Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	One key factor that can affect the willingness to invest in energy transition is the availability of financial resources in Romania. The deployment of local flexibility markets and the adoption of renewable energy sources can require significant upfront investments, which may be difficult for some companies or individuals to finance. In Romania, there have been efforts to increase the availability of financing options, including the establishment of energy efficiency and renewable energy financing programs. Another factor that can affect the willingness to invest in energy transition is the availability of time and resources. The transition towards a more sustainable energy system can require significant effort and time, particularly in terms of upgrading existing infrastructure and deploying new technologies. Additionally, there may be a lack of trained personnel and technical expertise in certain areas, which can further slowdown the transition process. The regulatory environment can also play a role in the willingness to invest in energy transition. In Romania, there have been efforts to establish a supportive regulatory framework that encourages investment in renewable energy and local flexibility markets. However, there are still challenges related to policy uncertainty and regulatory complexity that can make it difficult for companies and individuals to navigate the transition process	The willingness to invest in energy transition in Romania is a complex issue that is influenced by a range of factors. While there have been some positive developments in recent years, including the deployment of local flexibility markets and the adoption of renewable energy sources, there is still a long way to go to achieve a sustainable and resilient energy system. Continued efforts to increase financing options, build technical expertise, and establish a supportive regulatory framework will be critical in driving the transition forward	x	x	x	x	x		2
Smart grids deployment	Romania has made significant progress in the deployment of smart grids in recent years. The country has implemented several pilot projects to test the deployment of smart grid technologies, and it has also developed a comprehensive strategy for the deployment of smart grids across the country. This strategy focuses on the development of advanced communication and information technologies, as well as the integration of renewable energy sources and the promotion of energy efficiency. One of the key benefits of smart grids is their ability to support local flexibility markets. Smart grids can facilitate the integration of renewable energy sources and enable the optimization of energy consumption and distribution. This includes the use of advanced metering systems, which provide real-time information on energy consumption and production, as well as the integration of energy storage systems, which can help to balance the grid during periods of peak demand. In addition to supporting local flexibility markets, smart grids can also enhance the reliability and efficiency of the electricity system in Romania. Smart grids can detect and respond to disruptions in the grid in real-time, which can help to minimize the impact of outages and improve the overall reliability of the system. Smart grids can also enable the optimization of energy distribution, which can help to reduce energy waste and improve the efficiency of the system	The development of advanced communication and information technologies, the integration of renewable energy sources and the promotion of energy efficiency are all essential elements of the country's smart grid strategy. By deploying smart grids, Romania can improve the reliability, efficiency, and flexibility of its electricity system, while also promoting sustainable energy practices	x	x		x	x		3
Demand response infrastructure deployment (smart metering)	Smart metering is a key component of demand response infrastructure, as it allows for real-time monitoring of electricity usage and enables consumers to respond quickly to changing demand conditions. In Romania, the deployment of smart meters has been supported by both the government and utilities, with a goal of achieving full-scale deployment by 2028. Romania has also established local flexibility markets to support demand response. These markets allow consumers to sell their excess electricity back to the grid during periods of high demand, providing a financial incentive for reducing electricity usage. The deployment of demand response infrastructure in Romania has several benefits. Firstly, it can help to reduce the need for expensive new power plants, which can save consumers money on their electricity bills. It can also help in greenhouse gas emissions reduction by promoting energy efficiency and reducing the need for fossil fuel-based power generation and help to improve grid reliability and reduce the risk of blackouts during periods of peak demand	The need for significant investment in smart metering technology and the development of local flexibility markets. Additionally, consumers may be hesitant to participate in demand response programs if they perceive that they will be inconvenienced or if they do not trust the technology	x	x	x	x	x		2

Decentralised energy system and storage	Decentralised energy systems, such as microgrids, enable local energy production and consumption, reducing the need for long-distance energy transport and distribution in Romania. The regulatory framework established by the National Energy Regulatory Authority (ANRE) encourages the development of decentralised energy systems by promoting the participation of small-scale producers in the electricity market and providing incentives for the deployment of RES. Storage solutions, such as batteries, enable the storage of excess energy produced during periods of high generation and the supply of energy during periods of high demand. The regulatory framework for storage solutions is established by ANRE, which requires TSOs and DSOs to facilitate the participation of storage resources in the electricity market and to provide non-discriminatory access to the grid for storage operators. In the context of local flexibility markets, decentralised energy systems and storage solutions offer the possibility of integrating demand response resources, enabling consumers to actively participate in the electricity market by reducing energy consumption during periods of high demand and selling stored energy back to the grid during periods of high prices. This active participation is facilitated by the deployment of smart grid technologies, which enable real-time monitoring and control of energy consumption and production	The deployment of decentralised energy systems and storage solutions in Romania faces several challenges, including the lack of a clear regulatory framework for the participation of small-scale producers and storage operators in the electricity market, the high initial investment costs of these systems and solutions, and the lack of technical expertise and awareness among consumers. The deployment of decentralised energy systems and storage solutions in Romania faces several challenges, including the lack of a clear regulatory framework for the participation of small-scale producers and storage operators in the electricity market, the high initial investment costs of these systems and solutions, and the lack of technical expertise and awareness among consumers	x	x	x	x	x		2
TSO and DSO regulation	In Romania, the regulation of transmission system operators (TSOs) and distribution system operators (DSOs) is an essential factor for the development of local flexibility markets and the efficient and stable operation of the electricity grid. The regulatory framework for TSOs and DSOs is established by the Romanian Energy Regulatory Authority (ANRE) and is aimed at promoting competition, ensuring non-discriminatory access to the grid, and guaranteeing the security of the electricity system. In the context of local flexibility markets, the regulation of TSOs and DSOs is critical for enabling the integration of a wide range of actors into the electricity system, including small-scale producers and consumers, and ensuring the efficient management of electricity distribution and consumption. In Romania, the regulatory framework for TSOs is established by Law No. 123/2012, which provides for the separation of TSOs from other electricity market participants to ensure the independence and impartiality of TSOs. The law also requires TSOs to ensure non-discriminatory access to the grid, to operate the grid in a secure and efficient manner, and to promote competition in the electricity market. Similarly, the regulatory framework for DSOs in Romania is established by Law No. 121/2014, which provides for the separation of DSOs from other electricity market participants to ensure their independence and impartiality. The law also requires DSOs to ensure non-discriminatory access to the grid, to operate the grid in a secure and efficient manner, and to promote competition in the electricity market. ANRE has established specific regulations for the development of local flexibility markets in Romania. These regulations include the requirement for TSOs and DSOs to facilitate the participation of demand response resources and distributed energy resources in the electricity market, to provide real-time data on electricity consumption and production, and to develop technical solutions to enable the integration of these resources into the electricity system	The regulatory framework established by ANRE promotes competition, ensures non-discriminatory access to the grid, and guarantees the security of the electricity system, enabling the integration of a wide range of actors into the electricity system and the optimization of electricity distribution and consumption	x			x	x		3
Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	There are several software platforms and technologies that can support these applications in Romania, including the block chain-based platform developed by the Romanian start-up Elrond Network, which allows for the creation of P2P energy markets and VPPs. The platform is designed to enable secure and transparent energy trading and management, allowing users to sell excess energy generated from renewable sources to other users or to the grid. Another platform that can support P2P energy trading in Romania is the Power Ledger platform, which enables the creation of localized energy trading networks. The platform allows for the creation of smart contracts that can facilitate transactions between producers and consumers, and provides real-time monitoring of energy flows and prices. In addition to these platforms, there are also several other ICT solutions that can support the development of local flexibility markets and P2P energy trading in Romania. These include energy management systems, distributed energy resource management systems, and demand response management systems	The adoption of P2P energy trading and VPPs in Romania is still in its early stages, and there are several regulatory and technical challenges that need to be addressed to enable their widespread deployment. These challenges include the development of clear regulations for P2P energy trading and VPPs, the integration of these systems with existing grid infrastructure, and the development of standardized communication protocols for energy management systems	x	x	x	x	x		2
Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	In recent years, there has been a growing interest in promoting the active participation of customers in electricity markets in Romania, including the implementation of local flexibility markets and the introduction of measures to incentivize demand response and the generation of renewable energy. In this context, it is essential to analyse the rights of customers to participate actively in the electricity markets in Romania, including guaranteed grid access, remuneration for energy fed into the grid, and demand response. One of the key challenges facing customers in Romania is ensuring guaranteed grid access. While the country has made significant progress in expanding its electricity grid, there are still areas that are underserved, particularly in rural areas. To address this challenge, Romania has implemented measures to promote the development of renewable energy sources, including the establishment of a support scheme for the installation of solar and wind power systems. This scheme provides financial support to customers who install renewable energy systems, and it also includes provisions to ensure grid access for these systems. In addition to guaranteed grid access, customers in Romania also have the right to remuneration for energy fed into the grid, including the feed-in tariff system, which guarantees a fixed price for the electricity generated by renewable energy systems. The feed-in tariff system is an important incentive for customers to invest in renewable energy systems and participate actively in the electricity markets	Romania implemented measures to incentivize demand response, which allows customers to adjust their energy consumption in response to changes in the electricity market. This includes a time-of-use tariff system, which provides customers with lower electricity rates during off-peak hours. Romania has also established a capacity market, which provides incentives for customers to reduce their energy consumption during periods of high demand	x	x	x	x	x		4
Schemes and incentives that give advantage to big energy firms	Tax exemptions for investments in renewable energy projects that enable big energy firms to reduce the cost of their RES investments and gain a competitive advantage over smaller firms. Feed-in Tariffs (FiT) for renewable electricity that guarantee a fixed price for renewable electricity produced by big energy firms and boosting their interest in new investments. Government funding supporting large firms in covering the costs of renewable energy projects. This helps to level the playing field between them and smaller firms. Priority access to national grid via grid connections allowing them to upscale RES projects faster. Long-term contracts for big firms with energy suppliers - granted long-term energy supply contracts, providing them with a steady source of income from renewables and allowing their long-term planning	Energy market intervention will boost renewable energy investment as windfall tax will support new RES ventures	x	x		x	x		4
Grid connection costs	The government implemented incentive programs to reduce grid connection costs for renewable energy projects such as subsidies for grid connection and net-metering, as well as exemptions from certain taxes and fees. Also, introduced a new law requiring energy distributors to pay for the costs of connecting small-scale renewable energy projects (under 200kW) to the grid	High grid connection costs in Romania might slow down some RES projects	x	x		x	x		2
Uncertainty and limitations in feed-in-tariff levels and schemes	Romanian FiT scheme is very limited in terms of eligible technologies, and only a select few are eligible for FiTs. This limits the potential for competition and innovation in the sector as there is a lack of transparency in the FiT Tariffs having given a difficult to obtain by the public, information on the FiT levels	Insufficient public data access for the FiT in Romania leading to confusion and delays in the development of renewable energy projects	x	x	x	x	x		1

Legislative frameworks that make setting up LFM ventures difficult	Legal framework for renewable energy is complex and can be difficult for developers to navigate	New investments likely to be delayed due to framework complexity	x				x		2
Lack of support from local representatives/local energy agencies	A draft framework for CfD (contracts for difference) requiring developers to complete environmental permitting to participate in CfD. Visible support for wind and solar projects	Other than wind and solar projects might face delays due to their non-urgent nature	x		x		x		2
Lack of a policy framework for LFM investments	No RES investment framework making it difficult for the investors to commit to long-term investments in the sector, as the risk of policy changes is too high	Investors likely to go away rather than to invest in the renewables due to insufficient policies that could support their investments	x	x			x		1
Not mentioning LC as a relevant actor	The government does not prioritize local projects supported by local communities, unless they are associated in non-profit associations	Difficult to enforce with no support of the local authorities, only support for non-profit associations	x		x		x		2
Complex and changeable policies regarding LFM development	The National Renewable Energy Action Plan has been adopted in June 2019 by the government and sets the ambitious targets for up to 2030 as to increase the participation of renewables in domestic energy mix to 32%. The plan includes measures such as the introduction of Feed-in Tariffs (FiT) and Green Certificates, increasing the efficiency of energy production and consumption, and promoting energy efficiency in Romania	Current regulatory framework predominantly focused on coal and nuclear energy, making wind and solar investments unlikely to be prioritized in the short-term perspective	x	x		x	x		2
Lack of rules regarding the opportunity to operate micro-grids	Government promotes the adoption of smart grid technology as a way of improving the efficiency of national grid	They might not be enforced locally; it means not enough opportunities in the local context	x			x	x		2
Lack of regional focus on renewable energy projects with LFM	Lack of resources and investment in renewable energy projects in the country. Additionally, Romania has not yet implemented any policies or incentives to encourage the development of renewable energy projects, as well as no education and public awareness supporting renewables	Not enough support for the local projects focused on RES investments making it difficult to navigate through	x	x	x		x		1
Energy policies may have unwanted negative connotations	Largely focused on traditional energy sources such as coal and nuclear power. This has caused the country to be slow in transitioning to renewable energy sources such as wind and solar	Lack of renewables-focused policies making it impossible for renewables to upscale in Romania	x	x	x	x	x	x	1
Lack of cooperation between local authorities and local communities	Often due to ideological differences, lack of information and knowledge, and/or lack of financial incentives for RES projects	Both sides should cooperate more on the energy transition and renewables amid rising needs of upscaling renewables domestically	x	x	x	x	x		1
Difficulties for energy communities to generate enough surplus to cover organizational costs	No access to capital as the main difficulty for the energy communities to generate surplus of energy coming from renewables as the government does not line up enough financial incentives for RES technologies	Severe disruption in the production of any excess energy coming from renewables due to lack of funding	x	x	x	x			1
Lack of long-term government funding	Romania has one of the lowest shares of renewable energy in the European Union, with only 18% of its energy production coming from renewable sources. The government has failed to provide sufficient incentives and support to the renewable energy sector, which has resulted in limited investments due to government's priority to invest in fossil fuels and nuclear energy	No to little government funding hampered the growth of renewables across Romania	x	x	x	x			1
Initial financing problems at local government level	A change shift at the national government level that champions alternatives to renewables such as nuclear	Less support for renewables in the LFMs	x	x	x				3
National energy policy change and shift from RES to HYD	The Romanian government has made the decision to increase their reliance on hydrocarbons, such as coal and natural gas, over the use of renewable energy sources, such as solar, wind, and biomass as oversees them as not supporting domestic economy	Central government's opposition to renewables blocking the RES projects	x	x			x		1
Difficulty in accessing loans/contracts/funding for LFM projects	Too many rules at the national level, often dictated by the region it is addressed at	Not enough financial support at the local level due to changing priorities	x	x		x	x	x	3
Lack of tax exemptions or incentives unlocking new investment opportunities	This lack of support has limited the ability of Italian businesses and households to invest in renewable energy sources, and has inhibited the development of a competitive market for renewable energy	The lack of tax exemptions and incentives can discourage potential investors from investing in renewable energy projects, thus further limiting the growth of the sector	x	x	x				1
Investment incentives for hydrocarbons instead of RES	The government championing gas and shifted towards coals to secure energy supplies nationally	Delays in RES deployment in the LFMs context - shift in priorities caused by the war in Ukraine	x	x	x		x		2
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	Policy planning at the federal level with a mismatch between the expectations and the reality	Lower than expected investments for the right technologies	x	x	x		x	x	2

Lack of experience with LFM	Might be not enough outreach to energy communities as to learn about their direct energy needs	Possible delays in project planning			x	x			3
Low trust in renewable energy technologies	The government is sceptical about introducing more renewables than gas to energy grid amid high costs of new investments	Change in the energy complex paradigm resulting in lower RES ambitions on this occasion	x		x		x		2
Possible loss of support if the projects exceed certain size	Private funding is often limited by the size of a project. Private donors may not want to invest in a project that is too large and complex, as it may involve greater risk and higher costs	Local support for RES projects often limited which results in reduction in the number of projects	x		x	x	x	x	2
Lengthy grid connection procedures	The process is lengthy and involves obtaining various authorizations, permits and certificates from various government agencies and local authorities. The procedures can be divided into four stages: pre-application, application, construction, and commissioning	Delays in connecting new RES plants to the central grid	x	x		x	x		1
Lack of interest and engagement in the promotion of LFM	Romania has invested primarily in fossil fuels for energy production in the past, and is one of the largest producers of oil and gas in Europe which makes the government less likely to invest in the renewables sector	Too much scope being put onto fossil fuels domestically, affecting investments and foreign interest in the renewables sector in Romania	x	x	x	x	x	x	1
Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	The fear of displacement is largely due to the worry that RES will cause job losses in the traditional energy industry in the old generation	Might affect country's net-zero targets due to fewer RES projects available due to a lack of public support of such projects	x	x	x		x		1
Lack of experience in commissioning and managing RES projects	The Romanian government has not provided adequate incentives to encourage the development of renewable energy projects, but also, lacks behind with its legal and regulatory framework that would boost investments in RES	Difficult to navigate regulatory environment pushing most investors away from investing in renewables			x	x			1
Lack of accessible area for new renewable plants	Romania has a vast territory and abundant resources, but much of the land is forested, mountainous, or inaccessible for development of larger-scale renewable energy projects	Natural terrain conditions in Romania usually blocks bigger RES investments due to inaccessibility		x		x		x	2
Lack of sufficient requalification/training for potential LFM technology staff	The lack of training and requalification for potential RES technology staff impacts the efficiency and competitiveness of the renewable energy sector in Romania having given a still, early stage of domestic renewable energy sector	Fewer experts that can work on the RES projects qualified nationally which might affect the projects that need higher expertise	x	x	x	x	x	x	1
Difficulty in securing labour for LFM projects	Romania has a limited pool of qualified renewable energy professionals, as the country's renewable energy sector is still in its early development stages. Also, no financial incentives for new RES projects pushing away qualified labour as they seek opportunities internationally	Affects project capacities as not enough workforce available for most RES projects		x	x	x			1
Rigid legal, bureaucratic, and administrative procedures	Adopted in 2008, the Renewable Energy Law of Romania (RL) and has since been amended several times. This law sets out the framework for the development of renewable energy and establishes the rules for the promotion of renewable energy domestically. The bill also includes several requirements for investors, including the need for environmental impact assessments and the necessity of obtaining building permits. Also, set the requirement for obtaining an authorization from the Romanian National Agency for Energy and the National Regulatory Authority for Energy, as well as the need to apply for subsidies and other incentives. In addition, the Ministry of Environment, Waters and Forests must be consulted to obtain permission to construct renewable energy projects	Complex bureaucratic procedures for the development of RES might slow down new investments		x	x				3
Insufficient regulation regarding smart metering	Inadequate to current energy policies of Romania, need to be improved. Also, inadequate infrastructure in place to support the implementation of smart metering domestically and no consistency in the renewable energy pricing	Impacts and slows down new renewable energy projects	x	x	x		x		2
Strong aversion to risk towards larger RES projects	The authorities in some instances, prefer smaller projects due to lower operational and financial risk	Can affect large project ambitions	x				x		2
Lack of cooperation with other local communities to share expertise/knowledge/resources	Caused by a lack of financial resources, awareness of the potential benefits of renewable energy, and political will to invest in renewable energy. The high upfront costs of renewable energy infrastructure, such as solar panels or wind turbines, make it difficult for these communities to finance their own projects	Might affect local LFMs projects			x	x			1
Low citizen involvement in decision making activities	The government should organize public consultations on the future of renewables in Romania as society in some parts of the country do not pay attention to renewables issues	No to little citizen involvement has a negative impact onto attracting smaller developers, the country is focused on large operators	x	x	x				2

