C4T

Community of Practice

Implementing renewable energy investments with Cohesion Policy to enable sustainability transitions

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Table of Contents

Key messages

In 2021-2027, EU Cohesion policy allocated EUR 42 billion to the energy sector (compared to EUR 31 billion in 2014-2020). 75% of this allocation is dedicated to less developed regions or territories particularly affected by the energy transition, thereby promoting their convergence with more developed EU regions.

Renewable energy expansion can catalyse growth in less developed, often rural, regions. Realising the renewable energy expansion's full potential hinges on facilitating knowledge exchange and providing technical support in addition to substantial investments. Evaluating and showcasing the regional economic advantages of renewable energy sources (RES) across various dimensions can assist local and regional decision-makers in optimising the utilisation of cohesion policy funds while also enhancing public acceptance of RES (Jenniches, 2018).

Incorporating renewable energy deployment goals and detailed action plans into regional strategic documents is essential for attracting investments and fostering stability in renewable energy projects. By doing so, governments signal their dedication to the energy transition, which in turn enhances investor confidence and provides a clear roadmap for sustainable development.

Managing authorities must prioritise funding allocation towards a socially inclusive adoption of renewables to achieve a fair energy transition. This extends beyond merely creating jobs and generating tax revenue to promoting citizen participation, fostering local social cohesion, and unlocking potential value by establishing local supply chains. Research indicates that their engagement with vulnerable and underrepresented groups and providing access to their beneficial services to alleviate energy poverty remains uncommon (Hanke et al., 2021).

Local governance is responsible for establishing appropriate procedures to involve vulnerable groups and assisting community projects in better understanding their needs. A localised approach not only enhances community resilience but also contributes to the democratisation of energy. Additionally, efforts should focus on enhancing their capacity to fulfil a social role effectively (Hanke et al., 2021).

Implementing energy-efficient technologies and practices is a cost-effective way to extend the availability of RES and is a critical component of the sustainable energy transition.

1. Introduction

THEMATIC FOCUS

This Knowledge Piece thematically focuses on the transition to sustainable and renewable energy to mitigate climate change, acknowledging the role of cohesion policy as a decisive enabler of the energy transition in the European Union (EU).

Cohesion policy funding was pivotal in advancing over 12,000 renewable energy projects in the European Union, with an investment of €5.9 billion (1.3% of the total) during the programming period of 2014-2020. Additionally, in the 2021-2027 period, EU Cohesion policy will invest EUR 42 billion on the energy sector. 75% of this allocation is dedicated to less developed regions or territories particularly affected by the energy transition, thereby promoting their convergence with more developed EU regions. This substantial investment underscores the cohesion policy's commitment to supporting member states in transitioning to RES, facilitating Europe's energy transformation.

The impact of these investments in green energy has been particularly significant in fostering convergence within certain European regions. Notably, regions in the northern and western parts of Poland stand out, having received substantial support in EU investments for sustainable energy during 2007-2013 (Chodkowska-Miszczuk et al., 2016).

In this transition, cohesion policy plays a crucial role by providing financial support and facilitating regional cooperation. Cohesion policy helps bridge regional disparities, ensuring the transition to sustainable energy is inclusive and equitable. Cohesion policy's approach can serve as a blueprint for a transformative energy transition, emphasising not just technological advancements but also social and economic aspects.

Cohesion policy supports projects that boost energy efficiency, develop renewable energy sources, and modernise energy infrastructure, contributing to a more balanced and sustainable energy landscape. This policy demonstrates how targeted investments and regional collaboration can lead to a comprehensive and transformative change in energy systems. This is also crucial for implementing critical actions under the REPowerEU plan.

This publication draws upon existing evidence regarding the impact of funding for renewable energy deployment on economic cohesion within the EU, as well as the potential for further economic development, addressing territorial disparities, and fostering job creation across regions. This Knowledge Piece offers guidance to managing authorities on optimising the conditional effects on value-added and employment resulting from investments in renewable energy technologies (RET), storage, and system flexibility encompassing structuring projects for sustainable energy growth in a participatory and environmentally conscious way.

Technological advancement, specifically in the areas of energy storage, demand response and efficiency, is crucial for achieving energy solutions that are both competitive and sustainable. Essential components include the fair allocation of energy resources, modernising the power grid, raising public awareness, and establishing robust data systems. This transition is more than just a technology shift. The transition encompasses a socio-economic and cultural transformation highlighting the importance of inclusivity and global cooperation, which needs to ensure equal opportunities for all EU citizens to partake in the benefits of economic prosperity while advancing towards achieving climate neutrality by 2050.