Country:	France								
Factor (title)	Factor (description)	Impact for LFM development in the country	Political	Economic	Social	Technological	Legal	Environmental	Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)
Market structures that support centralised energy production/local flexibility markets	Feed-in Tariffs - centralised and supporting price support schemes with price guarantees for RES-sourced electricity; a number of other market structures that promote centralization of renewable energy production. These include government subsidies for renewable energy projects, regulations that favour the development of large-scale renewable plants, and a renewable energy certificate system that grants additional incentives to power plants that produce clean energy. Several long-term contracts with renewable energy producers, which provide additional stability and assurance to the renewable energy sector. The primary market structure supports centralized energy production is the Renewable Electricity Tariff (TAR). This guaranteed pricing mechanism incentivizes investments in renewable energy and helps to ensure that the resulting energy production is financially viable. The tariffs are also designed to ensure that the costs of renewable energy are affordable for consumers. In addition to the TAR, the government introduced the Local Energy Communities (CELs). These are local-level energy communities that are responsible for providing energy services to their members. CELs are required to purchase a certain percentage of their energy from renewable sources, which helps to encourage the development of local renewable energy sources, and the Feed-in Tariff (FiT), which provides financial incentives to producers of renewable energy, and the Green Certificates Scheme (GCS), which allows renewable energy producers to sell certificates for the energy they produce	Overseen as significant boosters of renewable energy project planning and new capacities. Regulatory environment likely to lift French renewable energy market in the local flexibility market's context and boost new RES investments	x	x					4
Security of energy supply	The security of energy supply is a critical issue for France, particularly as the country seeks to integrate renewable energy sources and implement local flexibility markets in the electricity sector. Local flexibility markets allow for the optimization of energy consumption and the integration of renewable energy sources, but they also require a reliable and secure energy supply. France has a diverse mix of energy sources, including nuclear power, renewable energy, and fossil fuels. Nuclear power is the primary source of electricity in France, accounting for approximately 70% of the country's total electricity production. While this provides a relatively stable and reliable source of energy, it also presents some security risks, particularly in the event of a nuclear accident or terrorist attack. In recent years, France has made significant progress in diversifying its energy mix and increasing the share of renewable energy sources. The country has set a target of achieving 40% renewable energy by 2030, and it has already made significant progress in developing wind and solar power. However, the intermittent nature of these energy sources can create challenges for energy security, particularly during periods of low wind and solar output. To address these challenges, France has implemented a number of measures to ensure the security of its energy supply, e.g., investments in energy storage, demand response, and other technologies that can help to balance the grid and ensure a reliable supply of energy. France has also developed several interconnections with neighbouring countries, which can provide access to additional sources of energy during periods of peak demand	France has a well-developed emergency response system in place to address any disruptions to the energy supply. The country has established a Strategic Reserve of electricity and gas, which can be used to supplement the energy supply in the event of an emergency. France has also developed a comprehensive emergency response plan, which outlines the roles and responsibilities of different stakeholders in the event of a disruption to the energy supply	x	x		x	x		3
Innovation capacity and digital independence	France has a strong tradition of technological innovation, particularly in the energy sector. The country is home to numerous research and development centres, including the French Alternative Energies and Atomic Energy Commission (CEA), which is a leading centre for renewable energy research. The country also has a vibrant startup ecosystem, with many companies developing innovative solutions for the energy sector, including energy storage, demand response, and smart grid technologies. In addition, France is a member of the European Union, which provides access to funding and resources for research and innovation. In terms of digital independence, France has taken steps to ensure that its digital infrastructure is secure and reliable. The country has invested in the development of its own digital infrastructure, including the deployment of a high-speed fibre optic network. France has implemented regulations to ensure the security of its digital infrastructure, including the General Data Protection Regulation (GDPR) and the French Network and Information Systems Security Agency (ANSSI)	One of the main challenges of implementation of LMFs in France is the complexity of the regulatory framework governing the energy sector, which can make it difficult for new entrants to enter the market. In addition, the energy market in France is dominated by large incumbent players, which can make it challenging for smaller companies and startups to compete. Finally, there is a need for further investment in digital infrastructure to ensure that the country has the necessary capacity to support the deployment of local flexibility markets	x	x	x	x	x		3
Attitudes towards energy efficient products, services, technologies, and appliances	There is growing interest in energy-efficient products, services, technologies, and appliances, particularly in the context of local flexibility markets and electricity in France, which is driven by several factors, including the need to reduce greenhouse gas emissions, lower energy costs, and increase energy security. One key driver of the shift towards energy-efficient products and services in France is the government's commitment to reducing greenhouse gas emissions. France has set a target of reducing its greenhouse gas emissions by 40% by 2030, compared to 1990 levels. To achieve this target, the government has implemented a range of policies and incentives to encourage the adoption of energy-efficient technologies and practices, including the promotion of renewable energy and the development of local flexibility markets. In addition to government policies, there is also growing consumer demand for energy-efficient products and services in France. Consumers are increasingly aware of the environmental impact of their energy consumption and are looking for ways to reduce their energy use and carbon footprint. This has led to a growing market for energy-efficient appliances, such as energy-efficient lighting, heating, and cooling systems, and for energy-efficient services, such as energy audits and home energy management systems. In the context of local flexibility markets and electricity, energy-efficient products and services are becoming increasingly important. Local flexibility markets allow energy consumers to participate in the management of the electricity grid by adjusting their energy consumption in response to changing demand and supply conditions. Energy-efficient products and services can help consumers to reduce their energy consumption during peak periods, when electricity is most expensive, and to shift their energy use to off-peak periods, when electricity is cheaper	The attitudes towards energy-efficient products, services, technologies, and appliances in France are positive and are likely to continue to grow in importance in the context of local flexibility markets and electricity	x	x	x	x	x		4

Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	France has shown a strong willingness to invest in energy transition, not just financially but also in terms of effort, time, resources, and policy measures. The country has set ambitious targets for the development of renewable energy sources, the reduction of greenhouse gas emissions, and the enhancement of energy efficiency, and has implemented a range of measures to support the achievement of these targets. In the context of local flexibility markets and electricity, France has been investing in the development of innovative solutions to enhance the efficiency and stability of the electricity grid. For example, the country has implemented a range of policies to support the deployment of smart grids, such as the energy transition law of 2015 that set a target of deploying 35 million smart meters by 2021, and the creation of a national smart grid plan in 2011. France has also been investing in the development of renewable energy sources, including solar and wind power, and has set a target of achieving 33% renewable energy in the country's energy mix by 2030. The country has implemented a feed-in tariff system to support the deployment of renewable energy sources, ensuring a stable income stream for renewable energy producers and incentivizing further investment in these sources	France has been investing in the development of energy storage technologies, which are critical for the integration of renewable energy sources into the electricity grid. The country has implemented policies to support the deployment of energy storage technologies, such as tax credits for the installation of energy storage systems. France has shown a strong willingness to invest in energy transition, recognizing the importance of developing sustainable and efficient energy systems. The country has implemented a range of policies and measures to support the deployment of renewable energy sources, enhance energy efficiency, and promote the development of innovative solutions to enhance the stability and efficiency of the electricity grid, including local flexibility markets	x	x		x	x		4
Smart grids deployment	France has been working on the deployment of smart grids for several years. The country's energy transition law, enacted in 2015, set a target for the deployment of 35 million smart meters by 2021, enabling the collection of real-time data on electricity consumption and production. This target was achieved in 2020, with 90% of households in France equipped with smart meters. The deployment of smart grids in France has enabled the development of local flexibility markets by providing real-time information on electricity consumption and production. Smart grids allow for the integration of demand response technologies, enabling consumers to adjust their electricity consumption in response to changes in electricity prices or grid conditions, thereby reducing the need for additional electricity generation capacity and enhancing the stability of the electricity system	The deployment of smart grids in France is a critical factor for the development of local flexibility markets and the optimization of electricity distribution and consumption. Smart grids enable the integration of a wide range of actors into the electricity system, including small-scale producers and consumers, and allow for the integration of renewable energy sources into the electricity system, enhancing the stability and efficiency of the electricity grid	x	x	x	x	x		4
Demand response infrastructure deployment (smart metering)	Smart-metering technology has been deployed in France to enable electricity suppliers to monitor and control consumption in real-time and allows electricity suppliers to remotely collect data on the amount of electricity consumed by individual households and businesses, providing them with the ability to adjust electricity consumption in response to changing demand patterns. In the context of local flexibility markets, smart-metering technology has provided an opportunity for the development of innovative and flexible solutions to manage energy consumption at the local level. By enabling electricity suppliers to monitor and control electricity consumption in real-time, they can now offer more granular pricing models, such as dynamic pricing, that incentivize customers to shift their consumption patterns to times when energy is in low demand. This can help to reduce overall demand during peak periods and prevent grid overload, which can lead to blackouts. Furthermore, the deployment of smart-metering technology in France has facilitated the creation of local flexibility markets that enable the trading of energy at the local level. This allows local energy providers to buy and sell electricity based on local demand and supply conditions. By incentivizing consumers to shift their electricity consumption, these markets can help to reduce the overall cost of electricity for both consumers and providers. In terms of the impact on electricity, the deployment of smart-metering technology has enabled electricity providers to reduce energy consumption during peak periods, which has resulted in a more stable and reliable grid. Additionally, by incentivizing consumers to shift their consumption to times when energy is in low demand, smart-metering technology has helped to reduce the overall cost of electricity, as electricity providers can avoid the need to invest in expensive infrastructure to meet peak demand	The deployment of smart-metering technology in France has had a significant impact on the local flexibility markets and the electricity system. By enabling real-time monitoring and control of electricity consumption, it has facilitated the development of innovative and flexible solutions to manage energy consumption at the local level. This has led to more stable and reliable grids, reduced overall electricity costs, and increased opportunities for energy trading at the local level	x	x	x	x	x		3
Decentralised energy system and storage	Decentralised energy systems involve the generation of energy from smaller-scale, distributed sources such as rooftop solar panels, wind turbines, and small-scale hydroelectric plants. These systems can provide a more localized source of energy, reducing the need for long-distance transmission and distribution infrastructure. Energy storage technologies, such as batteries, also play a critical role in enabling the integration of renewable energy sources into the grid by providing a means to store excess energy and balance supply and demand. In France, the development of decentralised energy systems and energy storage has been supported by several policies and initiatives, including the "Smart Grids Plan" and the "Future Investments Program," which aim to promote the development of smart grid infrastructure and technologies, including energy storage. Additionally, the French government has introduced several regulatory frameworks to support the development of local flexibility markets, including the Capacité Réserve Réseau (CRR) mechanism, which allows market participants to provide flexible capacity to the grid. The development of decentralized energy systems and energy storage in France is also supported by a favourable regulatory framework for renewable energy sources, including feed-in tariffs and net-metering programs, which incentivize the development of distributed energy sources	The supportive policies and regulatory frameworks, along with investments in smart grid infrastructure and technologies, will be key to ensuring the stability and reliability of the electricity system as France transitions to a low-carbon energy future	x	x	x	x	x		4
TSO and DSO regulation	The TSO in France is known as RTE, which is responsible for managing the high-voltage transmission grid and ensuring the stability and reliability of the electricity system. RTE is subject to regulation by the French energy regulator, the Commission de Regulation de l'Energie (CRE). The regulation of RTE includes setting tariffs for access to the transmission grid and ensuring non-discriminatory access to the grid for all market participants. The DSOs in France are responsible for managing the low-voltage and medium-voltage distribution grids, which connect end-users to the transmission grid. There are approximately 150 DSOs in France, which are subject to regulation by the CRE. The regulation of DSOs includes setting tariffs for access to the distribution grid and ensuring non-discriminatory access to the grid for all market participants. In the context of local flexibility markets and the integration of renewable energy sources, the regulation of TSOs and DSOs is particularly important. TSOs and DSOs play a key role in enabling the integration of renewable energy sources into the grid by facilitating the connection of distributed generation sources and managing the variability of renewable energy sources. In France, the regulation of TSOs and DSOs has been evolving in recent years to support the development of local flexibility markets. This includes the introduction of new regulatory frameworks, such as the Capacité Réserve Réseau (CRR) mechanism, which allows market participants to provide flexible capacity to the grid to help manage the variability of renewable energy sources	The French government has introduced a number of policies to support the development of local flexibility markets, such as the "Smart Grids Plan" and the "Future Investments Program," which aim to promote the development of smart grid infrastructure and technologies, including demand response and energy storage	x	x	x	x	x		4

Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	In France, there is a growing interest in peer-to-peer (P2P) energy trading and virtual power plants (VPPs) as a means of facilitating local flexibility markets and improving the overall efficiency of the electricity system. However, the availability of ICT solutions for P2P energy trading and VPPs is still relatively limited. Currently, there are several platforms available in France that offer P2P energy trading, including Enercoop, EkWateur, and Lumo. These platforms allow consumers to buy and sell renewable energy directly from one another, without the need for intermediaries such as utilities. However, these platforms are still relatively small in scale and are not yet widely adopted. In terms of VPPs, there are also some solutions available in France, such as the NextFlex platform developed by Enedis. This platform allows distributed energy resources (DERs) such as solar panels and battery storage systems to be aggregated and managed as a single entity, enabling them to participate in local flexibility markets and provide grid services. However, the availability of ICT solutions for P2P energy trading and VPPs is still somewhat limited in France	There are several challenges that need to be addressed in order to fully realize the potential of these technologies, including the need for standardized communication protocols and data exchange formats, as well as the need for greater interoperability between different platforms and systems	x	x	x	x			2
Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	In France, the rights for active participation of customers in the electricity markets through guaranteed grid access, remuneration for energy fed into the grid, and demand response are essential considerations for the development of local flexibility markets. One of the fundamental rights for active participation of customers in electricity markets in France is the guaranteed grid access. This right ensures that customers have access to the electricity grid to distribute their energy, regardless of their location or size. It allows customers to become electricity producers by installing renewable energy sources and feeding excess electricity into the grid. This right is a crucial element for the development of local flexibility markets in France, as it allows for the participation of a wide range of actors, including small-scale producers and consumers. Remuneration for energy fed into the grid is another important right for active participation in electricity markets. It ensures that customers who produce excess electricity and feed it into the grid receive fair compensation for their contribution to the electricity system. France has implemented a feed-in tariff system that guarantees remuneration for renewable energy producers, ensuring a stable income stream for these actors and incentivizing further investment in renewable energy sources. Demand response is another right for active participation of customers in electricity markets in France. It allows customers to adjust their electricity consumption in response to changes in electricity prices or grid conditions, thereby reducing the need for additional electricity generation capacity and enhancing the stability of the electricity system. Demand response technologies are an essential element of local flexibility markets, as they allow customers to become active participants in the electricity system, helping to balance the electricity grid and enhance its efficiency	The guaranteed grid access, remuneration for energy fed into the grid, and demand response are all important elements that enable customers to become active participants in the electricity system, contribute to the development of renewable energy sources, and enhance the stability and efficiency of the electricity grid	x	x	x	x	x		4
Schemes and incentives that give advantage to big energy firms	The government implemented Feed-in Tariffs, which reward energy producers for the amount of energy they produce from renewable sources. This system is advantageous to big energy firms as they can produce more energy compared to smaller firms, thus earning greater rewards. Also, a system of renewable energy certificates whereby energy producers are rewarded for the percentage of energy they produce from renewable sources. Finally, the government implemented subsidies for the installation of new renewable capacities, which are tailored to the size of the firm, meaning that big energy firms are able to access larger subsidies than smaller firms. Different types of mechanisms exist depending on the installation size.	Large firms likely to benefit from supportive government-backed measures which will likely result in new large-scale RES projects	x	x			x		4
Grid connection costs	French government planned to reduce the cost of connecting renewable energy projects to the grid by implementing measure, e.g., reduced fees for small-scale installations, as well as for systems connected to regional grids, as well as implemented a range of subsidies and grants for renewable energy projects, which can be used to offset the cost of grid connection	French government implemented a range of measures to reduce the cost of connecting renewable energy projects to the grid which boosted their competitiveness	x	x		x			4
Uncertainty and limitations in feed-in-tariff levels and schemes	France experienced regulatory instability due to frequent changes in its legal framework governing renewable energy production which led to a lack of clarity regarding the long-term prospects of Feed-in Tariff levels and schemes, creating uncertainty for investors and developers. Also, there is a lack of transparency in French Feed-in Tariff levels and schemes with a lack of clarity for the competition in the market, resulting in higher prices for consumers. Thirdly, the financing options available for renewable energy projects in France are limited, making it difficult for investors and developers to access capital. For small installation, the supplier and the prosumer have a long-term contract with fixed prices that allow a better clarity.	Complex regulatory environment slowing down RES deployment locally and nationally	x				x		2
Legislative frameworks that make setting up LFM ventures difficult	Legal framework for renewable energy is complex and can be difficult for developers to navigate	New investments likely to be delayed due to framework complexity	x				x		2
Lack of support from local representatives/local energy agencies	A draft framework for CfD (contracts for difference) requiring developers to complete environmental permitting to participate in CfD. Visible support for wind and solar projects	Other than wind and solar projects might face delays due to their non-urgent nature	x		x		x		2
Lack of a policy framework for LFM investments	Geothermal energy can be financed by several mechanisms (like "MaPrimeRénov" or an eco-loan). Since 01/03/2023, households can receive 5000€ to switch to geothermal energy	Energy planning not effective enough to support geothermal energy	x				x		3
Not mentioning LC as a relevant actor	The government does not prioritize local projects supported by local communities, unless they are associated in non-profit associations	Difficult to enforce with no support of the local authorities, only support for non-profit associations	x		x		x		2
Complex and changeable policies regarding LFM development	France implemented Feed-in Tariffs (FiTs) to encourage the development of renewables. The FiTs are set based on the technology type, size, and the amount of energy produced, and are adjusted regularly. Secondly, France implemented a variety of tenders and auctions for renewable energy projects which are designed to promote the development of RES and to provide financial assistance for their development. Third, France implemented Renewable Energy Certificates (RECs). These certificates are intended to incentivize the development of renewable energy sources and are a way to track the progress of renewable energy development in the country. Fourth, France has implemented a carbon tax to encourage the reduction of emissions. This tax is intended to encourage the development of renewable energy sources as an alternative to traditional energy sources, such as coal and oil	Regulatory support boosting French renewable project ambitions	x				x		3

Lack of rules regarding the opportunity to operate micro-grids	Only the centralized grid operated by Électricité de France can provide energy to French consumers, the lack of competition and regulation has resulted in a situation where renewable energy micro-grids are unable to operate without significant financial and administrative barriers	They might not be enforced locally, it means not enough opportunities for renewable energy deployment locally	x			x	x		2
Lack of regional focus on renewable energy projects with LFM	French energy sector is heavily centralized, it means that the decision-making power lies with the government, and France traditionally favours large-scale, nationally funded projects over local initiatives	The government should prioritize the local content more than centralized	x	x			x		2
Energy policies may have unwanted negative connotations	The gap between the actual RES in place and France's renewable electricity production make the country attractive for private investors (thanks to incentives). Concerning decarbonisation, the main issue for RES development is that French government aims to extend the nuclear power plants park.	The government prioritizes wrong policies that are not addressing the need of decarbonisation	x	x	x	x	x	x	2
Lack of cooperation between local authorities and local communities	Local authorities often lack the resources and expertise to adequately educate their constituents on the potential benefits of renewable energy, and may be hesitant to deviate from traditional energy sources	Both sides should cooperate more on the energy transition and renewables	x		x				1
Difficulties for energy communities to generate enough surplus to cover organizational costs	The cost of renewables can be high for smaller energy communities as the maintenance and upkeep of renewable energy systems can be high, requiring significant capital investment. The lack of a comprehensive legal framework for renewable energy in France makes it difficult for energy communities to access government funding and subsidies, which could boost financial support for new projects	Delays in the local RES context	x	x	x				2
Lack of long-term government funding	Limited resources available to support renewable energy initiatives as French government facing significant budget constraints, it has been difficult to allocate the necessary funds to support renewable energy projects, which often require large upfront investments in recent months and years	Not enough political will supporting renewables and new projects	x	x	x				2
Initial financing problems at local government level	A change shift at the national government level that champions alternatives to renewables such as nuclear	Less support for renewables in the LFMs	x	x	x				3
National energy policy change and shift from RES to HYD	The change in policy driven by several factors, e.g., declining cost of hydrocarbons, the slow pace of renewable energy development, and the increasing demand for energy in France	Insufficient government support and high-RES deployment costs	x	x			x		1
Difficulty in accessing loans/contracts/funding for LFM projects	One reason for the difficulty in accessing funding is the high level of competition for capital among renewable energy projects. With many renewable energy projects vying for limited funding, investors are more selective in the projects they choose to finance, which can make it difficult for renewable energy developers to secure funding	Not enough financial support at the local level due to changing priorities due to higher competition for funding	x	x		x	x	x	1
Lack of tax exemptions or incentives unlocking new investment opportunities	Despite the French government's efforts to increase the share of renewable energy in the country's energy mix, the absence of tax incentives has made it difficult for investors to support renewable energy projects. One of the main reasons for the lack of tax incentives is the French government's focus on reducing the country's debt and budget deficit, which has resulted in limited resources being allocated towards supporting renewable energy initiatives	The lack of tax exemptions and incentives can discourage potential investors from investing in renewable energy projects, thus further limiting the growth of the sector	x	x	x				1
Investment incentives for hydrocarbons instead of RES	France offers a variety of investment incentives for hydrocarbons instead of renewable energy sources (RES). These incentives are designed to encourage investment in hydrocarbon-based energy sources, such as oil and gas. The government also created tax incentives for investment in oil and gas exploration and production, including the deduction of up to 50% of exploration and production costs from corporate income tax.	Delays in RES deployment in the LFMs context - low public trust in renewables	x	x	x		x		2
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	High return on investment in France may be due to the government's generous subsidies for renewable energy sources, which provide incentives for investors to pursue renewable energy projects	Higher than expected investments for the right technologies nationally	x	x	x		x	x	3
Lack of experience with LFM	Might be not enough outreach to energy communities as to learn about their direct energy needs	Possible delays in project planning			x	x			3
Low trust in renewable energy technologies	There are public subsidies to invest in new renewable technologies (including R&D). The development of the gas sector is not that popular especially since the beginning of the energy crisis. There is also a government wish to act and develop the hydrogen sector in the next decade.	Change in the energy complex paradigm resulting in lower RES ambitions on this occasion	x		x		x		2
Possible loss of support if the projects exceed certain size	If a project exceeds certain size in France, there is a possibility of losing support from both the public and private sectors. Specifically, there is a risk of losing government support in the form of grants and subsidies, as well as potential private sector partners who may be wary of taking on too large a project	Public opinion and media coverage can also be a source of lost support for large projects due to potential environmental, economic, or social concerns that may arise	x	x	x	x	x	x	1
Lengthy grid connection procedures	Not sufficient planning at national and local levels	Delays in connecting new RES plants to the grid	x	x	x	x	x		2