IMPLEMENTATION CHALLENGES AND KNOWLEDGE NEEDS

The imperative transition to climate neutrality and climate change mitigation necessitates the phasing out all fossil fuels and their substitution with low-carbon energy sources, coupled with energy efficiency improvements in buildings, industry, transport and agriculture (International Energy Agency (IEA), 2023). Such a transition is pivotal for ensuring environmental sustainability and energy resilience (Akpan & Olanrewaju, 2023). Nevertheless, this transformation threatens established economic structures for many regions, making employment in specific sectors obsolete.

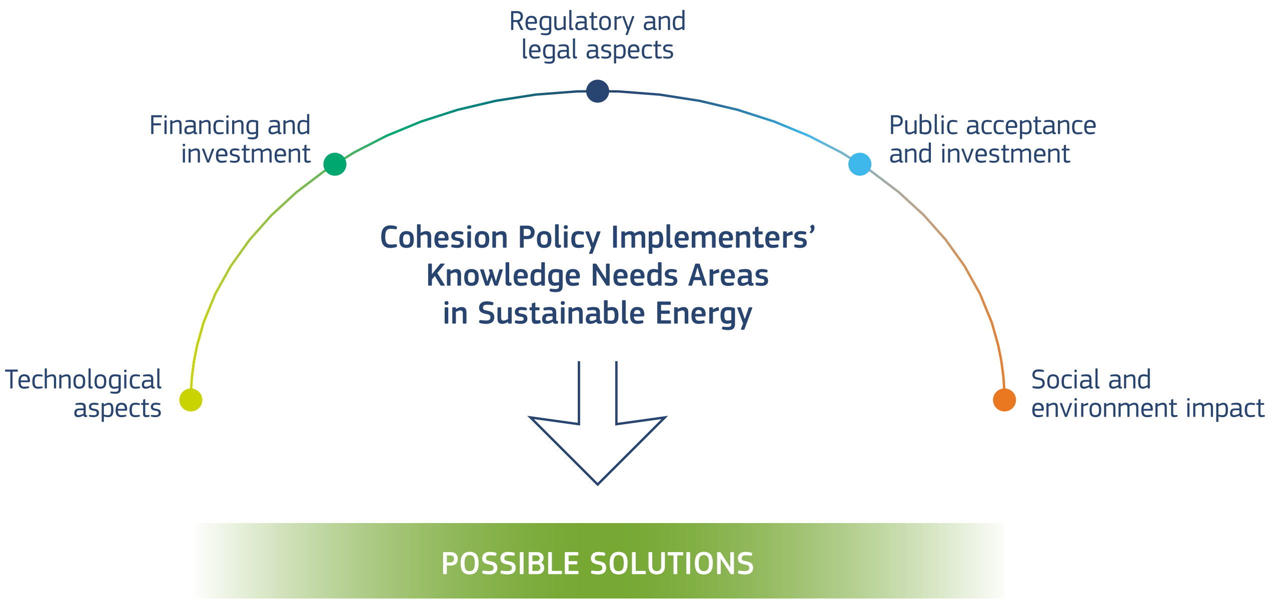
The extent of this transformation varies depending on factors such as technical potential, geographical conditions, the structure of existing energy systems, and economic structures within each region (Többen et al., 2023). Furthermore, significant capital requirements and sustainable funding frameworks might not be in place to adequately support the needs of new energy infrastructure without shifting the financial burden onto final consumers.

The intricate nature of regulations necessitates the alignment of policies across different locations. Innovative solutions are required to address technical challenges, such as the intermittency of RES and its integration into the grid. Furthermore, it is essential to effectively address the social and environmental consequences, guarantee fair and equal access for all communities, and ensure energy security throughout the transition. To achieve a successful and sustainable energy transition, it is imperative to confront these difficulties adequately.

An overview of the challenges and opportunities in the transition to sustainable energy is provided in Figure 1 below. It highlights critical areas for which sound knowledge is required, such as regulatory frameworks, financial elements, public perception, technological obstacles, and environmental considerations.

Addressing regulatory complexity and fostering public support are essential for a successful energy transition. Investments in technological innovation and resilient infrastructure are necessary to integrate RES effectively. Furthermore, policies promoting efficient permitting and co-existence with other land uses are crucial for streamlining project development. Stakeholders can pave the way for a sustainable and equitable energy future by addressing these challenges and leveraging opportunities in place-based policies.