Lack of interest and engagement in the promotion of LFM	There is a lack of public awareness and education around renewable energy sources, specifically RES technology. The lack of education led to no understanding and acceptance of the potential benefits of RES, which has led to a lack of enthusiasm and investment in the sector as government has not actively pursued policies that would promote the use of renewables, such as implementing generous tax incentives or subsidies	Public unawareness resulting in fewer RES projects	x		x			x	1
Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	Too long relationship with fossil fuels and nuclear energy resulting in national dilemma	Might affect country's net-zero targets due to fewer RES projects	x		x		x		1
Lack of experience in commissioning and managing RES projects	One of the main issues is the lack of technical expertise available as France does not have a large pool of experienced engineers and project managers that are familiar with the complexities of RES projects. This has led to inexperienced personnel being assigned to these projects, which has caused delays due to a lack of knowledge and understanding of the necessary processes	Current regulations are outdated and do not adequately address the needs of the modern energy sector, resulting in confusion and difficulties in obtaining necessary permits and approvals from local authorities			x	x			1
Lack of accessible area for new renewable plants	Too many highly urbanized areas where conditions for renewables are sufficient	High urbanization requires the shift in project area planning	x		x	x			2
Lack of sufficient requalification/training for potential LFM technology staff	The government does not invest enough in requalification of the workforce	Fewer experts that can work on the RES projects	x	x	x	x	x	x	2
Difficulty in securing labour for LFM projects	People prefer to work in low-labour settings where they do not need to requalify	Affects project capacities as not enough workforce		x	x	x			2
Rigid legal, bureaucratic, and administrative procedures	National and local policies championing hydrocarbons instead of renewables	Can disturb the LFMs context		x	x				2
Insufficient regulation regarding smart metering	Smart metering has been largely put in place in the last 6 years by the main French DSO (Enedis) and covers more than 90% households in France. Households that still refuse smart metering system (Linky) will be financially penalized in the coming years	Might affect the integration of smart metering with the plants	x	x	x		x		2
Strong aversion to risk towards larger RES projects	The authorities in some instances, prefer smaller projects due to lower operational and financial risk	Can affect large project ambitions	x				x		2
Lack of cooperation with other local communities to share expertise/knowledge/resources	Dialogue is made by some associations such as Energie Partagée (https://energie-partagee.org/). They help ECs with their communication plan and disseminate good practices.	Might affect local LFMs projects			x			x	3
Low citizen involvement in decision making activities	The government should organize public consultations on the future of renewables in France as society in some parts of the country do not pay attention to renewables issues	No to little citizen involvement has a negative impact onto attracting smaller developers, the country is focused on large operators	x	x	x				2

Country:	Portugal								
Factor (title)	Factor (description)	Impact for LFM development in the country	Political	Economic	Social	Technological	Legal	Environmental	Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)
Market structures that support centralised energy production/local flexibility markets	Market structure: Regulated Monopoly Suppliers – large, state-controlled companies that are responsible for the production, transmission and distribution of electricity and gas in Portugal. They are subject to regulation by the Portuguese energy regulator, and any changes in tariffs or terms and conditions must be approved by the regulator. Suppliers of renewable energy – companies producing electricity from renewables such as wind, solar and hydro. They are subject to the same regulatory regime as the regulated monopoly suppliers, but they can benefit from preferential tariffs and other incentives. Independent Electricity Producers – companies that are able to produce electricity from non-renewable sources such as coal, oil and gas. They are subject to the same regulatory regime as the other market players. Wholesale Electricity Markets – markets where electricity is traded on a short-term basis and open to all market players, and they are regulated by the Portuguese energy regulator The government introduced a Feed-in Tariff (FIT) in 2003, a renewable energy auction system in 2011, a green certificate system in 2013, and a capacity market in 2018	Stable and secure framework for centralised production in Portugal which unlocks new RES investments. Market structures have allowed Portugal to successfully transition to a more renewable energy-based economy, providing incentives for investment and encouraging the development of local flexible markets	x	x		x	x		4
Security of energy supply	The Portuguese electricity market was liberalized in 2004 and is currently based on a combination of a centralized market, the Iberian Electricity Market (MIBEL), and several local flexibility markets. Portugal has made significant progress in recent years as the country has diversified its sources of energy and has invested heavily in renewable energy, particularly wind and solar. Portugal's energy mix is now one of the most renewable in Europe, with renewables accounting for around 60% of the country's electricity generation. The development of renewable energy sources has reduced Portugal's dependence on imported fossil fuels, thereby increasing the security of energy supply. Portugal has developed a robust electricity transmission and distribution system that can efficiently transport electricity across the country, ensuring that electricity is available when and where it is needed. Portugal has been working on the development of energy storage technologies, which can play a critical role in ensuring the security of energy supply. Energy storage allows for the storage of excess electricity during times of low demand and the release of stored energy during times of high demand, helping to balance the electricity system and ensuring a secure supply of electricity. The government also worked on the development of demand response technologies, which can help to manage electricity demand during peak times and reduce the need for additional electricity generation capacity. Demand response technologies allow consumers to adjust their electricity consumption patterns in response to changes in electricity prices or grid conditions, thereby reducing the need for additional electricity generation capacity and enhancing the security of energy supply	Portugal has made significant progress in ensuring the security of energy supply in the context of local flexibility markets and electricity. The development of renewable energy sources, a robust electricity transmission and distribution system, energy storage technologies, and demand response technologies are all critical factors that contribute to the country's energy security.	x	x	x	x	x		4
Innovation capacity and digital independence	Portugal has been making significant strides in recent years in terms of innovation capacity. The country has been investing heavily in renewable energy, particularly wind and solar, and has become a leader in these areas. Portugal's commitment to renewable energy has led to the development of innovative technologies and business models that support the integration of these sources into the electricity system. The government of Portugal has been working on the development of smart grid technologies that enable the integration of renewable energy sources, energy storage, and demand response technologies. These smart grids provide greater visibility and control over the electricity system, allowing for more efficient management of electricity generation and consumption. In terms of digital independence, Portugal has been making efforts to ensure that its electricity system is not dependent on external actors or technologies. The country has been working on developing its own digital infrastructure to support the electricity system, including the development of local energy management systems and smart grid technologies. Furthermore, Portugal has been working on the development of block chain-based systems for energy trading and management. These systems offer a high degree of digital independence, as they allow for secure, transparent, and decentralized energy trading without the need for central intermediaries	Portugal has shown a strong innovation capacity and a commitment to digital independence in the development of its electricity system. These factors will be critical for the successful development of local flexibility markets in the country, which will play a significant role in the transition to a more sustainable and resilient electricity system	x	x	x	x	x		3
Attitudes towards energy efficient products, services, technologies, and appliances	Portugal has been a pioneer in renewable energy, having set ambitious targets to reduce its carbon emissions. This has led to an increased awareness of the importance of energy efficiency and a growing demand for energy-efficient products and services. In recent years, there has been a significant increase in the adoption of energy-efficient products and technologies, particularly in the residential sector. This is due in part to government incentives and subsidies for the installation of energy-efficient appliances, such as solar panels and heat pumps. There has also been an increased focus on the energy efficiency of buildings, with the government implementing measures to improve insulation and reduce energy consumption in buildings. The local flexibility markets in Portugal have also contributed to the positive attitudes towards energy-efficient products and services. These markets allow households and businesses to generate and sell their own energy, which incentivizes the adoption of renewable energy technologies and energy-efficient appliances. This has led to increased investment in renewable energy sources, such as solar and wind power, and a reduction in energy consumption. Also, there has been a growing interest in smart meters and home automation systems, which enable consumers to monitor and control their energy consumption in real-time. These technologies have been particularly popular among consumers who are concerned about their energy usage and want to reduce their carbon footprint	The government's focus on renewable energy, along with incentives and subsidies for energy-efficient products, has led to an increased adoption of energy-efficient technologies and appliances. The local flexibility markets have further incentivized the adoption of renewable energy sources, while smart meters and home automation systems have allowed consumers to take greater control of their energy usage	x	x	x	x	x		3

Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	The willingness to invest in energy transition in Portugal has been increasing in recent years, driven by the need to reduce greenhouse gas emissions and meet the country's renewable energy targets. This includes not only financial investments but also efforts in terms of time, resources, and infrastructure One of the key areas of investment in energy transition in Portugal is the development of local flexibility markets. These markets are designed to enable the integration of renewable energy sources into the grid by allowing for more flexible energy consumption and production. This requires investment in smart grid infrastructure and technology, such as advanced metering systems, energy storage, and demand response systems. The development of local flexibility markets in Portugal has been supported by several initiatives and policies, including the National Energy Strategy 2020-2030, which aims to increase the share of renewable energy in the country's energy mix and promote energy efficiency measures. The strategy also includes the establishment of a national flexibility platform to facilitate the integration of renewable energy sources into the grid. The nation has made significant progress in increasing its share of renewable energy sources, particularly wind and solar power. In 2020, renewable energy accounted for 55% of Portugal's electricity consumption, with wind power alone accounting for over 27% of the country's electricity generation. This has been supported by policies and initiatives such as the Renewable Energy Auction Program and the National Plan for Energy and Climate 2030	There are still challenges to be addressed in the energy transition in Portugal, particularly in terms of the integration of renewable energy sources into the grid. This requires further investment in infrastructure and technology, as well as the development of new policies and regulations to support the growth of local flexibility markets	x	x	x	x	x		3
Smart grids deployment	In Portugal, the deployment of smart grids is seen as a key enabler of local flexibility markets and a more efficient and sustainable energy system. Smart grids are designed to integrate advanced technologies, such as sensors, automation, and communication systems, into the electricity grid. This allows for greater monitoring and control of the grid, enabling more efficient use of energy and better integration of renewable energy sources. One of the key benefits of smart grids in Portugal is the ability to better manage the variability of renewable energy sources, such as wind and solar. Smart grids can use real-time data to forecast energy production and consumption, allowing for more effective management of the grid and better integration of renewable energy sources which reduces the need for fossil fuel power plants and helps to reduce greenhouse gas emissions	The deployment of smart grids in Portugal is critical for the development of local flexibility markets and a more efficient and sustainable energy system. By enabling the integration of renewable energy sources, facilitating demand response programs, and promoting new business models and energy services, smart grids are helping to transform the energy sector in Portugal and promote a more sustainable future	x	x	x	x	x		3
Demand response infrastructure deployment (smart metering)	In Portugal, smart metering deployment has been ongoing since 2009, with a goal to have all households equipped with smart meters by 2020. Back in 2021, it is estimated that around 90% of households in Portugal had smart meters installed. The deployment of smart metering has enabled the implementation of demand response programs, such as the Interruptibility Program, which provides financial incentives for large industrial consumers to reduce their electricity consumption during periods of peak demand. Additionally, the use of smart meters allows for more accurate billing and can help to reduce energy waste and lower electricity costs	The deployment of smart metering in Portugal has also faced some challenges, such as concerns about data privacy and security. The Portuguese government has implemented regulations to ensure that consumer data is protected and used only for authorized purposes	x	x	x	x	x		2
Decentralized energy system and storage	In Portugal, the adoption of decentralized energy systems has been increasing, with the installation of small-scale renewable energy sources such as solar panels, wind turbines, and micro-hydro plants Energy storage is an essential component of a decentralized energy system and allows for excess energy produced by renewable sources to be stored and used when needed, thereby increasing the overall flexibility of the energy system. There has been a significant increase in the deployment of energy storage systems in recent years, particularly for residential and commercial customers. The development of a decentralized energy system and energy storage is critical to the success of local flexibility markets in Portugal. Local flexibility markets enable the integration of small-scale renewable energy sources and energy storage systems into the energy system. These markets allow customers to participate in energy markets by providing flexibility services such as demand response, energy storage, and aggregation of small-scale generation resources	The adoption of these systems enables the integration of small-scale renewable energy sources, increases the overall flexibility of the energy system, and aligns with the country's energy policy goals. However, the deployment of these systems also presents several challenges that need to be addressed, including the integration into the existing grid infrastructure	x	x	x	x			3
TSO and DSO regulation	The TSO regulation in Portugal is primarily governed by the Portuguese Energy Services Regulatory Authority (ERSE) and responsible for the transmission of electricity from power generation plants to distribution systems. The TSO ensures that the transmission system is reliable, secure, and efficient. In the context of local flexibility markets, the TSO plays a crucial role in facilitating the integration of renewable energy sources and balancing the grid. the DSO regulation in Portugal is governed by the General Directorate of Energy and Geology (DGEG). The DSO is responsible for the distribution of electricity to end-users through the distribution network. The DSO ensures that the distribution system is reliable, secure, and efficient. In the context of local flexibility markets, the DSO plays a crucial role in managing the distribution network and integrating small-scale distributed energy resources (DERs) such as rooftop solar panels, electric vehicles, and battery storage systems. Both TSO and DSO regulations in Portugal have been undergoing significant changes in recent years to accommodate the evolving energy landscape. The Portuguese government has introduced several initiatives to encourage the development of local flexibility markets, including the establishment of the Portuguese Energy Storage Association (APESB) and the creation of a regulatory framework for the operation of virtual power plants (VPPs)	One of the key challenges facing TSOs and DSOs in the context of local flexibility markets is the need to manage the increasing complexity of the energy system. The growing number of DERs connected to the grid, along with the variability of renewable energy sources, can lead to grid instability and power quality issues. To address these challenges, TSOs and DSOs are increasingly relying on advanced digital technologies such as artificial intelligence (AI), machine learning (ML), and block chain	x	x		x	x		2
Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	Domestically, there are currently several ICT solutions available for peer-to-peer (P2P) energy trading and virtual power plants (VPPs) in the context of local flexibility markets and electricity in Portugal. These solutions are designed to enable consumers to sell excess electricity generated from renewable sources back to the grid, and to trade energy with their neighbours in a decentralized and more sustainable manner. One of the main solutions available for P2P energy trading and VPPs in Portugal is the use of block chain technology, such as We Power and Power Ledger provide a secure and transparent way for consumers to buy and sell energy in real-time, without the need for intermediaries. These platforms also allow consumers to track the source of their energy and ensure that it comes from renewable sources. Another ICT solution available in Portugal for P2P energy trading is the use of smart contracts. Smart contracts can be used to automate the buying and selling of energy between consumers, and to ensure that transactions are settled automatically once certain conditions are met. This eliminates the need for intermediaries and reduces transaction costs. In addition to these solutions, there are also several VPP solutions available in Portugal. VPPs are a collection of distributed energy resources that are aggregated and managed as a single entity. These resources can include solar panels, wind turbines, and energy storage systems. VPP solutions such as Generali's and Next Kraftwerke enable consumers to participate in demand response programs, where they can offer their energy resources to the grid in exchange for financial incentives	The availability of ICT solutions for P2P energy trading and VPPs in the context of local flexibility markets and electricity in Portugal is quite good. The use of block chain technology and smart contracts provides a secure and transparent way for consumers to trade energy, while VPP solutions enable consumers to participate in demand response programs and monetize their energy resources	x	x	x	x	x		4

Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	Portuguese customers have the right to actively participate in electricity markets through guaranteed grid access, remuneration for energy fed into the grid, and demand response programs as the rights are outlined in the country's energy legislation and are aimed at promoting the development of local flexibility markets and a more efficient and sustainable energy system. Guaranteed grid access is one of the fundamental rights of electricity consumers in Portugal and means that all customers have the right to connect to the grid and access electricity, regardless of their location or the type of generation technology they use. This is particularly important for customers who generate their own electricity through renewable sources, such as solar panels, as it ensures they can sell any excess electricity they generate back to the grid. Remuneration for energy fed into the grid is also an important right for customers in Portugal. The country has established a feed-in tariff system that provides financial incentives to produce renewable energy, including solar, wind, and hydroelectric power. This means that customers who generate their own electricity can earn money by selling any excess energy they produce back to the grid. Demand response programs are another key aspect of customer participation in electricity markets in Portugal. These programs allow customers to reduce their energy consumption during periods of peak demand, in exchange for financial incentives. This helps to balance the grid and reduce the need for expensive and polluting fossil fuel power plants to be brought online during times of high demand	The rights help to promote the adoption of renewable energy, reduce energy consumption during periods of peak demand, and encourage the development of new energy technologies and business models	x	x	x	x	x		4
Schemes and incentives that give advantage to big energy firms	Feed-in Tariffs - government-regulated payments that energy firms receive when they produce renewable energy. The tariffs are higher for larger energy companies, giving them a financial incentive to invest in renewable energy. Long-Term Contracts - big energy firms are often able to secure long-term contracts with utilities and other energy customers which gives them a steady stream of income and makes them more attractive to investors. Government subsidies - generous subsidies for renewable energy projects, which often go to large energy firms. This helps to reduce the cost of investing in renewable energy, making it more attractive to big companies. Regulatory Support - Portugal has passed several policies that give big energy firms an advantage when it comes to developing renewable energy projects. This includes providing them with access to transmission lines and other infrastructure	Generic schemes and incentives championing enormous RES growth across Portugal	x	x			x		4
Grid connection costs	Relatively high when compared to other countries in the region since the Portuguese electric grid is not particularly well-developed and needs to be upgraded to accommodate the influx of renewable energy sources. Also, the country faces significant infrastructure and regulatory challenges which contribute to high grid connection costs. These include the need to upgrade existing transmission lines and substations, as well as the need to develop a new regulatory framework for renewable energy projects.	Vast financial support needed for connecting new RES to the grid	x	x		x			1
Uncertainty and limitations in feed-in-tariff levels and schemes	The Portuguese government recently announced a new set of feed-in-tariff levels, which are lower than the previous ones. These new rates are still uncertain and subject to change, depending on the results of the public consultation process; they are also limited in scope as they are only available for certain types of renewable energy projects such as wind and solar photovoltaics. Their duration is also short, only 15 years which less than in other EU countries	Wrong Fit planning resulting in possible project cancellations/amendments	x				x		2
Legislative frameworks that make setting up LFM ventures difficult	Legal framework for renewable energy is complex and can be difficult for developers to navigate	New investments likely to be delayed due to framework complexity	x				x		2
Lack of support from local representatives/local energy agencies	A draft framework for CfD (Contracts for Difference) requiring developers to complete environmental permitting to participate in CfD. Visible support for wind and solar projects	Other than wind and solar projects might face delays due to their non-urgent nature	x		x		x		2
Lack of a policy framework for LFM investments	The main problem with the lack of a policy framework is that it creates an uncertain environment for potential investors, making it difficult for them to assess the long-term profitability of RES investments. Since April 2020, natural gas used for electricity generation (excluding co-generation) is subject to a progressive reduction of the ISP and carbon tax exemptions. Since April 2020, natural gas used for electricity generation (excluding co-generation) is subject to a progressive reduction of the ISP and carbon tax exemptions. This is intended to favour the deployment of renewable generation, although the NECP indicates that natural gas electricity generation will be maintained until at least 2040	Without a policy framework to provide the necessary security and incentives for RES investments, Portugal will struggle to reach its renewable energy goals. The progression of the ISP and carbon tax exemption for natural gas is intended to favour the deployment of renewable generation, although the NECP indicates that natural gas electricity generation will be maintained until at least 2040	x				x		2
Not mentioning LC as a relevant actor	The government does not prioritize local projects supported by local communities, unless they are associated in non-profit associations	Difficult to enforce with no support of the local authorities, only support for non-profit associations	x		x		x		2
Complex and changeable policies regarding LFM development	Renewable Energy Sources Support Mechanism (RES-E), a Feed-in Tariff (FiT) system, and a quota system for the purchase of RES-E electricity and The Portuguese Renewable Energy Action Plan (PREAP) aims to increase the share of renewable energy in the electricity mix from 28.3% in 2020 to 60% by 2040	May delay new investments due to policy complexity	x				x		2
Lack of rules regarding the opportunity to operate micro-grids	Government promotes the adoption of smart grid technology as a way of improving the efficiency of national grid	They might not be enforced locally; it means that there is not enough opportunities in the local context	x			x	x		2
Lack of regional focus on renewable energy projects with LFM	The country has a decentralized energy market, which means that each region is responsible for its own energy production and distribution. As a result, regions have not adequately invested in renewable energy projects, leading to a reliance on traditional sources of energy such as coal, gas, and oil	The government should prioritize the local context as the regional planning lacks behind the country as a whole	x	x			x		1
Energy policies may have unwanted negative connotations	Current national policy of generating electricity from renewables resulted in an increase in the cost of electricity for consumers, as well as an increase in the cost of installation for renewable energy projects. This has caused some scepticism and resistance from consumers who feel that the cost of renewable energy is too high, and the benefits are not worth it. Another policy that has had negative connotations is the government's focus on promoting the use of natural gas for electricity generation, which has led to decreased investment in renewable energy project. The government is focused on encouraging large scale energy projects, such as wind farms and hydro-electric dams, rather than smaller-scale projects that could be more beneficial to local communities	The government prioritizes wrong policies which punished small-scale RES investments	x	x	x	x	x		2

Lack of cooperation between local authorities and local communities	Portuguese citizens are often unaware of the economic, environmental, and social benefits of renewable energy, and this has contributed to a lack of support for local initiatives. Furthermore, the lack of a clear legal framework governing the development of renewable energy projects in Portugal has contributed to the lack of cooperation between local authorities and local communities	Both sides should cooperate more on the energy transition and renewables. The government should educate the residents	x	x	x	x			1
Difficulties for energy communities to generate enough surplus to cover organizational costs	Local authorities often lack the necessary financial resources to develop such projects which affects energy communities interested in working on local renewable energy projects	Delays in the local RES context	x	x	x				2
Lack of long-term government funding	Decision-making tends to be bureaucratic and collaborative relationships with local companies are considered the most appropriate strategy for entering the Portuguese market. Portugal continues to be an attractive market for the development of renewable energy. However, decision-making tends to be bureaucratic and collaborative relationships with local companies are considered the most appropriate strategy for entering the Portuguese market. Any major project will mostly require some joint venture	Limited access to research and capital resulting in fewer to no projects. Any major project will mostly require some joint venture between the parties involved	x	x	x				1
Initial financing problems at local government level	In March 2020, Portugal announced a EUR 9.2 billion stimulus package consisting mainly of broad fiscal measures, state-backed credit guarantees and increased social payments. Portugal also took actions specific to the energy sector, including fast-tracking the permitting and grid connection of 220 solar photovoltaic (PV) projects.	Providing funding to public transportation operators, and introducing a financial support programme for building energy efficiency measures, which was highly successful and will be continued in the coming years within a stimulus package	x	x	x				1
National energy policy change and shift from RES to HYD	Portugal's plan supports the green transition through a large-scale investment programme of €300 million to improve the energy-efficiency of residential buildings. This investment is accompanied by further investments in the energy-efficiency of public buildings. Extensions of the metro networks in Lisbon and Porto for over €600 million will make transport more sustainable. In addition, the plan involves the private sector deploying 15,000 electric vehicle charging stations by 2025. €185 million support Portugal's ambition to expand the production of renewable hydrogen. Projects for the greening of industry will also be supported with more than €800 million. There is a strong focus on electricity and natural gas interconnection to unlock the potential of Portugal's solar and wind resources and liquefied natural gas capacity to support local economic development and European energy security. To achieve these ambitious goals, Portugal announced the decommissioning of the country's two coal-fired thermoelectric power plants. The EDP coal-fired power plant in Sines closed in January 2021, and the Tejo Energia Pego power plant closed on the 30th of November 2021. The country has also developed a hydrogen strategy to decrease natural gas imports and reduce greenhouse gas emissions by 2030		x	x			x		1
Difficulty in accessing loans/contracts/funding for LFM projects	Too many rules at the national level, often dictated by the region it is addressed at	Not enough financial support at the local level due to changing priorities	x	x		x	x	x	3
Lack of tax exemptions or incentives unlocking new investment opportunities	Portugal's plan supports the green transition through a large-scale investment programme of €300 million to improve the energy-efficiency of residential buildings. This investment is accompanied by further investments in the energy-efficiency of public buildings. Extensions of the metro networks in Lisbon and Porto for over €600 million will make transport more sustainable. In addition, the plan involves the private sector deploying 15,000 electric vehicle charging stations by 2025. €185 million support Portugal's ambition to expand the production of renewable hydrogen. Projects for the greening of industry will also be supported with more than €800 million	Portugal's drive towards creating a sustainable transport network based on hydrogen and electric vehicles to unlock large investments in hydrogen technology in the country	x	x	x				3
Investment incentives for hydrocarbons instead of RES	Driven by the cost-effectiveness of hydrocarbons as a fuel source compared to renewable energy sources, e.g., the cost of electricity from natural gas is much lower than from renewable energy sources, allowing energy producers to maximize their profits	Delays in RES deployment in the LFMs context - shift in priorities caused by energy security dilemma and lower costs of hydrocarbons	x	x	x		x		1
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	Policy planning at the federal level with a mismatch between the expectations and the reality	Lower than expected investments for the right technologies	x	x	x		x	x	2
Lack of experience with LFM	Might be not enough outreach to energy communities as to learn about their direct energy needs	Possible delays in project planning affecting the RES projects			x	x			3
Low trust in renewable energy technologies	The government has set a fund to finance research and projects on innovation and technological development in the field of renewable energy, as well as has started campaigns to raise awareness on RES issues	Change in the energy complex paradigm resulting in higher RES ambitions thanks to €13.9 billion in grants and €2.7 billion in loans for supporting Portugal's green and digital transition	x		x		x		3
Possible loss of support if the projects exceed certain size	The Portuguese public may not be willing to pay the extra costs associated with larger projects, and may also be concerned about the environmental impact that large projects may have	Large projects may take a long time to complete, and the public may become impatient with the process and loss interest, resulting in a loss of support	x		x	x	x	x	2
Lengthy grid connection procedures	Not sufficient planning at national and local levels	Delays in connecting new RES plants to the grid	x	x	x	x	x		2
Lack of interest and engagement in the promotion of LFM	A need to educate the public on the benefits of utilizing renewable energy sources, such as improved air quality, reduced energy costs, and increased energy independence	Too much scope being put onto fossil fuels nationally, citizens are not educated on the benefits of RES	x		x			x	1

Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	Many people in Portugal, particularly in rural areas, are afraid of losing their jobs or income as a result of implementing renewable energy sources. This fear is compounded by a lack of understanding about the technology, which leads to unfounded beliefs about the potential risks associated with it	Low citizen involvement due to a lack of understanding of RES	x		x		x		1
Lack of experience in commissioning and managing RES projects	Portugal has only very recently begun transitioning to a more renewable energy-oriented economy, which means that the country has a limited amount of experience with the commissioning and management of such projects. Also, economic situation in the country prevents bigger renewable energy investments due to the costs associated with them	The Covid-19 pandemic resulted in national shift away from renewables as it was too expensive for Portugal to invest in renewables at the time			x	x			2
Lack of accessible area for new renewable plants	Too many highly urbanized areas where conditions for renewables are sufficient, but Portugal is starting to make use of the water lands. A floating solar farm on a hydropower reservoir can be connected to existing links to the power grid making it cost-effective and an excess of power generated on sunnier days can pump water up into the lake to be stored for use on cloudy days or at night. Portugal is starting to make use of the water lands. A floating solar farm on a hydropower reservoir can be connected to existing links to the power grid making it cost-effective and "excess power generated on sunnier days can pump water up into the lake to be stored for use on cloudy days or at night"	High urbanization requires the shift in project area planning towards water-based technological solutions, e.g., floating solar and wind farms	x		x	x			2
Lack of sufficient requalification/training for potential LFM technology staff	The government does not invest enough in requalification of the workforce	Fewer experts that can work on the RES projects	x	x	x	x	x	x	2
Difficulty in securing labour for LFM projects	People prefer to work in low-labour settings where they do not need to requalify	Affects project capacities as not enough workforce		x	x	x			2
Rigid legal, bureaucratic, and administrative procedures	National and local policies championing hydrocarbons instead of renewables	Can disturb the LFMs context		x	x				2
Insufficient regulation regarding smart metering	An outdated regulation regarding smart metering	Might affect the integration of smart metering with the plants	x	x	x		x		2
Strong aversion to risk towards larger RES projects	The authorities in some instances, prefer smaller projects due to lower operational and financial risk	Can affect large project ambitions	x				x		2
Lack of cooperation with other local communities to share expertise/knowledge/resources	The dialogue between the parties is difficult to reach	Might affect local LFMs projects			x			x	2
Low citizen involvement in decision making activities	The government should organize public consultations on the future of renewables in Portugal as society in some parts of the country do not pay attention to renewables issues	No to little citizen involvement has a negative impact onto attracting smaller developers, the country is focused on large operators	x	x	x				2

Country:	Ireland								
Factor (title)	Factor (description)	Impact for LFM development in the country	Political	Economic	Social	Technological	Legal	Environmental	Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)
Market structures that support centralised energy production/local flexibility markets	Market structures include Feed-in Tariffs (FiT) - a policy tool that rewards renewable energy producers for supplying energy to the grid. The Irish government established a FiT for renewable energy in 2011, providing a guaranteed payment for renewable energy sources such as wind, solar, and hydropower. The FiTs was an important driver in encouraging investment in renewable energy projects. Renewable Energy Obligation (REO) - the government established a REO requiring energy suppliers to obtain a percentage of their electricity from renewables, which helped to increase the amount of renewable energy on the Irish grid and incentivise renewable energy projects. Renewable Energy Support Scheme (RESS) - a government programme that provides financial support for renewable energy projects, including funding for research and development, as well as funding for the construction and operation of renewable energy projects. Renewable Energy Credits (RECs) - that are tradable certificates that are awarded to renewable energy producers for supplying energy to the grid. The Renewable Energy Support Scheme (RESS) that sets out a framework for the operation of renewable energy in the country, including a range of financial incentives to encourage the development of renewable energy sources. Secondly, the Electricity Market Reform (EMR) that is a policy that sets out the framework for the operation of the electricity market in Ireland, including the creation of a single electricity market, the Renewable Energy Feed-in Tariff (REFiT) scheme that sets out the tariffs for the sale of generated renewable energy, allowing producers to receive a fixed price for their energy. And lastly, the Renewable Energy Obligation (REO) scheme. This scheme sets out the obligations on electricity suppliers to purchase a certain amount of renewable energy from the market	Likely to significantly boost renewable energy deployment across Ireland. A variety of policies supporting renewable energy deployment and production across Ireland	x	x					4
Security of energy supply	The electricity system operator, EirGrid, has been actively exploring the development of local flexibility markets as a means of integrating DERs into the grid. These markets would allow DER owners to provide flexibility services to the grid operator, such as adjusting their electricity consumption or exporting excess energy back to the grid when needed. But despite the progress that has already been made, the increasing penetration of DERs can lead to fluctuations in the electricity supply, which can create grid stability issues. In addition, the use of digital technologies to manage these resources can create new cyber security risks	The security of energy supply in the context of local flexibility markets and electricity in Ireland is a complex issue that requires a comprehensive approach. By implementing robust security measures and developing innovative solutions, the electricity industry can enhance the security of energy supply while also accelerating the transition to a more sustainable energy system	x	x	x	x	x		2
Innovation capacity and digital independence	Ireland has put a strong focus on innovation in the energy sector, with several initiatives aimed at promoting the development and deployment of new technologies, e.g., the Irish government has established several funding programs to support research and development in areas such as renewable energy, energy storage, and smart grids. Also, there is a growing community of innovative startups and companies in Ireland that are developing new solutions for the energy sector. These companies are leveraging technologies such as artificial intelligence, block chain, and the internet of things to create new business models and services that can help to promote the transition to a more sustainable and efficient energy system. Digital independence is also important in the context of local flexibility markets and electricity in Ireland. The energy sector relies heavily on digital technologies such as advanced metering infrastructure, energy management systems, and demand response platforms. Therefore, it is essential to ensure that these technologies are secure, reliable, and independent	Ireland invests in a range of initiatives aimed at enhancing the cybersecurity of the energy sector. These include the development of national cybersecurity strategies, the establishment of dedicated cybersecurity centres, and the promotion of cybersecurity awareness and training	x	x	x	x	x		3
Attitudes towards energy efficient products, services, technologies, and appliances	There has been a significant shift in attitudes towards energy-efficient products, services, technologies, and appliances in recent years in Ireland. Consumers have become increasingly aware of the benefits of energy efficiency, both in terms of reducing their energy bills and contributing to a more sustainable future. In the context of local flexibility markets and electricity in Ireland, energy efficiency has become a key priority for both consumers and electricity providers. Consumers are looking for ways to reduce their energy consumption and contribute to a more sustainable future, while electricity providers are seeking to manage peak demand periods and reduce the need for costly investments in new power generation capacity. To incentivize consumers to adopt energy-efficient products and services, electricity providers in Ireland have introduced a range of programs and initiatives, e.g., some providers offer financial incentives, such as rebates or lower tariffs, for consumers who install energy-efficient appliances or technologies in their homes. Others have introduced demand response programs that reward consumers for reducing their energy consumption during peak periods. The Irish government has been actively promoting energy efficiency through a range of policies and initiatives, including the Sustainable Energy Authority of Ireland (SEAI) and the Energy Efficiency Obligation Scheme. These policies and initiatives aim to encourage the adoption of energy-efficient products and technologies by offering financial incentives, such as grants and tax credits, to consumers and businesses	The Irish government has been actively promoting energy efficiency through policies and initiatives, and consumers are increasingly aware of the benefits of energy efficiency. As such, energy efficiency is likely to play an increasingly important role in the development of local flexibility markets and the management of electricity supply and demand in Ireland	x	x	x	x	x		3
Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	The widespread growing awareness of the need to invest in energy transition is highly promoted by the Irish government that has set ambitious targets for renewable energy deployment, with a target of 70% renewable electricity by 2030. To achieve these targets, significant investment in renewable energy sources such as wind, solar, and hydro power is required. There is also a growing interest from private investors in the energy transition. The deployment of local flexibility markets and other advanced energy technologies has created new opportunities for investment, particularly in the development of decentralized energy systems and energy storage solutions	The regulatory uncertainty, technical challenges related to the integration of renewable energy sources and energy storage systems into the grid, and the high upfront costs of these technologies are the main challenges of investing in energy transition across Ireland. To overcome these challenges, it is essential to create a supportive policy environment that encourages investment in energy transition. This includes measures such as feed-in tariffs and other financial incentives for renewable energy deployment, as well as regulatory frameworks that support the integration of renewable energy sources and energy storage systems into the grid	x	x	x		x		2

Smart grids deployment	The deployment of smart grids in the context of local flexibility markets and electricity in Ireland is a critical component in the development of a more sustainable, efficient, and reliable energy system. There are several initiatives in Ireland aimed at promoting the deployment of smart grids, e.g., the Irish government has set a target of 50% smart grid penetration by 2027, with a focus on improving the integration of renewable energy sources and enabling greater consumer participation in the energy market. One key aspect of smart grid deployment is the integration of advanced metering infrastructure (AMI) as this enables two-way communication between consumers and the electricity grid, allowing for real-time monitoring and control of energy consumption. This enables the deployment of demand response programs, whereby consumers can adjust their energy consumption in response to market signals. Another important aspect of smart grid deployment in Ireland is the integration of distributed energy resources (DERs), such as rooftop solar panels and battery storage systems. Smart grids enable the integration of DERs by providing advanced monitoring and control systems that can manage the fluctuations in energy supply and demand associated with these systems	The main challenges associated with the deployment of smart grids in Ireland are technical challenges related to the integration of these systems into the grid, as well as regulatory barriers to the deployment of these systems. Additionally, the high upfront costs of smart grid deployment can be a barrier to their widespread deployment of smart grids across LFMs	x	x		x	x		2
Demand response infrastructure deployment (smart metering)	The deployment of smart meters has enabled the implementation of more sophisticated demand response programs in Ireland, allowing electricity providers to better monitor and manage the electricity grid in real-time. With smart meters, consumers can receive real-time information about their energy consumption, allowing them to make more informed decisions about when and how to use electricity. In turn, electricity providers can use this data to incentivize consumers to reduce their energy consumption during peak periods by offering financial incentives, such as lower tariffs or rebates.		x	x		x	x		2
Decentralised energy system and storage	There are several initiatives aimed at promoting decentralised energy and energy storage solutions across Ireland, e.g., the Sustainable Energy Authority of Ireland (SEAI) has developed a grant program to support the deployment of renewable energy systems and energy storage systems in homes, businesses, and communities. The program aims to support the integration of renewable energy sources and promote energy self-sufficiency. the Irish government has set ambitious targets for renewable energy deployment, with a target of 70% renewable electricity by 2030. Decentralized energy and energy storage solutions will play a critical role in achieving these targets, by enabling the integration of intermittent renewable energy sources such as wind and solar power	There are the challenges associated with the deployment of decentralised energy and storage solutions in Ireland, such as technical challenges related to the integration of these systems into the grid, as well as regulatory barriers to the deployment of these systems. Additionally, the high upfront costs of energy storage systems can be a barrier to their widespread deployment	x	x		x	x		3
TSO and DSO regulation	The regulation of Transmission System Operators (TSOs) and Distribution System Operators (DSOs) plays a critical role in ensuring the efficient and secure operation of the energy system of Ireland. TSOs and DSOs are responsible for managing the transmission and distribution of electricity, respectively, and are subject to regulation by the Commission for Regulation of Utilities (CRU). The CRU has developed a regulatory framework that sets out the roles and responsibilities of TSOs and DSOs in the context of local flexibility markets and aims for promoting greater flexibility in the energy system, while also ensuring the safe and reliable operation of the grid	The regulation of TSOs and DSOs in the context of local flexibility markets and electricity in Ireland is critical for promoting a more flexible, efficient, and sustainable energy system by ensuring the integration of DERs, supporting demand response programs, and promoting innovation and competition by DSOs and TSOs ensuring the integration of DERs, supporting demand response programs, and promoting innovation and competition, TSOs and DSOs can play a key role in shaping the energy system of the future	x			x	x		3
Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	There are several ICT solutions that enable peer-to-peer energy trading and virtual power plants in Ireland, e.g., the EirGrid Group launched the DS3 program, which includes a virtual power plant that aggregates and manages distributed energy resources (DERs) such as rooftop solar panels and battery storage systems. The virtual power plant uses advanced ICT solutions to manage the DERs and optimize their contribution to the grid. Another example of an ICT solution for peer-to-peer energy trading is the Electrifi platform, which enables consumers to buy and sell renewable energy credits from each other. The platform uses blockchain technology to ensure transparency and security in the trading process. There are also several other startups and companies in Ireland that are developing ICT solutions for peer-to-peer energy trading and virtual power plants, e.g. GridBeyond is a software platform that enables businesses to participate in demand response programs and benefit from energy trading opportunities	There are still issues related to data privacy and security, as well as regulatory barriers to peer-to-peer energy trading. Additionally, there may be challenges related to the integration of these solutions into existing energy systems and infrastructure	x	x	x	x			2
Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	Irish customers have the right to participate in the electricity markets through a guaranteed grid access, remuneration for energy fed into the grid, and demand response. In the context of local flexibility markets and electricity in Ireland, there are several rights that customers have regarding their participation in the energy market. One of the most important rights for customers is guaranteed grid access. The customers who generate their own electricity, such as through rooftop solar panels or small wind turbines, have the right to connect to the grid and feed their excess energy into it. In Ireland, customers are entitled to grid connection under the Microgeneration Support Scheme, which was introduced in 2021 to support the deployment of small-scale renewable energy systems. The government also introduced the Feed-in Tariff which provides a financial incentive for customers to invest in renewable energy systems. In Ireland, the feed-in tariff is available under the Support Scheme for Renewable Heat, which provides a payment for each kWh of renewable heat generated over a 15-year period	Irish customers have certain rights for active participation in the electricity markets which are critical for promoting a more flexible and sustainable energy system in Ireland. By guaranteeing grid access, providing remuneration for energy fed into the grid, and supporting demand response programs, customers can play a more active role in shaping the energy system and reducing their carbon footprint	x	x	x	x	x		3
Schemes and incentives that give advantage to big energy firms	The government introduced several incentives and subsidies to encourage the development of renewable energy projects, including feed-in tariffs, tax credits, grants for research and development	A variety of policies supporting renewable energy deployment and production across Ireland	x	x			x		3
Grid connection costs	Typically, between €20,000 and €30,000 MW/h. This is significantly lower than the cost of connecting an onshore wind farm to the grid in the UK, which can be up to €100,000 MW/h. The cost of connecting a solar PV system to the grid in Ireland is also relatively low, typically ranging between €2,500 and €5,000 MW/h. The cost of connecting a combined heat and power plant to the grid in Ireland is typically between €10,000 and €30,000 MW/h	The cost of connecting renewable energy to the grid in Ireland is generally quite competitive. As such, Ireland is becoming increasingly attractive to renewable energy developers	x	x		x			4
Uncertainty and limitations in feed-in-tariff levels and schemes	The Irish government has changed the structure and levels of Feed-in Tariffs (FiT) several times over the past decade, which resulted in uncertainty and an unpredictable environment for new renewable energy projects. On another hand, current Feed-in Tariff scheme is based on competitive bidding, which means that the level of payment for renewable energy varies depending on the type of technology used and the amount of energy generated. It is then difficult for the investors to determine the expected return on their investment	Feed-in Tariffs capped at 20MW result in only small projects supported by the scheme. This is also associated with no long-term security for investors	x	x			x		2