Figure 1 Key knowledge areas for a renewable energy transition



Cohesion policy addresses many challenges of renewable energy transitions. Critical components cohesion policy seeks to support include:

- **Investment:** Cohesion policy prioritises investment in renewable energy, energy efficiency, and grid technology. These investments aim to create a sustainable energy infrastructure that reduces dependence on fossil fuels and minimises greenhouse gas emissions.
- **Challenges:** Cohesion policy acknowledges and seeks to address various challenges, including financial barriers that may hinder investments, legislative complexities that can slow down implementation, and technological constraints that affect the integration and efficiency of renewable energy systems.
- **Multilayered cooperation:** Cohesion policy promotes cooperation across multiple governance layers to manage the energy transition effectively. This includes EU-wide collaborations that align with overarching sustainability goals, market-oriented cooperation involving the private sector, and engagement with local communities to ensure that the transition is equitable and considers local needs.
- **Public awareness and engagement:** Cohesion policy recognises the importance of public involvement. By facilitating partnerships and community involvement, the aim is to foster a culture of sustainability and ensure that the public is informed about and engaged in the energy transition. This also includes building the capacity of stakeholders and establishing robust data systems to track progress and inform policy.

- **Socio-economic inclusivity:** Cohesion policy emphasises the need for the energy transition to be socio-economically inclusive. Cohesion policy aims to ensure equity and social/spatial justice so that all regions and communities can benefit from the transition. Economic resilience is another focus, aiming to create a robust economy that can withstand energy production and consumption shifts. Addressing energy poverty ensures that vulnerable populations are not left behind and can access affordable energy.
- **Government policies' influence:** Finally, the figure 1 highlights government policies' significant impact on the energy transition. Influential areas include modernising power grids to handle the increased load and variability of renewable energy, promoting energy storage and efficiency to maximise the benefits of renewables, and equitable distribution of energy resources to ensure fairness and social cohesion.

GUIDANCE PROVIDED BY THIS KNOWLEDGE PIECE

This Knowledge Piece provides guidance on the numerous complex dimensions of expanding renewable energy production and consumption.

This contribution navigates the complex landscape by highlighting knowledge needs and challenges (Chapter 2.1) and bottlenecks (Chapter 2.2), offering several solutions (Chapter 2.3), and making concrete policy recommendations (Chapter 3).

MAIN ADDRESSEES

This Knowledge Piece aims to provide a comprehensive overview for individuals and organisations involved in advancing towards a sustainable energy future, including policymakers, agencies, and local communities, such as:

- Managing authorities and policymakers who are pivotal in formulating and executing renewable energy programs
- Energy industry, such as utility companies, developers of renewable energy, and industry groups
- Environmental campaigners and community leaders
- Investors
- Scholars and scientists
- Individuals in the general population.

These may benefit from this Knowledge Piece by:

- A comprehensive and compact overview of challenges, solutions, and policy recommendations
- A sensitisation to effectively adapt to the evolving energy production and distribution environment
- Better understanding of advancing sustainable energy methods at the local community level
- Being better informed for decisions and fostering cooperation
- Providing insights for educational and research endeavours
- Acquiring a deeper understanding of the intricacies and components of the shift towards alternative energy sources
- Enabling a more active engagement in discussions and decision-making processes about renewable energy and sustainability.

This publication will underscore the urgent need for and importance of:

- Significant investments in renewable technology and infrastructure upgrades to facilitate this transition
- Strong local governance, effective policy formulation, and prioritisation, alongside capacity-building efforts to manage renewable energy investments
- Community engagement and public awareness are needed to garner broader support for the transition while considering project implementation timelines
- Technological advancements for overcoming challenges such as energy storage and grid integration while minimising the environmental impact of new energy infrastructures.

2. Navigating sustainable renewable energy across European regions

European regions exhibit diverse starting points in their transition towards sustainable renewable energy. These differences are reflected in their current energy profiles, availability of natural resources, economic structures, and progress in decarbonisation efforts. Some regions in Central and Eastern Europe and parts of Southern Europe grapple with high carbon intensity and face a longer path to climate neutrality. Others in Central and Western Europe, with higher urbanisation rates, boast robust urban infrastructure and dense populations.

This urban landscape presents both challenges and opportunities for renewable energy development. Competition for land use in urban environments may arise, requiring careful planning and coordination to balance the needs of renewable energy development with other urban priorities, such as housing, recreation, and infrastructure.
Moreover, coal regions and their communities encounter unique and intricate challenges in transitioning to a more positive trajectory, given their strong economic ties to coal mining or coal-based industries. Consequently, numerous local and national governments are actively engaging in managing this transition to prevent impacted regions and their inhabitants from being marginalised. This approach is commonly referred to as the concept of a "just transition".