Legislative frameworks that make setting up LFM ventures difficult	Legal framework for renewable energy is complex and can be difficult for developers to navigate	New investments likely to be delayed due to framework complexity	x				x		2
Lack of support from local representatives/local energy agencies	A draft framework for CfD (Contracts for Difference) requiring developers to complete environmental permitting to participate in CfD. Visible support for wind and solar projects	Other than wind and solar projects might face delays due to their non-urgent nature	x		x		x		2
Lack of a policy framework for LFM investments	Not enough or outdated national policies and regulatory guidance regarding renewable energy projects often affect financial side of new projects which keeps investors away	Due to not enough interest in RES deployment, the country is still dependent on HYD which slows national decarbonisation ambitions	x	x			x	x	1
Not mentioning LC as a relevant actor	The government does not prioritize local projects supported by local communities, unless they are associated in non-profit associations	Difficult to enforce with no support of the local authorities, only support for non-profit associations	x		x		x		2
Complex and changeable policies regarding LFM development	Ireland has implemented various policies to encourage the development of renewable energy sources	May delay new investments	x				x		3
Lack of rules regarding the opportunity to operate micro-grids	Government promotes the adoption of smart grid technology as a way of improving the efficiency of national grid	They might not be enforced locally; it means not enough opportunities in the local context	x			x	x		2
Lack of regional focus on renewable energy projects with LFM	Insufficient government support for renewable projects, inadequate funding and incentives, and a lack of public awareness and engagement in the local context	Not enough incentives for local governments or businesses to invest in renewable energy sources	x	x			x		2
Energy policies may have unwanted negative connotations	Often not ambitious enough to positively impact new RES investment plans nationally, despite a very ambitious 30-80% RES participation in energy generation plans for 2030, current policies have been criticized for providing too many subsidies to traditional energy sources, such as fossil fuels, while not doing enough to incentivize renewable energy sources	The government prioritizes wrong policies that do not support a possible high increase in RES deployment in Ireland in the coming years	x	x	x	x	x	x	2
Lack of cooperation between local authorities and local communities	Local authorities often lack the financial resources for the investments in renewable energy projects, leaving them unable to contribute to the costs of those, also may be reluctant to take on the perceived risks associated with investing in renewable energy sources, such as the potential for fluctuating energy costs, as well as they may have concerns about the impact of renewable energy projects on the environment and local communities, such as noise pollution that is associated with wind turbines	lack of cooperation between local authorities and local communities can impede the development of renewable energy sources in Ireland and limit the potential for RES development in the country	x	x	x				1
Difficulties for energy communities to generate enough surplus to cover organizational costs	Lack of capital and resources to invest in the necessary infrastructure due to the relatively small size of most energy communities in Ireland, they often lack the financial resources to invest in the technology and equipment necessary to generate renewable energy	Limits in the ability to generate enough surplus to cover the costs of operational and maintenance expenses, as well as the costs associated with connecting renewable energy installations to the national grid	x	x	x				2
Lack of long-term government funding	Lack of long-term funding for LFMs in Ireland has inhibited their growth and sustainability	Associations have more financial incentives for new projects rather than individuals	x	x	x				3
Initial financing problems at local government level	A change shift at the national government level that champions alternatives to renewables such as nuclear	Less support for renewables in the LFMs	x	x	x				3
National energy policy change and shift from RES to HYD	The war in Ukraine impacted Ireland's RES ambitions and forced the government to invest more in alternative gas supplies but also, to cooperate with the United Kingdom on the energy sector	Not enough local project support resulting in slowing down new projects	x	x			x		3
Difficulty in accessing loans/contracts/funding for LFM projects	Too many rules at the national level, often dictated by the region it is addressed at	Not enough financial support at the local level due to changing priorities	x	x		x	x	x	3
Lack of tax exemptions or incentives unlocking new investment opportunities	This lack of support has limited the ability of Irish businesses and households to invest in renewable energy sources, and has inhibited the development of a competitive market for renewable energy	The lack of tax exemptions and incentives can discourage potential investors from investing in renewable energy projects, thus further limiting the growth of the sector	x	x	x				1
Investment incentives for hydrocarbons instead of RES	The Irish Government offers investment incentives for hydrocarbons, such as tax exemptions, low-interest loans and subsidies to encourage investment in hydrocarbon-based energy sources. Additionally, the government has established the Carbon Tax, which allows businesses to benefit from a tax credit for any carbon emissions they capture or reduce	Can significantly slow down new RES investments across the country	x	x	x		x		2
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	Policy planning at the national level reflecting on national needs, domestic economy and weather conditions	Lower than expected investments for the right technologies	x	x	x		x	x	2

Lack of experience with LFM	Might be not enough outreach to energy communities as to learn about their direct energy needs	Possible delays in project planning at domestic level			x	x			3
Low trust in renewable energy technologies	The government is sceptical about introducing more renewables than gas to energy grid amid high costs of new investments	Change in the energy complex paradigm resulting in lower RES ambitions on this occasion	x		x		x		2
Possible loss of support if the projects exceed certain size	If a project is too large and exceeds the size restrictions set by the local government, the project could lose support from the community and local government	Project sizes will be reduced to the minimum if their sizes go against the policies	x		x	x	x	x	2
Lengthy grid connection procedures	Relatively sufficient planning at national and local levels	Delays in connecting new RES plants to the grid	x	x	x	x	x		2
Lack of interest and engagement in the promotion of LFM	There is strong public support for renewable energy in Ireland, with many citizens concerned about the impact of climate change and the country's dependence on fossil fuels	Too much scope being put onto fossil fuels	x		x			x	1
Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	Fear of displacement as a common reason for opposing renewables in Ireland. It is largely based on a perception that RES will lead to economic displacement, replacing traditional jobs and industries with fossil fuel alternatives	Might affect country's net-zero targets due to fewer RES projects supported by local communities	x	x	x		x		1
Lack of experience in commissioning and managing RES projects	The lack of experience in commissioning and managing renewable energy projects in the context of local flexibility markets and electricity in Ireland is a significant challenge that needs to be addressed. This is due to the fact that the Irish energy sector has traditionally relied heavily on fossil fuels, making it difficult to transition to renewable energy sources such as solar and wind. The lack of experience can be addressed by increasing capacity building and training opportunities for stakeholders in the energy sector. This includes providing comprehensive training to local authorities, energy companies, and other stakeholders on the commissioning and managing of renewable energy projects	Affects local and country wide context projects	x		x	x	x		2
Lack of accessible area for new renewable plants	Not too many highly urbanized areas where conditions for renewables are sufficient, very good natural and geographical conditions for renewables - mainly onshore and offshore wind nationally	High urbanization requires the shift in project area planning	x		x	x			2
Lack of sufficient requalification/training for potential LFM technology staff	The government does not invest enough in requalification of the workforce	Fewer experts that can work on the RES projects	x	x	x	x	x	x	2
Difficulty in securing labour for LFM projects	People prefer to work in low-labour settings where they do not need to requalify, however, high education system nationally also attracts the RES workforce	Affects project capacities as not enough workforce		x	x	x			2
Rigid legal, bureaucratic, and administrative procedures	The Irish government has implemented several legal, bureaucratic, and administrative procedures to ensure that only renewable energy sources are supported and developed instead of new fossil fuel-focused projects. Ireland supports its renewables sector following European Renewable Energy Directive that resulted in government introducing a few different regulations and laws, such as the Renewable Energy Support Scheme (RESS) and the Renewable Heat Incentive (RHI)	Renewable Energy Support Scheme (RESS) and the Renewable Heat Incentive (RHI) as policies boosting new RES and renewable heat projects in Ireland		x	x				4
Insufficient regulation regarding smart metering	Currently no legal requirements to install smart meters, and no incentives for consumers to do so. This lack of regulation is a major barrier to the adoption of renewable energy sources in the country. Also, not clear, or consistent regulatory environment across different energy suppliers, which can make it difficult for consumers to understand their rights and to choose the best option for their needs	Lack of transparency and customer support can lead to confusion and frustration for those using smart meters, potentially leading to a decrease in uptake of renewable energy source and new projects	x	x	x		x		1
Strong aversion to risk towards larger RES projects	The authorities in some instances, prefer smaller projects due to lower operational and financial risk	Can affect large project ambitions	x				x		2
Lack of cooperation with other local communities to share expertise/knowledge/resources	The dialogue between the parties is difficult to reach due to not enough government financial support for new RES projects in the local context, and a lack of knowledge about the potential benefits of renewable energy. Also, in some counties, local authorities have been sceptical to invest in renewable energy infrastructure due to high upfront costs of new RES installation	No national energy strategy that would ease a dialogue between the parties. Likely to affect local RES project context	x	x	x				1
Low citizen involvement in decision making activities	The government should organize public consultations on the future of renewables in Ireland as society in some parts of the country do not pay attention to renewables issues	No to little citizen involvement has a negative impact onto attracting smaller developers, the country is focused on large operators	x	x	x				2

Country:	The Netherlands							
Factor (title)	Factor (description)	Impact for LFM development in the country	Political	Economic	Social	Technological	Legal	Environmental	Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)
Market structures that support centralised energy production/local flexibility markets	The Dutch government has adopted a Feed-in Tariff (FIT) system requiring electricity suppliers to purchase renewable energy from the producers at a guaranteed price which supports investments in RES, as well as secures a continuous supply of renewable energy to large scale RES plants. Additionally, the government introduced grants, tax credits, and loan support for RES projects. These incentives allow energy producers to invest in the technology and infrastructure supporting large scale power production. The Netherlands champions both, local and national context with generous incentives for the households producing renewable energy	The Dutch government set ambitious targets for renewable energy generation that provide strong incentives for renewable energy producers interested in investing in large-scale, centralized energy production in the Netherlands. Energy market intervention will boost renewable energy investment as windfall tax will support new RES ventures	x	x		x			4
Security of energy supply	The Netherlands has a relatively stable and secure energy supply, with a mix of fossil fuels and renewable energy sources. However, the country is working towards a more sustainable energy system by increasing the share of renewable energy sources and reducing the dependence on fossil fuels. the development of local flexibility markets is supported by several initiatives and policies. For example, the Dutch government has introduced the Energy Agreement, which aiming for reduction in CO2 emissions and increase the share of renewable energy sources in the country's energy mix. The government has also established the Smart Grids and Flexible Energy Systems (SGFES) program focusing on the development of smart grids and local flexibility markets	Successful deployment of local flexibility markets requires the cooperation of multiple actors and the development of new market mechanisms	x	x		x	x		3
Innovation capacity and digital independence	The Netherlands has a strong tradition of innovation and is home to a thriving technology industry, which has led to the development of a wide range of innovative solutions for energy management, storage, and distribution. The government is committed to promoting research and energy sector's development with the use of innovative solutions for energy management, storage, and distribution. The country is also a home to a growing number of startups and SMEs that specialize in energy management, storage, and distribution while at the forefront of innovation in the energy sector, and supported by a network of incubators, accelerators, and venture capitalists that help them to grow and develop	The innovation capacity and digital independence of the Netherlands provide a strong foundation for the development of local flexibility markets and electricity systems. The country's commitment to research and development, its well-developed digital infrastructure, and its progressing startup ecosystem all contribute to a favourable environment for innovation and the adoption of new technologies in the energy sector	x	x	x	x	x		4
Attitudes towards energy efficient products, services, technologies, and appliances	There is a growing awareness and appreciation for energy efficient products, services, technologies, and appliances, particularly in the context of local flexibility markets and electricity in the Netherlands and highly visible through government policies, public awareness campaigns, and the increasing availability and affordability of energy efficient solutions. One of the main drivers of energy efficiency in the Netherlands is government policies and regulations, such as the Energy Performance of Buildings Directive and the Energy Efficiency Directive, setting targets for energy efficiency and require energy efficiency measures to be implemented in buildings and appliances nationwide. The government has invested heavily in energy efficiency initiatives, including the implementation of energy efficiency standards for appliances and the implementation of energy labelling for consumer goods. It has also launched programs such as the Climate Agreement, which encourages households to replace their old heating systems with more efficient ones, and the Energiebespaarlening, which helps households finance energy-saving investments	The government actively promotes local flexibility markets, as it has created several incentives and subsidies to encourage households to invest in energy efficiency measures. Additionally, the government has invested in smart meter technology and digital energy platforms, which allow households to monitor their energy use and adjust their energy consumption in line with current market needs	x	x	x	x	x		4
Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	The Dutch government has implemented several initiatives to encourage investment in energy transition. These include an open electricity market, which allows consumers to choose from a variety of suppliers, and a subsidy scheme for renewable energy sources. Additionally, the Netherlands has set ambitious targets for reducing greenhouse gas emissions, increasing the share of renewable energy, and introducing energy efficiency measures. Furthermore, the government also implemented several measures to promote the development of local flexibility markets. These include an auction system for local energy assets, which allows local communities to bid for and purchase renewable energy sources enabling local authorities to increase their share of renewable electricity and to access more cost-effective sources of energy. In terms of financial investment, the Dutch government has established the Sustainable Energy Transition Fund (SET), which is a fund dedicated to promoting investments in renewable energy projects s has seen several venture capital funds and private equity funds investing in energy transition projects	The willingness to invest in energy transition in the context of local flexibility markets and electricity in the Netherlands is high. The Dutch government has implemented several initiatives to encourage investment in energy transition, and these have been met with enthusiasm by businesses, local authorities, and citizens alike. The government, energy companies, consumers, and communities have all demonstrated a willingness to invest in energy transition, but there is still a need for greater awareness, education, and policy support to enable the continued growth and development of local flexibility markets and the transition to a sustainable and resilient energy system	x	x	x		x		3
Smart grids deployment	The deployment of smart grids is critical to the development of local flexibility markets in the Netherlands, as it enables the integration of distributed energy resources and the provision of flexibility services by market participants. The deployment of smart grids is being supported by various policies and incentives, such as the introduction of a smart grid innovation program aiming at promoting the development and demonstration of smart grid technologies, and the integration of smart grids with other technologies, such as electric vehicle charging infrastructure and home energy management systems. The deployment of smart grids in the Netherlands has facilitated the growth of local flexibility markets, allowing for a more efficient and cost-effective delivery of electricity	The deployment of smart grids is critical to the development of local flexibility markets in the Netherlands, as it enables the integration of distributed energy resources and the provision of flexibility services by market participants. Policies and incentives that support the deployment of smart grids and their integration with other technologies are essential for the continued growth and development of local flexibility markets, and for enabling the integration of renewable energy sources into the electricity system	x	x		x	x		3
Demand response infrastructure deployment (smart metering)	The deployment of smart-metering infrastructure is critical to the development of local flexibility markets in the Netherlands, as it enables customers to participate actively in the electricity system through demand response and other flexibility services. the deployment of smart-metering infrastructure is being supported by the government and energy regulators through various policies and incentives, such as the introduction of a smart meter rollout program and the development of regulations that require energy suppliers to offer smart metering to all customers. The Dutch government has set ambitious targets for the deployment of smart meters, with the goal of having all households and small businesses equipped with smart meters by the end of 2023	The Dutch policies and incentives that support the deployment of smart meters and their integration with other technologies are essential for the continued growth and development of local flexibility markets, and for enabling the integration of renewable energy sources into the electricity system. Also, the deployment of smart-metering and local flexibility markets across the Netherlands could support energy costs and emissions reduction, as well as to improve grid reliability	x	x	x	x			3

Decentralised energy system and storage	The Dutch decentralised energy system and storage are critical components of local flexibility markets in the Netherlands, which aim to promote the integration of renewable energy sources and enable customers to participate actively in the electricity system. In the Netherlands, decentralized energy systems are supported by various policies and incentives, such as feed-in tariffs, tax credits, and subsidies, which encourage their deployment and use. While energy storage is supported by various policies and incentives, such as tax credits, subsidies, and grants, which encourage the deployment and use of energy storage technologies. And last but not least, local flexibility markets are being developed through pilot projects and regulatory reforms, such as the introduction of market-based mechanisms to incentivize the provision of flexibility services by market participants	The Dutch decentralised energy systems and energy storage are critical components of local flexibility markets enabling customers to participate actively in the electricity system and contribute to the integration of renewable energy sources. Policies and incentives that support the deployment and use of these technologies are essential for their continued growth and development, while market-based mechanisms that incentivise the provision of flexibility services by market participants are key to the development of local flexibility markets	x	x	x	x	x		3
TSO and DSO regulation	The Netherlands has adopted a market-based system to facilitate local flexibility markets to balance the electricity supply and demand. This system is based on the concepts of Time-Shiftable Output (TSO) and Demand Side Output (DSO). he regulation of Transmission System Operators (TSOs) and Distribution System Operators (DSOs) is critical to the development of local flexibility markets and the efficient and effective integration of renewable energy sources into the electricity system	Regulators such as the ACM play a key role in setting tariffs and quality standards for the transmission and distribution system, while incentivizing the provision of flexibility services by market participants. Through these mechanisms, TSOs and DSOs can ensure the stability and security of the grid while enabling customers to participate actively in the electricity system as active players	x	x	x	x	x		3
Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	The best example of an ICT solution for peer-to-peer energy trading/virtual power plants in the Netherlands is the Decentralized Energy Marketplace (DEM), developed by Dutch startup Vandebro which is a digital platform enabling individuals and businesses to trade energy with each other through creation of virtual power plants to increase the flexibility of the local energy system. The platform also facilitates peer-to-peer energy trading, allowing individuals and businesses to buy and sell electricity directly from one another	The active participation mechanisms provide customers with economic incentives, technical standards, and opportunities to monetize their flexibility assets supporting the integration of renewable energy sources and improve the reliability and efficiency of the grid	x	x	x	x	x		4
Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	In the Netherlands, active participation of customers in the electricity markets is encouraged through various mechanisms, including guaranteed grid access, remuneration for energy fed into the grid, and demand response. These mechanisms are aimed at promoting the development of local flexibility markets and enabling customers to participate in the electricity system as active players, rather than passive consumers. Guaranteed grid access is an important right for Dutch customers, as it ensures that they can connect to the grid and feed energy into it without facing unnecessary barriers which is particularly important for customers who generate their own renewable energy, such as solar panels, and want to sell any excess energy they generate back to the grid. Dutch customers have the right to connect to the grid, provided they comply with certain technical and safety standards	The Netherlands through guaranteed grid access, remuneration for energy fed into the grid, and demand response are important mechanisms for promoting the development of local flexibility markets and enabling customers to participate in the electricity system as active players through their rights to active participation in electricity markets. These mechanisms provide customers with economic incentives, technical standards, and opportunities to monetize their flexibility assets, which can help to support the integration of renewable energy sources and improve the reliability and efficiency of the grid	x	x	x	x	x		3
Schemes and incentives that give advantage to big energy firms	The government introduced a number of incentives and subsidies to encourage the development of renewable energy projects, such as Feed-in Tariffs (FiT) designed to increase RES production through providing guaranteed price for electricity sourced from renewables; Tax Breaks for businesses investing in renewable sources, which reduces costs pf new projects and enabling cost-efficiency in case of big energy firms; Capital Subsidies addressed at the companies investing in new RES projects - help with initial investment cost reduction and preventing financial risk in case of large investors; and Grants that support cost reduction and minimizing financial risk that might be otherwise be taken by large investors	The government schemes and incentives provide a clear advantage to big energy firms in the renewable energy sector. These incentives help in reduction in renewable energy project costs, and provide a guaranteed price for the electricity generated, giving big energy firms a competitive edge over smaller firms	x	x			x		3
Grid connection costs	Grid connection costs vary depending on the RES technology used, e.g., low costs for solar PV ranging between €0.50 and €1.50/kWh. For wind projects, the costs are much higher, averaging around €7.50-10.00/kWh. The cost of grid connection depends on the type of connection being made, with higher connection costs for projects with higher voltage or longer distances from the grid	Grid connection costs for renewable energy projects in the Netherlands are relatively low compared to other EU-27 countries. This is largely due to the country's high levels of investment in grid infrastructure and its effective management by regional energy companies, also offers financial incentives, e.g., subsidies and tax credits that offset renewable energy projects which is making them more affordable for potential investors	x	x		x			4
Uncertainty and limitations in feed-in-tariff levels and schemes	Largely due to constantly changing and unpredictable market conditions, e.g., the Netherlands is subject to frequent changes in energy demand and supply, which affects the FIT levels and schemes in place	Government set a limit on the total amount of renewable energy that can be generated through FiT schemes, which can limit the effectiveness of these schemes	x	x		x	x		2
Legislative frameworks that make setting up LFM ventures difficult	Renewable Energy Sources Act that sets out the government subsidies and grants available to renewable energy projects, such as solar, wind, and biomass. It also outlines the procedures for obtaining these subsidies and grants. Secondly, the Electricity Act that sets out the rules and regulations related to the generation and distribution of electricity. It also establishes the regulatory framework for the electricity market, including the pricing structure and the licensing of electricity producers	Very complex bureaucratic environment that must be addressed before a renewable energy source venture can be set up. It can substantially limit the projects that can enter the development phase	x	x			x		3
Lack of support from local representatives/local energy agencies	A draft framework for CfD (contracts for difference) requiring developers to complete environmental permitting to participate in CfD. Visible support for wind and solar projects	Other than wind and solar projects might face delays due to their non-urgent nature	x		x		x		2
Lack of a policy framework for LFM investments	Particularly detrimental effect on the development of large-scale renewable energy projects, such as offshore wind farms	Difficult to secure the necessary financing for these large-scale projects and has also led to high transaction costs which discourages investors from investing in large scale renewable energy projects	x	x		x	x		1
Not mentioning LC as a relevant actor	The government does not prioritize local projects supported by local communities, unless they are associated in non-profit associations	Difficult to enforce with no support of the local authorities, only support for non-profit associations	x		x		x		2
Complex and changeable policies regarding LFM development	The Netherlands has implemented various policies to encourage the development of renewable energy sources	May delay new investments	x				x		3

Lack of rules regarding the opportunity to operate micro-grids	Government promotes the adoption of smart grid technology as a way of improving the efficiency of national grid	They might not be enforced locally; it means not enough opportunities in the local context	x			x	x		2
Lack of regional focus on renewable energy projects with LFM	The Netherlands lacks a comprehensive regional strategy for the development and implementation of renewable energy projects	The government should prioritize the local context	x	x			x		2
Energy policies may have unwanted negative connotations	Government has been slow to implement policies that would promote the development of renewable energy sources, such as solar, wind, and geothermal; also failed to provide adequate incentives for businesses and individuals to invest in renewable energy sources, making it difficult for them to make the switch from traditional sources of energy	A lack of sufficient energy policies resulted in a lack of reliable and cost-effective access to renewable energy, meaning that many households and businesses have been unable to make the switch to cleaner energy sources thanks to fewer investments blocked by ineffective policies	x	x	x	x	x	x	2
Lack of cooperation between local authorities and local communities	The highly industrialized areas are usually opposing the new RES projects as want to protect local jobs that's support labour work	Both sides should cooperate more on the energy transition and renewables	x		x				1
Difficulties for energy communities to generate enough surplus to cover organizational costs	Very small land area and population in the Netherlands make it difficult for local communities to generate the necessary surplus to cover their organizational costs in the context of renewable energy sources. Fossil fuel energy still much cheaper for the Dutch than renewables that are less attractive for energy communities	Netherlands' limited access to natural resources, such as onshore wind and solar energy, makes it difficult to generate enough energy to cover national demand with renewables alone		x	x	x			2
Lack of long-term government funding	Lack of long-term funding for LFMs in The Netherlands has inhibited their growth and sustainability	Associations have more financial incentives for new projects rather than individuals	x	x	x				3
Initial financing problems at local government level	A change shift at the national government level that champions alternatives to renewables such as nuclear	Less support for renewables in the LFMs	x	x	x				3
National energy policy change and shift from RES to HYD	The war in Ukraine impacted Dutch RES ambitions and forced the government to invest more in alternative gas supplies	Not enough local project support resulting in slowing down new projects	x	x			x		3
Difficulty in accessing loans/contracts/funding for LFM projects	Too many rules at the national level, often dictated by the region it is addressed at	Not enough financial support at the local level due to changing priorities	x	x		x	x	x	3
Lack of tax exemptions or incentives unlocking new investment opportunities	Investors less likely to invest in renewable energy projects due to a lack of attractive financial returns on investments, especially visible in case of small-scale RES investments which usually require more capital injection than large projects	The lack of tax exemptions and incentives can discourage potential investors from investing in renewable energy projects, thus further limiting the growth of the sector	x	x					1
Investment incentives for hydrocarbons instead of RES	The government championing gas and shifted towards coals to secure energy supplies nationally	Delays in RES deployment in the LFMs context - shift in priorities caused by the war in Ukraine	x	x	x		x		2
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	Policy planning at the federal level with a mismatch between the expectations and the reality	Lower than expected investments for the right technologies	x	x	x		x	x	2
Lack of experience with LFM	Might be not enough outreach to energy communities as to learn about their direct energy needs	Possible delays in project planning			x	x			3
Low trust in renewable energy technologies	The government is introducing more renewables than gas to energy grid amid its long commitments to meeting carbon neutrality targets by the nations	Change in the energy complex paradigm resulting in lower RES ambitions on this occasion	x		x		x		2
Possible loss of support if the projects exceed certain size	Government funding can only support required project size	It might slow down climate neutrality ambitions and bigger renewable capacity ambitions	x		x	x	x	x	2
Lengthy grid connection procedures	Not sufficient planning at national and local levels	Delays in connecting new RES plants to the grid	x	x	x	x	x		2
Lack of interest and engagement in the promotion of LFM	Strong public and government support for renewable energy in The Netherlands, with many citizens concerned about the impact of climate change and the country's dependence on fossil fuels	Too much scope being put onto fossil fuels	x		x			x	1

Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	Too long relationship with fossil fuels resulting in national dilemma	Might affect country's net-zero targets due to fewer RES projects	x		x		x		1
Lack of experience in commissioning and managing RES projects	Lack of experience in large-scale projects due to insufficient renewable energy policies and no large-scale RES projects were delivered in the past resulting in a lack of expertise and knowledge of successful planning, financing, and managing renewable energy projects	Lack of experience resulted in limited innovation and investment in the renewable energy sources, as businesses and investors are hesitant to invest in new projects without having a proven track record of successful RES project implementation			x	x			2
Lack of accessible area for new renewable plants	Too many highly urbanized areas where conditions for renewables are sufficient	High urbanization requires the shift in project area planning	x		x	x			2
Lack of sufficient requalification/training for potential LFM technology staff	The government does invest in requalification of the workforce that will support new RES projects	Fewer experts that can work on the RES projects	x	x	x	x	x	x	2
Difficulty in securing labour for LFM projects	Largely due to the limited availability of skilled workers in the renewable energy sector, the Dutch renewable energy industry is still relatively new, and the workforce is not yet well equipped with the necessary expertise to support the development and expansion of RES project	Affects project capacities as not enough highly qualified workforce specialized in renewables		x	x	x			2
Rigid legal, bureaucratic, and administrative procedures	National and local policies championing renewables, however, natural gas is also widely used due to national reserves	Can disturb the LFMs context		x	x				2
Insufficient regulation regarding smart metering	One of the top regulations is the smart metering in Europe	Might affect the integration of smart metering with the plants	x	x	x		x		2
Strong aversion to risk towards larger RES projects	The authorities in some instances, prefer smaller projects due to lower operational and financial risk	Can affect large project ambitions	x				x		2
Lack of cooperation with other local communities to share expertise/knowledge/resources	The dialogue between the parties is difficult to reach due to differences in approach to RES projects by local communities due to regional policy differences, also a lack of trust and communication between stakeholders	Might affect local LFMs projects as local collaborations on RES projects are difficult to reach consensus			x			x	1
Low citizen involvement in decision making activities	The government should organize public consultations on the future of renewables in The Netherlands as there are still individuals not supporting renewables within LFMs context	No to little citizen involvement has a negative impact onto attracting smaller developers, the country is focused on large operators	x	x	x				2

Country:	The United Kingdom								
Factor (title)	Factor (description)	Impact for LFM development in the country	Political	Economic	Social	Technological	Legal	Environmental	Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)
Market structures that support centralised energy production/local flexibility markets	The government championing Renewables Obligation - policy that requires electricity suppliers to source a certain percentage of their energy from renewable sources. Energy suppliers are required to purchase, Renewables Obligation Certificates (ROCs) from renewable energy producers to demonstrate their compliance with the policy, the Feed-in Tarif - that provides financial support to renewable energy producers by guaranteeing them a fixed price for the electricity they produce which ensures that renewable energy producers can earn a return on their investment and encourages investment in renewable energy technologies, and the Contracts for Difference (CfD) - that allows renewable energy producers to enter into long-term agreements with the government or other energy buyers. These agreements provide a stable revenue stream for renewable energy producers and help to ensure that they can compete with traditional energy sources. Supported by several market structures, including the UK power market, which is based on a single buyer-seller model. This model allows the government to act as a single buyer of energy, setting the wholesale price of electricity and taking on the risks associated with generating and distributing energy. Gas market, which is based on a hub-and-spoke system. This system involves the physical delivery of gas through pipelines and the trading of gas at different points of delivery and energy balancing markets, which provide a mechanism for balancing the demand and supply of electricity. Capacity markets, which enable energy producers to receive payments for providing capacity during times of peak demand. National renewables obligation, which requires the energy suppliers to source a certain percentage of their energy from renewables	Renewable investments might be slightly delayed in the next few years having given UK's priority with nuclear energy & new gas plant development. Energy market intervention will boost renewable energy investment as windfall tax will support new RES ventures	x	x		x	x		3
Security of energy supply	Government established targets for reducing carbon emissions and increasing the use of renewable energy sources, and implemented measures to ensure that there is sufficient capacity in the electricity market to meet demand, e.g., Capacity Market. The market is made up of various components, including generation, transmission, distribution, and supply. The generation component includes large-scale power plants and smaller-scale renewable energy sources, e.g., solar panels, wind turbines. The transmission component involves the high-voltage power lines that transport electricity from generation sites to local distribution network	Government-implemented measures to ensure that there is sufficient capacity in the electricity market to meet demand, e.g., Capacity Market	x	x		x	x		3
Innovation capacity and digital independence	The UK has a strong track record of innovation in the energy sector, with a thriving ecosystem of startups, research institutions, and established companies. The government has also implemented policies to support innovation in the energy sector, such as the Clean Growth Strategy and the Industrial Strategy Challenge Fund	Policies provide funding and support for research and development, as well as incentives for companies to invest in new technologies	x	x	x	x	x		3
Attitudes towards energy efficient products, services, technologies, and appliances	Energy-efficient services are becoming increasingly popular in the UK, with consumers looking for ways to reduce their carbon footprint and lower their energy bills. Energy-efficient services such as smart home technologies and energy monitoring services provide consumers with the information, they need to make informed decisions about their energy usage. They also allow consumers to monitor their energy consumption and adjust reduce their energy usage.	The government is focused on the energy efficient appliances, energy-efficient technologies, the impact of new installations on the consumers and a strong support for renewables' adoption that reduce nation's reliance on fossil fuels	x	x	x	x	x		4
Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	There is a growing investors' interest in investing in UK's energy transition which is reflected in the increasing amount of capital being directed towards renewable energy projects and technologies. Institutional investors, such as pension funds and insurance companies, are looking for opportunities to invest in renewable energy assets, which offer stable, long-term returns. The UK government is also providing incentives, such as subsidies and tax credits, to encourage investment in renewable energy.	The UK LFM market is undergoing significant changes, as the country shifts towards a more distributed energy system. This creates new opportunities for investment in renewables and energy-efficient solutions, e.g., the growth of renewable energy sources is leading to the development of new energy storage technologies, which can help balance the grid and reduce the need for traditional fossil fuel power plants	x	x	x	x	x	x	3
Smart grids deployment	In the UK, the deployment of smart grids is still in its early stages, but there are several initiatives underway to accelerate their adoption. One of the main drivers of smart grid deployment is the need to support the growth of renewable energy sources, such as wind and solar power	Smart grids can help manage this variability by optimizing the use of energy storage, demand response, and other flexibility measures. Local flexibility markets are also playing a key role in the deployment of smart grids in the UK. These markets enable consumers and businesses to generate, store, and sell their own energy, which can create new opportunities for investment in renewable energy technologies	x	x	x	x	x		2
Demand response infrastructure deployment (smart metering)	The UK government's smart meter rollout program aims to install smart meters in all households and small businesses by 2025. This is expected to bring significant benefits to both consumers and electricity suppliers, enabling them to better understand energy usage patterns and tailor their supply and demand accordingly	Real-time data on energy supply and demand, enables the energy suppliers can adjust their output to ensure that the grid remains stable and reliable, even as the proportion of renewable energy increases	x	x	x	x	x		3
Decentralised energy system and storage	The UK has seen a significant increase in the uptake of decentralised energy systems and storage technologies in the past decade, in the context of local flexibility markets and electricity. This was driven by several policy initiatives, such as the Feed-in Tariff, the Renewable Heat Incentive, the Capacity Market and the recently launched Local Electricity Trading Framework. All these measures have enabled decentralised energy systems to become more cost effective and competitive with traditional grid energy sources	Decentralised energy systems offer multiple benefits to local energy networks, such as improved energy security, reduced reliance on large, centralised energy sources, and greater flexibility in meeting local energy needs. the introduction of local flexibility markets is allowing decentralised energy systems and storage technologies to become more integrated into the UK's electricity system, enabling local energy networks to trade excess energy among themselves which can reduce strain on the UK's national grid	x	x	x	x	x		3

TSO and DSO regulation	The TSO is responsible for the operation and maintenance of the high voltage transmission system in the UK. It is responsible for ensuring secure and reliable operation of the system and for balancing supply and demand across the network. The TSO is also responsible for coordinating the wholesale electricity market and ensuring that electricity from renewable sources is integrated into the grid. The DSO regulation is designed to ensure that electricity is delivered reliably and safely to customer which requires DSOs to monitor and plan for the delivery of electricity to customers, coordinate with electricity generators and suppliers, and ensure that the distribution system is operated in accordance with the technical requirements	The introduction of TSO and DSO has allowed the UK to make significant progress in the transition towards a low-carbon economy. It has enabled the development of local flexibility markets, allowing local electricity demand to be managed more efficiently and enabling more diverse sources of electricity generation to be integrated into the local grid	x	x		x	x		3
Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	The UK has seen a growing interest in ICT solutions for peer-to-peer energy trading and virtual power plants (VPPs) in recent years, which is due to the increasing need for local flexibility markets and electricity in the UK, as well as the potential for these technologies to reduce costs and improve efficiency. There are several companies that are currently offering ICT solutions for peer-to-peer energy trading and virtual power plants in the UK. These companies include Energi, Open Utility, and SolarCoin. These companies provide a platform that allows individuals, businesses, and organisations to trade energy directly with each other, without the need for a traditional energy provider	There is a growing availability of ICT solutions for peer-to-peer energy trading and virtual power plants are becoming increasingly popular due to the potential cost savings and increased efficiency that they can provide for the UK	x	x		x	x		3
Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	UK customers are provided with a range of rights for active participation in the electricity markets in the context of local flexibility markets and electricity, including guaranteed grid access, remuneration for energy fed into the grid, and demand response	Active participation in the UK electricity market can be beneficial for customers in terms of both cost savings and income generation. The customers have the right to access competitive prices, receive remuneration for energy fed into the grid, and participate in demand response programmes. These rights help to ensure that customers are able to make informed decisions about their energy use	x	x	x	x	x		4
Schemes and incentives that give advantage to big energy firms	The government introduced several incentives and subsidies to encourage the development of renewable energy projects, including Feed-in Tariffs, tax credits, grants for research and development	Likely to boost RES deployment across the United Kingdom, offshore wind projects in particular	x	x			x		4
Grid connection costs	Onshore wind and solar projects tend to incur higher grid connection costs than offshore projects, with costs ranging from £50,000 to £1 million	The government needs to ensure the minimum costs are met for alternative to onshore wind and solar projects	x	x		x			3
Uncertainty and limitations in feed-in-tariff levels and schemes	Limitation of FiT is that the levels are determined by the government, and the current levels in the UK are not sufficient to drive significant uptake of RES since the FiT rates are often too low to be attractive to investors, and can become further reduced as the government seeks to reduce the costs of renewable energy in a foreseeable future	Not enough investments resulting in slower than expected RES uptake nationwide	x	x		x	x		2
Legislative frameworks that make setting up LFM ventures difficult	Legal framework for renewable energy is complex and can be difficult for developers to navigate	New investments likely to receive government support due to framework accessibility	x				x		3
Lack of support from local representatives/local energy agencies	A draft framework for CfD (Contracts for Difference) requiring developers to complete environmental permitting to participate in CfD. Visible support for wind and solar projects	Other than wind and solar projects might face delays due to their non-urgent nature	x		x		x		2
Lack of a policy framework for LFM investments	Lack of a clear policy framework resulted in lower investor confidence in RES projects, as they are less likely to commit capital to projects due to the returns' uncertainty. Also. the lack of a policy framework has made it difficult for investors to understand the regulatory and financial risks associated with investing in renewables	Difficult for renewable energy projects to access the necessary financing to move forward, further impeding the development of renewable energy sources in the UK	x	x		x	x		1
Not mentioning LC as a relevant actor	The government does prioritize local projects supported by local communities even though they are often qualified and willing to work on the new projects	Likely affect RES deployment in the local county context	x	x	x				2
Complex and changeable policies regarding LFM development	UK Government has introduced a range of fiscal incentives for RES, such as the Feed-in Tariff and Renewable Heat Incentive, to encourage the development of RES. These incentives are designed to reduce the cost of developing renewable energy projects and to make them economically viable. The government also provides a range of grants and loans to support the development of RES projects. Also, several regulations, such as the Renewables Obligation and the Capacity Market, to support the development of RES. These regulations require energy companies to purchase a certain amount of electricity from RES sources and to pay a premium for it, and the Renewable Energy Planning Framework and the Renewable Energy Investment Fund	Might be too difficult for investors to navigate through which will limit the projects not meeting certain criteria	x	x			x		2
Lack of rules regarding the opportunity to operate micro-grids	Government promotes the adoption of smart grid technology as a way of improving the efficiency of national grid, while the UK has no specific regulations for micro-grids, leaving the development and deployment of these systems largely unregulated. This lack of regulation has created several challenges for those looking to develop and operate micro-grids in the context of renewable energy	They might not be enforced locally; it means not enough opportunities in the local context	x	x	x	x	x		2
Lack of regional focus on renewable energy projects with LFM	The government does one of the best jobs globally on investing in the technologies that have natural potential in various area of the United Kingdom where nature supports such projects such as offshore wind in Scotland and Wales, or nuclear in the southeast of England	Some regions of the UK are highly industrialized which means they are not focused on RES projects in long-term	x	x			x		3
Energy policies may have unwanted negative connotations	Some energy policies in the UK can be seen as a form of governmental overreach by some citizens like new natural gas or coal plants, e.g., in Devon	Centralized policies preventing RES deployment in central areas due to focus being put onto HYD	x	x	x	x	x	x	2

Lack of cooperation between local authorities and local communities	Lack of engagement from both sides. Local authorities often fail to adequately engage with local communities on matters concerning renewable energy sources. It may also be a result of no to little understanding of potential benefits of RES deployment and the complexity associated with the technology	Local authorities often fail to adequately communicate the potential benefits of renewable energy sources to local communities, leading to a lack of interest and engagement in renewable energy projects at the local level	x		x		x		1
Difficulties for energy communities to generate enough surplus to cover organizational costs	The main reason is very high upfront costs associated with the installation of renewable energy systems across the UK. Also, renewable energy installations require significant upfront investments, and these investments can be difficult for energy communities to cover. Additionally - RES, such as solar panels, are often large and require significant amounts of space which can be a challenge for energy communities that may lack the necessary land or resources to install such systems	Limited subsidies for renewable energy sources as there are limited public awareness of the environmental benefits of renewable energy sources	x	x	x				1
Lack of long-term government funding	UK's current renewable energy policy framework is heavily reliant on intermittent, short-term funding sources such as the Feed-in Tariffs and Renewable Obligation Certificates. These funding sources tend to be unstable, with sudden changes in policy and incentives, leaving investors uncertain about future returns	Lack of long-term government support hinders the growth of renewable energy sources in the UK, as investors lack the security and stability of long-term contracts, making it difficult to secure the necessary financing for large-scale renewable energy projects	x	x					2
Initial financing problems at local government level	A change shift at the national government level that champions alternatives to renewables such as nuclear energy, natural gas and coal in some instances where all funding is redirected towards those strategic projects	Long-term government funding provides a strong incentive for innovation and development of renewable energy technologies but only if it is prioritized now of project planning	x	x		x	x		2
National energy policy change and shift from RES to HYD	The war in Ukraine impacted UK's RES ambitions and forced the government to invest more in alternative gas supplies	Government funding addressed at an immediate energy security; RES projects delayed	x	x					2
Difficulty in accessing loans/contracts/funding for LFM projects	Too many rules at the national level, often dictated by the region it is addressed at	Some RES projects might be affected due to insufficient regional planning	x	x			x		2
Lack of tax exemptions or incentives unlocking new investment opportunities	The government does not oversee tax exemptions as an option as all projects are a subject to tax fee	Potential investment overturns	x	x		x	x	x	2
Investment incentives for hydrocarbons instead of RES	The government championing gas and shifted towards coals to secure energy supplies nationally as a result of a direct measure that arose with the war in Ukraine that elevated UK energy prices	Direct hydrocarbon investments resulting in better energy security as they will be faster than new renewable capacities as to cover national energy needs in the times of crisis	x	x	x				1
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	May be contradictory to the nature of renewable energy sources because it can lead to an increase in the price of energy for consumers. The deployment of RES is high across the UK, so returns on investment will be higher than expected as to make the technology economically feasible	Might lead to an increase in energy prices for consumers, which could be considered a contradiction to the nature of renewables considered for the development	x	x	x		x		1
Lack of experience with LFM	Might be not enough outreach to energy communities as to learn about their direct energy needs	Local projects likely to be not included in national RES planning as only large projects would be prioritized	x	x	x		x	x	2
Low trust in renewable energy technologies	Cost of renewable energy sources such as solar and wind higher than traditional sources of energy. This led to an opinion that the UK government is not investing enough in renewable energy and is instead favouring fossil fuels such as coal and gas	Pricey RES development costs preventing investors from making more investments in renewables			x	x			2
Possible loss of support if the projects exceed certain size	Could come in the form of a decrease in public interest, a lack of political will to fund the project, and even outright opposition from the public or local authorities	Projects could face increased scrutiny from the media and regulatory bodies, leading to delays and additional costs, the increased size of the project could also lead to a greater environmental impact, which could further reduce public and political support	x	x	x		x	x	2
Lengthy grid connection procedures	The grid connection procedure for renewable energy sources in the United Kingdom is quite lengthy and complex. It involves a number of steps and processes, including grid connection applications, impact assessments, grid connection design, and grid code compliance	All projects must undergo a grid code compliance review. This review ensures that the project is compliant with the relevant grid codes and regulations, and that it meets the necessary safety and performance standards	x		x	x	x	x	3
Lack of interest and engagement in the promotion of LFM	There is a very strong public support for renewable energy in the UK, with many citizens concerned about the impact of climate change and the country's dependence on fossil fuels	Likely to boost renewable energy policymaking and attract multiple investments if the government will understand the importance of new RES projects	x	x	x	x	x		3
Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	Fear of displacement is a major factor preventing the adoption of RES, e.g., many people in the UK are concerned that the transition away from fossil fuels will result in job losses and economic hardship. These fears are understandable, but they are unfounded as the UK can create jobs in renewable energy industries such as solar, wind, and hydropower	Might stop new projects, especially large-scale at local level. Important is to build a dialogue and educate the residents on the benefits of RES deployment	x		x	x			2
Lack of experience in commissioning and managing RES projects	The UK has only recently started to invest heavily in renewable energy sources, such as wind and solar, which results in low availability of resources and personnel with the necessary expertise to manage these projects is limited	Delays in projects due to not enough resources and qualified workforce		x	x	x			2

Lack of accessible area for new renewable plants	Too many highly urbanized areas where conditions for renewables are sufficient	Only small-scale projects available for implementation		x	x				2
Lack of sufficient requalification/training for potential LFM technology staff	The government does not invest enough in requalification of the workforce	Too high market demand resulting in project delays and cancellations due to not enough specialized workforce	x	x	x				1
Difficulty in securing labour for LFM projects	People prefer to work in the labour settings where they do not need to requalify, e.g., coal mines	Not enough staff for RES project development			x	x			1
Rigid legal, bureaucratic, and administrative procedures	The Electricity Act 1989 lays out the legal framework for the generation and supply of electricity, it also follows EU RED that sets out the legal requirements for renewable energy sources. Additionally, the Energy Act 2011 introduced several measures to promote the deployment of renewable energy sources, including the Feed-in Tariff, which incentivizes the generation of electricity from renewable sources	National policies likely to attract new investments	x	x		x	x		3
Insufficient regulation regarding smart metering	Lack of clear guidance on how the meters should be used to facilitate the integration of renewable energy sources into the UK's energy system. Poor consumer understanding of smart meter technology, which can lead to inadequate use or non-use of the meters. Also, insufficient incentives for energy suppliers to encourage the adoption of renewable energy sources. Limited access to data concerning smart meter usage and the effectiveness of renewable energy sources. And a lack of clarity regarding the cost of smart meters and their installation	To ensure the successful integration of renewable energy sources into the UK's energy system, it is important that the government puts in place clear policies and guidance on the use of smart meters	x	x	x	x	x	x	2
Strong aversion to risk towards larger RES projects	The authorities in some instances, prefer smaller projects due to lower operational and financial risk	Large-scale developments might be affected due to prioritized small-scale RES projects		x	x	x			2
Lack of cooperation with other local communities to share expertise/knowledge/resources	The UK does have a UK National Energy and Climate Plan (NECP), however individual communities have adopted their own policies and strategies for renewable energy, leading to a patchwork of policies and approaches in the local context resulting in unwillingness to cooperate at national level	Local communities often lack the resources, expertise, and capacity to develop and implement RES projects, which limits their ability to cooperate with other local communities as to share resources	x	x	x				2
Low citizen involvement in decision making activities	The government should organize public consultations on the future of renewables in the UK as society in some parts of the country do not pay attention to renewables issues, e.g., Northern Ireland/some parts of Scotland/industrial areas in England and Wales	Local projects in less involved communities such us in Northern Ireland can be affected resulting in smaller RES capacities		x	x				2

Country:	Norway								
Factor (title)	Factor (description)	Impact for LFM development in the country	Political	Economic	Social	Technological	Legal	Environmental	Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)
Market structures that support centralised energy production/local flexibility markets	Norway's electricity market is regulated by the Norwegian Energy Regulatory Authority (NVE) which sets maximum prices for electricity and ensures that the market is open, transparent, and competitive. The country is divided into two main market areas, the Nord Pool and the Elhub, responsible for the wholesale electricity market. The Nord Pool is an independent market operator, responsible for the Nordic electricity market. It is responsible for the day-ahead and intraday markets and the balancing markets. The Elhub is Norway's national market operator and is responsible for the long-term contracts, physical balancing, and the balancing energy markets. Norway's energy system is based on gas, hydropower, however sufficient investments in renewables are on the way. Government aims high for decarbonisation	Market clearly supporting oil and gas developments instead of renewables. Likely to boost RES deployment in long-term	x	x		x			1
Security of energy supply	Norwegian energy sector is regulated by the Norwegian Water Resources and Energy Directorate (NVE) responsible for ensuring the security of energy supply. The NVE works closely with grid operators and energy companies to ensure that the electricity grid can cope with fluctuations in electricity demand and supply	Norway is a part of the Nordic power market, which is one of the largest and most integrated electricity markets in the world. The Nordic power market allows for the trading of electricity between Norway, Sweden, Denmark, Finland, and Estonia, which can help to enhance the security of energy supply by providing access to a diverse range of energy sources	x	x		x	x		3
Innovation capacity and digital independence	Innovation capacity in the energy sector is supported by a range of initiatives and programs across Norway, including funding for research and development, as well as collaboration between industry, academia, and government. The Norwegian Research Council provides funding for research projects in the energy sector, including those related to local flexibility markets and digitalization	Norway has established centres for innovation and entrepreneurship in the energy sector, e.g., the Norwegian Energy Collaboratorium (NEC) which is a collaborative platform for energy companies, universities, and research institutions to work together on innovative energy solutions	x	x	x	x	x		3
Attitudes towards energy efficient products, services, technologies, and appliances	Norway introduced regulations to promote energy efficiency in buildings, including requirements for energy-efficient building materials, ventilation systems, and insulation, which helped to promote the use of energy-efficient technologies and appliances in the building sector	The deployment of local flexibility markets and the integration of distributed energy resources also provide opportunities for energy efficiency as use of smart home technologies and energy management systems can help to optimize energy consumption and reduce energy waste	x	x	x	x	x		3
Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	The Norwegian government has implemented the policies and initiatives aiming at promoting energy transition, including support for renewable energy, energy efficiency, and the electrification of transport. This has created a supportive environment for individuals and organizations to invest in energy transition	The use of smart home technologies and energy management systems can help to optimize energy consumption and reduce energy waste and the deployment of renewable energy sources such as solar and wind can provide clean and sustainable sources of energy	x	x		x	x		3
Smart grids deployment	Norway invests in the development of advanced monitoring and control systems for the electricity grid, helping to improve the efficiency and reliability of the grid. These systems are designed to provide real-time information on the performance of the grid and enable the rapid detection and resolution of any issues that arise	The deployment of smart grid technologies enables the integration of renewable energy sources, such as wind and solar into Norwegian electricity grid	x	x		x			4
Demand response infrastructure deployment (smart metering)	Norway has been actively deploying smart metering infrastructure in recent years, with the aim of improving the efficiency and flexibility of the electricity grid	Smart meters are being installed across the country, providing consumers with real-time information on their energy consumption and enabling the development of demand response programs	x	x	x	x	x		4
Decentralized energy system and storage	Decentralized energy system in Norway is based on energy storage systems such as batteries and pumped hydro storage, are being deployed to enable the storage of excess renewable energy generated during periods of low demand. In addition, the decentralized Norwegian energy system is supported by the development of advanced monitoring and control systems for the electricity grid. These systems enable the integration of distributed energy resources and energy storage systems into the electricity grid, providing real-time information on the performance of the grid and enabling the rapid detection and resolution of any issues that arise	The deployment of a decentralized energy system with energy storage in Norway is enabling the development of local flexibility markets and the integration of distributed energy resources	x	x		x	x		3
TSO and DSO regulation	TSOs and DSOs in Norway are required to provide non-discriminatory access to the grid for all market participants, including small-scale generators and consumers. This ensures that consumers and generators are able to participate in local flexibility markets and sell excess energy back to the grid	Required to provide transparent and accurate information on grid capacity and availability, which enables market participants to make informed decisions about their participation in local flexibility markets	x	x		x	x		2
Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	Norway is a leader in the development of ICT solutions for peer-to-peer energy trading and virtual power plants. The country has a highly advanced digital infrastructure, which has enabled the development of innovative energy solutions	An ICT solution for peer-to-peer energy trading in Norway is the Fjordkraft Flex platform allowing customers to buy and sell renewable energy credits directly with each other, bypassing traditional energy suppliers. The platform uses block chain technology to securely and transparently manage transactions, and it allows customers to track the origin and environmental impact of the energy they buy and sell	x	x	x	x	x		3

Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	Norway established a regulatory framework that supports the active participation of customers in the electricity markets. The country has implemented policies that provide customers with the right to connect to the grid and sell excess energy back to the grid, which helped to promote the deployment of decentralized energy systems, such as rooftop solar panels and small-scale wind turbines, and has enabled customers to play a more active role in the management of their energy consumption and production	Norwegians have the right to grid access as this is guaranteed by law. Grid operators are required to provide non-discriminatory access to the grid for all market participants. This means that customers who generate their own electricity, such as through rooftop solar panels, have the right to connect to the grid and sell any excess energy back to the grid at a fair price	x	x					3
Schemes and incentives that give advantage to big energy firms	The government introduced several incentives and subsidies to encourage the development of renewable energy projects, including Feed-in Tariffs (FiT), tax credits, grants for research and development	Supports a more favourable regulatory environment for renewable energy development, making it easier for big energy firms to secure the necessary permits and licenses to operate their projects	x	x			x		3
Grid connection costs	For small-scale onshore wind and solar PV systems up to 10-50 kW, the grid connection cost is typically around €1,000 to €2,000. For larger systems, the cost can range from €20,000 to €50,000. For offshore wind and large-scale solar PV systems, grid connection costs can be in the range of €50,000 to €250,000. These costs are typically shared between the energy producer and the grid operator	Incentives are designed to reduce the cost of grid connection and other renewable energy investments. The Norwegian government has also established a renewable energy fund, which provides financial support to renewable energy projects and helps to reduce grid connection costs.	x	x		x			4
Uncertainty and limitations in feed-in-tariff levels and schemes	Feed-in Tariff levels and schemes can arise from market conditions. The cost of renewable energy is dependent on the market price of energy, and as such, any changes to the market price of energy can have a direct impact on the cost of renewable energy. Also, Norway's renewable energy sector heavily depends on government subsidies, and changes to these subsidies can also have an impact on the cost of renewable energy	Changes to the Renewable Energy Act or the Renewable Energy Directive can have a direct impact on the cost of renewable energy	x	x			x		2
Legislative frameworks that make setting up LFM ventures difficult	Legal framework for renewable energy is complex and can be difficult for developers to navigate	Too many fossil fuel policies so RES are not prioritized at policymaking level	x				x		2
Lack of support from local representatives/local energy agencies	There is a lack of understanding of the benefits of renewable energy, which has caused many local representatives to be hesitant to commit resources to the development of renewable energy projects, also a lack of financial incentives for local representatives to invest in renewable energy, leading to a lack of political will to invest in such projects, and a lack of support from the national government, which has led to a lack of coordination between local representatives and other stakeholders involved in the development of renewable energy projects	RES deployment highly dependent on the good will of the government	x	x	x	x	x		1
Lack of a policy framework for LFM investments	Without a policy framework, there is a lack of clarity and certainty regarding the investments that must be made, which can lead to confusion and delays in implementing the necessary measures, also difficulties in attracting financing and investments for new RES projects	No adequate policy network in place, resulting in a lack of interest in renewables	x				x		1
Not mentioning LC as a relevant actor	The government likely to miss out on valuable local knowledge and insights, as well as the potential for collaboration. This could lead to decisions that are out of touch with the local context and could be detrimental to the successful implementation of renewable energy projects	Local projects affected by no dialogue between the government and the local communities	x	x	x		x		1
Complex and changeable policies regarding LFM development	Norway has implemented various policies to encourage the development of renewable energy sources in the past few years, but they are still lacking behind the needs to decarbonize its grid	Too slow progress on RES policymaking affecting renewable energy projects in Norway	x	x		x	x		2
Lack of rules regarding the opportunity to operate micro-grids	Government promotes the adoption of smart grid technology as a way of improving the efficiency of national grid	Likely to boost new, especially local RES projects	x			x	x		3
Lack of regional focus on renewable energy projects with LFM	Lack of focus has been attributed to multiple factors, including a lack of government investment in regional renewable energy projects, a lack of access to funding for smaller projects, and an emphasis on large-scale projects such as hydroelectric power plants. Norway struggled to find consensus among its regional governments on the best approach to renewable energy development	The Norwegian government should provide more funding and technical assistance to regional renewable energy projects, as well as increasing public awareness and support for these initiatives	x	x			x		2
Energy policies may have unwanted negative connotations	Energy policies in Norway are focused on national natural gas reserves, hydropower capacities and potential offshore wind projects/geothermal. Not sufficient policies regarding solar PV and onshore wind	Only certain types of projects supported due to LFMS market conditions	x	x	x	x	x	x	2
Lack of cooperation between local authorities and local communities	Local authorities may not be aware of the potential benefits of renewable energy or may be sceptical to invest in it having concerns about the costs and complexity of implementation. Meanwhile, local communities may be hesitant to embrace renewable energy due to a lack of information or a lack of trust in the local authorities. Also, a lack of incentives for local communities to cooperate with local authorities on renewable energy development. Local authorities may not provide sufficient financial or legislative support for renewable energy projects, or may not be willing to negotiate with local communities on the terms of the project	Local projects most likely affected by a lack of communication between all stakeholders	x	x	x		x		1
Difficulties for energy communities to generate enough surplus to cover organizational costs	High upfront costs associated with the development of renewable energy projects as much of the energy infrastructure in Norway is remote, which requires substantial investments in transport and grid infrastructure to connect the renewables to the energy grid. Norwegian energy communities unlikely to attract investors to support renewable energy projects, due to the relatively small and dispersed population in the country. This can be especially challenging for smaller communities with limited resources, as they may have difficulty in providing sufficient incentives to attract investors	Difficulties in accessing government grants and subsidies that are available to support renewable energy development, as these grants and subsidies may be limited in scope and require a lengthy application process for new renewable energy projects	x		x				1

Lack of long-term government funding	Norwegian government highly reliant on oil and gas revenues to finance its energy transition and has been slow to invest in renewable energy sources, also no capacity to establish a comprehensive policy framework to support the development and deployment of renewable energy sources	Little to no government funding that is available for RES projects	x	x			x		1
Initial financing problems at local government level	Depend on the type of renewable energy under development, e.g., solar energy projects often require large upfront investments in equipment, while wind and hydropower projects require long-term investments in infrastructure. Thus, local governments often face challenges in securing sufficient funds for renewable energy projects, as there are few sources of public funds available for renewable energy projects at the local level	To overcome RES financing challenges, local governments in Norway begun to explore innovative financing solutions, such as public-private partnerships, crowd funding, green bonds, and other forms of private financing. Additionally, local governments have taken advantage of various public funding instruments, such as the Norwegian Energy Fund, to finance renewable energy projects	x	x	x	x	x		2
National energy policy change and shift from RES to HYD	The war in Ukraine resulted in Norway exporting its natural gas reserves to Europe amid strengthening continental energy security caused by Russian war in Ukraine resulting in an increase in domestic fossil fuels production and usage	Unlikely to have a positive effect on the RES development	x	x		x		x	1
Difficulty in accessing loans/contracts/funding for LFM projects	Too many rules at the national level, often dictated by the region it is addressed at	Too complex regional policies make it difficult to work on renewable energy projects	x	x			x		2
Lack of tax exemptions or incentives unlocking new investment opportunities	Limited ability of renewable energy companies to access capital for new RES projects	The lack of tax exemptions or incentives also restricts the ability of renewable energy companies to innovate and develop new technologies. Without these incentives, renewable energy companies may be hesitant to invest in research and development activities due to the potential high costs	x	x		x	x	x	2
Investment incentives for hydrocarbons instead of RES	The government championing gas to secure energy supplies nationally	Natural gas production domestically championed over renewables where only hydropower projects see a wide support of the government	x	x	x				2
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	Tend to require large upfront investments, which may not necessarily lead to high returns in the short-term. Therefore, while RES technologies may lead to long-term environmental and economic benefits, the immediate return on investment may not necessarily be high enough to attract investors	Small investment funds available for the projects likely to minimize the project availability as only those projects that don't require a large upfront investment the be developed	x	x	x		x		2
Lack of experience with LFM	Might be not enough outreach to energy communities as to learn about their direct energy needs. Rather federal focus on the energy dilemma issues and new investments	Local context projects unlikely to receive enough funds and support due to little understanding of the local communities showed by Norwegian authorities	x	x	x		x	x	2
Low trust in renewable energy technologies	A result of a lack of public understanding about how renewable energy technologies work, as well as the perception that the technologies are unreliable, expensive, and difficult to maintain. The Norwegian public has limited awareness of the environmental and economic benefits of renewable energy, as well as the potential for job creation in the sector	Low trust in RES resulting in fewer projects			x	x			1
Possible loss of support if the projects exceed certain size	Renewable energy sources are heavily supported by government subsidies, tax incentives, and other forms of support. However, if projects exceed certain size, they may be subject to a loss of support.	Possible subject to a loss of support from government subsidies and tax incentives, as well as stricter regulatory oversight. This could lead to increased costs and delays, making it more difficult to finance and develop the projects			x		x		2
Lengthy grid connection procedures	The grid connection procedure is made up of three phases: the pre-application phase, the actual application phase, and the post-application phase	Extended time for possible new grid connections across the country and the integration with renewables	x		x	x	x	x	2
Lack of interest and engagement in the promotion of LFM	Norwegian government has not provided enough incentives for households to switch to renewable energy sources. This lack of financial support has further limited the uptake of RES technology in Norway	High cost of renewables, the lack of government incentives, and the lack of public awareness reducing investments to the minimum	x	x	x	x	x		2
Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	Too long relationship with fossil fuels resulting in national dilemma whether to invest in more renewables or not	Can reduce new RES investments due to a believe that fossil fuels are more reliable energy sources	x		x	x	x		1
Lack of experience in commissioning and managing RES projects	Norway has a long history of relying on oil and gas as its primary sources of energy, meaning that the country's renewable energy industry is very much in limited	The country lacks the necessary experience in the areas of commissioning and managing RES projects			x	x	x		1
Lack of accessible area for new renewable plants	Norway has an extensive coastline and large mountainous areas, making the development of new renewable plants difficult due to limited space	The cost of developing and installing new renewable plants is high due to the harsh environment, making it difficult to justify such investments			x	x		x	1

Lack of sufficient requalification/training for potential LFM technology staff	Since many of the available requalification/training courses are too expensive for potential staff. The courses do not focus on the specific technologies used in Norway, such as offshore wind and wave energy	National qualified staff shortage can significantly reduce the growth of renewables in Norway	x		x		x		2
Difficulty in securing labour for LFM projects	The cost of labour in Norway is relatively high compared to other countries, and this can be an obstacle for RES projects. This is compounded by the fact that the government in Norway has put in place strict regulations to ensure that workers are paid fair wages, which further increases the cost of labour	Not enough qualified labour for the RES projects	x	x	x	x	x		2
Rigid legal, bureaucratic, and administrative procedures	Norway is a leader in the development and implementation of renewable energy sources, particularly in the areas of hydropower and wind energy. The Norwegian government has implemented a variety of rigid legal, bureaucratic, and administrative procedures to ensure the development and use of renewable sources of energy. First, the Norwegian Energy Act of 1990 regulates the development and exploitation of renewable energy sources in Norway. This Act sets out the legal framework for the use of renewable energy sources, including the requirement that all new power plants must use renewable sources of energy. The Norwegian Ministry of Petroleum and Energy has established a Renewable Energy Development Program that sets out the criteria and procedures for the development of renewables. The Norwegian government has established several administrative procedures to ensure that the development of renewable energy sources is efficient and effective. For example, the Norwegian Energy Agency has established a Renewable Energy Certification System setting out the requirements for the certification of RES projects	Too complex regulations might delay projects, put away unprepared investors/developers	x		x	x	x		3
Insufficient regulation regarding smart metering	There is a need for stronger regulation regarding smart metering in the context of renewable energy sources despite the progress being already made. One of the major issues with the current regulatory environment is that the Norwegian government has not established clear standards and guidelines for the installation and use of smart meters	Led to a lack of consistency in the implementation of smart metering, which can lead to inefficiencies and a lack of effectiveness in the use of renewables	x	x	x	x	x	x	2
Strong aversion to risk towards larger RES projects	These projects require a significant amount of capital investment and often involve several different stakeholders	Complex Norwegian regulatory framework can cause a variety of additional risks, such as delays in project completion or potential changes in the regulatory framework. The Norwegian government has been reluctant to invest in large-scale RES projects due to concerns over their potential environmental impact	x	x	x	x	x	x	2
Lack of cooperation with other local communities to share expertise/knowledge/resources	The dialogue between the parties is difficult to reach, as one of the key reasons is the lack of shared incentives between different local governments that have different goals, objectives, and interests when it comes to renewable energy, and they may not be willing to invest the necessary resources to collaborate with other local governments	Can displace renewables	x	x	x		x		2
Low citizen involvement in decision making activities	Lack of public awareness and knowledge about the benefits of renewables and the lack of awareness and knowledge can be attributed to the fact that the government has not been proactive in disseminating information about renewable energy sources to the public. Largely attributed to the lack of public awareness, engagement and consultation, the lack of financial incentives and support, and the complex regulatory environment in place	Too complex regulatory environment can reduce the number of RES projects in Norway	x		x			x	2

Country:	Switzerland								
Factor (title)	Factor (description)	Impact for LFM development in the country	Political	Economic	Social	Technological	Legal	Environmental	Impact evaluation of the factor. Scale 1 to 4 (1=negative impact; 4=positive impact)
Market structures that support centralised energy production/local flexibility markets	centralised energy production from renewable sources is centred around the FiT (Feed-in Tariffs). Producers of renewable energy are guaranteed a fixed price for the electricity they generate which relates to any market conditions in Switzerland. Also, the tax exemptions and grants for research and development are in place. The Swiss government has recently implemented a system of carbon pricing incentivizing businesses and households to reduce their carbon emissions. Swiss electricity market structure and LFMs supported by Electricity Exchange (EEX) and The Power Exchange Switzerland (PXS) exchanges providing a platform for the trading of electricity and the balancing of supply and demand in the market. Also feed-in tariffs, renewable energy certificates, and energy auctions have been put in place and supported by several regulations and policies, such as the Renewable Energy Act, the Energy Efficiency Act, and the Energy Strategy 2050	More favourable market environment for renewable energy production in Switzerland. The Swiss government has encouraged the development of local flexibility markets to allow for increased participation of decentralized producers and consumers in the electricity market.	x	x		x			4
Security of energy supply	Switzerland has a diversified energy mix that includes nuclear power, hydroelectric power, and a growing share of renewable energy sources such as solar and wind power. This diversification reduces the country's dependence on any single source of energy and helps to ensure a reliable and secure supply. Also, a well-developed electricity grid that is interconnected with the grids of its neighbouring countries, providing backup and support during times of peak demand or supply disruptions, Switzerland has significant potential for pumped hydro storage due to its mountainous terrain, which can be leveraged to store excess energy from renewable sources. The development of local flexibility markets can also contribute to the security of energy supply by enabling the integration of distributed energy resources such as rooftop solar panels, electric vehicles, and home energy storage systems. Switzerland has set ambitious energy efficiency targets and implemented a range of policies and programs to promote energy efficiency	Diversification of energy sources, grid reliability and resilience, energy storage, local flexibility markets, and energy efficiency are all key considerations when analysing the security of energy supply in Switzerland	x	x		x	x		3
Innovation capacity and digital independence	A well-established education system, a culture of entrepreneurship, and a long history of investment in research and development. In recent years, Switzerland has also emerged as a leader in the development of digital technologies, particularly in the areas of block chain and artificial intelligence that have an enormous potential in Swiss electricity and LFMs planning	The country has invested heavily in the development of smart grid technologies and has implemented a range of policies and programs to promote the integration of renewable energy sources and the deployment of energy storage technologies	x	x		x	x		3
Attitudes towards energy efficient products, services, technologies, and appliances	Swiss consumers are generally aware of the importance of energy efficiency and are willing to invest in products and technologies that can help them reduce their energy consumption and carbon footprint	The Swiss government introduced the subsidies for energy-efficient building renovations, tax incentives for the adoption of energy-efficient technologies, and a range of other measures designed to promote sustainable energy consumption	x	x	x	x	x		3
Willingness to invest in energy transition (not just financially but also in terms of effort, time, resources, etc.)	There is a growing interest among Swiss consumers and businesses in investing in energy transition initiatives that can help them to optimize their energy consumption and production including the adoption of smart grid technologies, the implementation of decentralized energy systems, and the deployment of energy storage solutions	Strong commitment to sustainability, concerns about climate change, and a desire to reduce energy costs and increase energy independence leading to a widespread energy transition discussion positively affecting LFM deployment	x	x	x				3
Smart grids deployment	Swiss utilities and energy service providers invest heavily in the deployment of smart grid technologies, including advanced metering infrastructure, distribution automation, and grid analytics. This investment is expected to continue in the coming years, as the country seeks to achieve its ambitious energy transition goals	Present major challenge is the need to balance the deployment of smart grid technologies with the need to maintain grid stability and reliability which requires a careful coordination between utilities and grid operators, as well as the development of advanced grid management tools and techniques	x		x	x	x		3
Demand response infrastructure deployment (smart metering)	Smart metering deployed as part of the national rollout of advanced metering infrastructure (AMI). The AMI program is a joint initiative between the Swiss Federal Office of Energy and the country's four main electricity distributors. It aims to install smart meters in every household and small business by 2035, with a target of 80% penetration by 2027	Expected to create new opportunities for local flexibility markets. These markets allow households and businesses to participate in demand response programs by adjusting their electricity consumption in response to price signals or grid needs	x	x	x	x	x		3
Decentralized energy system and storage	Growing interest in decentralized energy systems and storage, particularly in the context of local flexibility markets across Swiss markets as they enable DER owners to sell their excess energy back to the grid or participate in demand response programs, thereby helping to balance supply and demand on the grid	The federal government promotes the development of local flexibility markets through various initiatives, including the Energy Strategy 2050 and the Smart Grid Switzerland program. These initiatives aim to facilitate the integration of DERs, increase energy efficiency, and reduce greenhouse gas emissions	x	x	x	x	x		3
TSO and DSO regulation	Swiss regulatory framework for TSOs and DSOs is set out in the Electricity Supply Act (StromVG) and the Electricity Supply Ordinance (StromVV). The StromVG sets out the legal framework for the Swiss electricity sector, while the StromVV contains detailed rules and guidelines for the operation of the electricity grid	Existing need to facilitate the integration of renewable energy sources and promote local flexibility markets in Switzerland. This requires a regulatory framework that incentivizes investment in grid infrastructure and enables the participation of distributed energy resources (DERs) in the electricity market	x	x			x		2
Availability of ICT solutions for peer-to-peer energy trading/virtual power plants	The federal government is promoting the development of local flexibility markets through various initiatives, including the Energy Strategy 2050 and the Smart Grid Switzerland program. These initiatives aim to facilitate the integration of distributed energy resources (DERs) and promote the development of new business models for energy management	Several actors developing the P2P, VPPs and working on energy management that can enable greater efficiency, lower costs, and increased flexibility in the electricity grid	x	x	x	x	x		3

Rights for active participation of customers in the electricity markets (through guaranteed grid access, remuneration for energy fed into the grid and demand response)	Swiss Customers have the right to access the electricity grid on a non-discriminatory basis, which means that they have equal access to the grid regardless of their size or location which is ensured through the Swiss Energy Act and the Energy Ordinance, which regulate the operation of the electricity grid and ensure that grid operators do not discriminate against any customers	The Swiss government promotes the development of local flexibility markets to enable customers to participate in demand response and other flexibility mechanisms	x	x	x	x			4
Schemes and incentives that give advantage to big energy firms	Tax Credits - e.g., the Energy Efficiency Tax Credit of up to 40% of the cost of energy-efficient measures such as insulation, energy efficiency windows, energy appliances. Subsidies - e.g., big energy firms can take advantage of various subsidies for renewable energy projects, such as the Feed-In Tariffs providing a fixed subsidy for renewable energy projects. Feed-In Tariffs - providing a guaranteed market for the sale of renewable energy, meaning big energy firms can invest in renewable energy projects knowing they will have a guaranteed market for the electricity they produce. Government Grants - big energy firms can benefit from various government grants and financial incentives for renewable energy projects, e.g., Swiss Energy Efficiency Fund and the Swiss Renewable Energy Fund. Renewable Energy Certificates - e.g., energy firms can take advantage of renewable energy certificates, which are issued by the government for each megawatt-hour of electricity generated from renewables. Certificates can be traded on the open market for additional revenue	Provide substantial support for big new infrastructure renewable energy projects nationally	x	x		x	x		4
Grid connection costs	Grid connection costs became rather expensive in recent years due to the increasing demand for renewable energy in Switzerland. Costs are comprised of two major components: the infrastructure costs for connecting the renewable energy source to the grid, and the variable costs for maintaining the connection	Might result in delays in projects due to pricey grid connection process	x	x		x			2
Uncertainty and limitations in feed-in-tariff levels and schemes	Feed-in-tariff levels and schemes in Switzerland are subject to regulatory changes that can cause uncertainty for renewable energy developers and investors. Depending on the region, the FiT differ which can be difficult for the investors to navigate. The feed-in-tariff levels and schemes are based on a maximum capacity, which limits the amount of renewable energy that can be produced in each region of Switzerland. The FiT levels and schemes are designed to encourage investment in renewable energy production, but they do not necessarily provide economic incentives for greater efficiency or innovation.	The feed-in-tariff levels and schemes in Switzerland are not necessarily applicable to all renewable energy technologies, limiting the types of renewable energy that can be developed in the country.	x				x		2
Legislative frameworks that make setting up LFM ventures difficult	The Feed-in Tariff System, the Renewable Energy Law and the Energy Law	Feed-in Tariff System requires producers of renewable energy to sell electricity to the grid at a fixed price, making it difficult for new renewable energy ventures to compete with existing producers. The Renewable Energy Law sets a limit on the amount of electricity that can be produced from renewable energy sources and requires producers to pay a minimum fee for any additional energy produced. Finally, the Energy Law requires producers of renewable energy to purchase power from the grid at a higher price than they are allowed to sell it back to the grid, making renewable energy less economically attractive to producers.	x	x		x	x		2
Lack of support from local representatives/local energy agencies	Local representatives and local energy agencies have not provided adequate support for the adoption of renewable energy because of limitations in federal funding spent on the single regions, so the funds allocated to agencies are limited. Adoption permits difficult to obtain at local level	Investment costs associated with RES are often perceived as too high for some local governments, leading to an unwillingness to invest in these technologies	x	x	x		x		2
Lack of a policy framework for LFM investments	Highly uncertain investment climate and has limited the country's ability to reach its renewable energy goals. Switzerland has a legally binding target to increase its share of renewable energy to 11% by 2050	There is a need to develop a comprehensive policy framework to facilitate investment in renewable energy projects that prevented the country from establishing a coherent regulatory system to ensure that renewable energy investments are profitable and that the energy produced is secure	x	x			x		2
Not mentioning LC as a relevant actor	Ignored the importance of local support and engagement in driving the development of renewable energy. Without local support, renewable energy projects can face resistance and lack the necessary public approval to move forward	Not recognizing local communities as relevant actors, the benefits of renewable energy projects, such as economic and environmental advantages, are not distributed equally. Often with expertise, tend to be ignored by the federal government	x		x		x		2
Complex and changeable policies regarding LFM development	Very ambitious renewable energy policy that is highly focused on the development of renewable energy sources such as wind, solar, hydro, and biomass. But the policy is constantly changing with the government introducing new incentives and regulations to help promote the development of renewable energy sources. Also, a quota system requiring the electricity suppliers to source a certain percentage of their electricity from renewables	The government has set up several initiatives to increase public awareness and knowledge of renewable energy, such as providing free information and education about renewable energy technologies	x		x		x		3
Lack of rules regarding the opportunity to operate micro-grids	No specific regulations or rules regarding the operation of micro-grids in the context of renewable energy. The lack of rules has resulted in a lack of clarity and structure around the operation of micro-grids, leading to confusion among operators, consumers, and other stakeholders	A lack of incentives and subsidies for micro-grid operators, making it difficult to develop and maintain these projects	x	x		x	x		1
Lack of regional focus on renewable energy projects with LFM	Limited land area, making it difficult to implement large-scale projects having given the most expensive land prices in the world which results in shortage of land for the construction of RES projects	Government has historically been reluctant to invest in renewable energy projects, instead favouring traditional energy sources such as nuclear and fossil fuels	x	x			x		2

Energy policies may have unwanted negative connotations	The Swiss population is not particularly supportive of renewable energy projects, with many citizens preferring to remain with traditional energy sources.	Decreases the likelihood of renewable energy projects being implemented on a regional basis.	x	x	x	x	x	x	1
Lack of cooperation between local authorities and local communities	Government has not implemented a comprehensive renewable energy policy, which has caused a lack of clarity and cohesion amongst local authorities when it comes to the details of such projects. Many local communities have limited access to information about renewable energy potential and the different technologies available, leading to a lack of knowledge and understanding of the opportunities available		x	x	x		x		1
Difficulties for energy communities to generate enough surplus to cover organizational costs	High cost of installation and maintenance of renewable energy technologies due to expensive labour and high maintenance costs for RES projects	The return on investment for renewable energy installations is often lower than for other investments, making it a less attractive option for energy communities	x		x				1
Lack of long-term government funding	Lack of government subsidies and incentives for renewable energy projects, as well as the limited access to capital for these types of initiatives, also make it difficult for local communities to generate enough surplus to cover the costs of their renewable energy projects	RES projects minimized to the minimum due to federal costs needed for such investments		x	x				1
Initial financing problems at local government level	Limited public funding, a lack of private investment due to high risk, and the challenge of making a return on investments. Also, often a lack of knowledge and technical expertise on renewable energy projects, as well as a lack of incentives from the local government	Difficult for local governments to implement renewable energy initiatives, leading to a lack of infrastructure and limited access		x		x			1
National energy policy change and shift from RES to HYD	Prompted by a desire to reduce the country's reliance on imported fuel, as well as to reduce energy costs and create more jobs but this change could also have negative implications for the national RES sector, as the promotion of hydrocarbons could disincentivise investment in renewables	The increased use of hydrocarbons could lead to increased pollution levels and higher carbon emissions	x	x				x	2
Difficulty in accessing loans/contracts/funding for LFM projects	Switzerland has a highly centralized energy sector, with most of the energy production controlled by a few large companies and lack of competition makes it difficult for smaller entities to get access to available funding for renewable energy projects. Also, the Swiss government has put in place several regulations to ensure that renewable energy projects meet certain criteria before receiving any funding	High environmental impact of some projects might have a negative impact on the Swiss environment	x	x			x	x	3
Lack of tax exemptions or incentives unlocking new investment opportunities	The Swiss government does not currently provide any tax incentives for renewable energy investments, such as tax credits, accelerated depreciation, or other tax break	Difficult for investors to make long-term investments in renewable energy projects, as returns are often too low to be attractive	x	x		x	x	x	2
Investment incentives for hydrocarbons instead of RES	Swiss government has not set any binding targets for renewable energy, meaning that there is no clear policy direction for the sector, making it difficult for investors to make sound investment decisions	The high cost of capital in Switzerland makes it difficult for renewable energy projects to be economically viable	x	x	x				2
A high return on investment may be contradictory to the nature of a LFM and their long-term outlook	Can lead to short-term financial gain rather than long-term sustainability and environmental gains but high return on investment incentivizes investors to focus on projects that result in the highest returns, rather than those that are most beneficial for the environment or create lasting change	High return on investment can lead to over-investment in certain renewable energy technologies, pushing others out of the market, and can lead to a lack of diversification in the energy mi	x	x	x		x		1
Lack of experience with LFM	Primarily due to the limited availability of renewable energy resources in the country. Switzerland is largely dependent on imported energy sources, particularly nuclear and hydroelectric power, and has yet to develop the infrastructure required to make the most of its potential in RES	Swiss government policies have yet to adequately incentivize the development of renewable energy projects, resulting in a lack of investment in renewable energy projects	x	x	x		x	x	1
Low trust in renewable energy technologies	Lack of public engagement in the decision-making process, as well as a lack of awareness of the benefits of renewable energy. Also lack of transparency in federal energy policy	Too high costs of renewables resulting in limited dialogue and RES promotion	x	x	x	x			1
Possible loss of support if the projects exceed certain size	If the projects in renewable energy technologies in Switzerland exceed certain size, there is a possibility that the support from the government and other local organizations will decline.	Possible lack of public support for these projects as the cost may be too high for the public to support	x	x	x		x		1
Lengthy grid connection procedures	The grid connection procedures for renewable energy technologies in Switzerland are lengthy and complex. The procedures involve multiple steps such as obtaining an authorization to connect, applying to the grid, obtaining an assessment of the connection request, and obtaining a final connection agreement	All renewable energy projects must comply with the legal requirements and standards set by the Swiss Federal Office of Energy and the Swiss Federal Electricity Commission which causes delays in projects	x		x	x	x		2
Lack of interest and engagement in the promotion of LFM	Lack of investment in renewable energy infrastructure, with a small fraction of national energy sources coming from RES resulting in low promotion of them	A lack of enthusiasm and commitment from the public and private sectors, and the cost of renewable technologies is much higher than HYD, so not as attractive for the business environment and households	x	x	x	x	x		2
Unreasonable opposition to RES dictated by fear of displacement, beliefs, lack of knowledge	Often based on an assumption that renewable energy sources, such as wind and solar, are not as reliable as traditional energy sources like coal and natural gas	Fear of displacement leads to opposition to the implementation of renewable energy initiatives that could lead to job losses in the traditional energy sector		x	x	x			1

Lack of experience in commissioning and managing RES projects	Limited knowledge among stakeholders on how to develop, finance, and operate renewable energy projects, as well as a lack of expertise in the area of project management	The uncertainty associated with renewable energy projects is a major barrier, as investors are often unwilling to take on the risks associated with such projects		x	x	x			2
Lack of accessible area for new renewable plants	Limited land availability due to country's size which resulted in some of the world's most expensive land prices	Too high costs associated with land purchases by the investors preventing new RES project planning and approval		x	x	x			1
Lack of sufficient requalification/training for potential LFM technology staff	Despite traditionalism and championing hydrocarbons, Switzerland shifts away from traditional energy sources and increases its reliance on renewable energy, the need for skilled and knowledgeable staff to operate and maintain the new technology is becoming increasingly important. But a significant lack of qualified personnel in the country, which is hindering the growth of the renewable energy sector. Additionally, the lack of adequate training and requalification for potential RES technology staff is a major obstacle, as it prevents them from acquiring the necessary skills to effectively operate and maintain the new technology	Possible costly mistakes of underqualified staff and health and safety issues at renewable energy plants	x	x	x		x		1
Difficulty in securing labour for LFM projects	Mainly due to a lack of skilled workers and high external costs of labour	Not enough requalification program offers resulting in securing labour for renewable energy projects		x	x	x			2
Rigid legal, bureaucratic, and administrative procedures	The Renewable Energy Act (REA) introduced in 2000, providing the legal framework for the promotion of renewable energy sources. The REA is enforced by the Federal Office of Energy (SFOE), which is responsible for the monitoring and evaluation of renewable energy projects.	The SFOE is responsible for the implementation of a system of incentives and subsidies for renewable energy projects and ensures their feasibility	x	x	x	x			3
Insufficient regulation regarding smart metering	Smart metering systems are not required for new renewable energy installations, and existing meters are not mandated to be replaced with smart meters	The lack of regulation has hindered the growth of renewable technologies across Switzerland	x	x	x	x	x	x	2
Strong aversion to risk towards larger RES projects	Renewable energy projects in Switzerland have a long history of cost overruns, delays, and technical problems. Also, population's concerns that large RES projects will damage the environment	The government has not provided the necessary financial and regulatory support to incentivize investors to take on the risk associated with such projects.	x	x	x	x		x	1
Lack of cooperation with other local communities to share expertise/knowledge/resources	The lack of a national energy policy and the highly decentralized nature of the Swiss energy market. Local communities often lack the resources and expertise to develop and implement effective renewable energy strategies, leading to a fragmented approach to renewable energy implementation	Differences in RES project implementation, depending on the region the project is planned to be allocated in	x			x	x		2
Low citizen involvement in decision making activities	Citizens are hesitant to invest in renewable energy initiatives due to the lack of a clear policy framework and the uncertain economic benefits	Limited access to capital and high costs of renewable energy plants affects cooperation between communities and the investors/government	x		x			x	2

Legend
LC - Local Communities
RES - Renewable Energy Sources
HYD - Hydrocarbons
RED - EU Renewable Energy Directive
EC - Energy Communities
ROI - Return on Investment
LFM - Local Flexibility Market
DSO - Distribution System Operator
TSO - Transmission System Operator
DER - Distributed Energy Resources
P2P - Peer-to-peer
VPPs - Virtual Power Plants

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