Positive economic impacts from RES expansion in one region can benefit neighbouring areas through energy exports, fostering mutual economic growth.

Spill-over effects between interconnected regions play a pivotal role. Positive economic impacts from RES expansion in one region can benefit neighbouring areas through energy exports, fostering mutual economic growth. Conversely, adverse spill-over effects may arise if economic decline in one region spreads to others.

However, disparities also emerge in institutional capabilities, knowledge, and expertise related to renewable energy projects and access to digital solutions for permitting and land use optimisation. Cultural differences and attitudes toward new technology deployment further contribute to the diversification among European regions.

2.1 Needs and challenges of cohesion policy implementers

REGULATORY AND LEGAL ASPECTS

Managing authorities must adhere to national and international renewable energy laws covering energy production, environmental protection, land use, permitting processes, and decommissioning guidelines. Compliance involves obtaining permits for site development, conducting environmental impact assessments (EIAs), securing grid connection agreements, and ensuring safety standards are met. Challenges may arise from overlapping regulations, bureaucratic processes, and varying interpretations of laws at different administrative levels. Furthermore, managing authorities must navigate rapid legislation updates at the EU level, which can influence national regulations. Regulatory uncertainty and gaps in the legislation have their price, and it is usually transferred through the risk burden in the investment models to the final customers, which policymakers and local/ national governance have to protect.

The EU has emphasised the pivotal role of renewable energy in achieving carbon neutrality by 2050 through its long-term vision implied in the European Green Deal (EGD) (European Commission, 2019). All 27 EU member states have committed to reducing their 2030 emissions by 55% compared to 1990. A vital component of the EGD is the 'Fit for 55' legislative package (European Commission, 2021), which aims to meet the 2030 climate target, ensure a just transition, foster innovation, and maintain EU industry competitiveness.

In response to the energy crisis stemming from Russia's military aggression against Ukraine, the EU introduced the REPowerEU plan (European Commission, 2023), elevating the 2030 renewable energy target of final energy demand, enhancing energy efficiency ambitions and setting particular strategies for the wind and solar sectors. To accelerate permitting processes, the EU Council proposed changes to the Renewable Energy Directive (Eur-lex, 2023), resulting in the Revised Directive EU/2023/2413 adopted in November 2023. It increased the EU target of at least 42.5% of renewables by 2030 (for which installed capacities are projected to more than double by 2030). Member States are required to designate renewable energy accelerated areas and prepare plans to expedite permitting, leveraging appropriate tools and datasets. However, the transposition process could take more than a year. Therefore, concrete measures to address permitting challenges were proposed by Council Regulation on December 22, 2022 (Emergency Regulation) (Council of the European Union, 2022).

Recognising the urgent need to bolster the European wind power industry, the European Commission unveiled the European Wind Power Action Plan (European Commission, 2023). This initiative aims to align the clean energy transition with industrial competitiveness, focusing on accelerating wind energy deployment through enhanced predictability and faster digital permitting processes.

Renewable energy projects must adhere fully to the EU's environmental policy, primarily guided by the Habitats (Eur-lex, 1992) and Birds Directives (Eur-lex, 2009). These directives aim to establish a cohesive European network of protected areas. Alongside measures for designating and conserving core protection sites within the Natura 2000 network, strict protection regimes are mandated by legal documents. While Natura 2000 areas do not inherently preclude RET (renewable energy technologies) adoption, projects must be conducted in a manner that preserves the integrity of these sites. A thorough case-by-case assessment procedure is required to anticipate and mitigate potential adverse impacts. The Habitats Directive specifies that permitting procedures must include screening stages, assessments of cumulative impacts on protected sites' integrity, and conditions for derogations allowing specific projects to proceed despite potential negative impacts.

Renewable energy projects must adhere fully to the EU's environmental policy, primarily guided by the Habitats (Eur-lex, 1992) and Birds Directives (Eur-lex, 2009).

In the regulatory framework of cohesion policy financial instruments, the integration of the "Do No Significant Harm" (DNSH) principle aligns with the overarching design of the "Horizontal principle" outlined in Article 9(4) of the Common Provisions Regulation (CPR). This principle mandates the consideration of DNSH alongside the UN Sustainable Development Goals and the Paris Agreement. Specifically, the CPR articulates this Horizontal Principle within the ERDF/CF Regulation, notably in Recital 6 (Eur-lex, 2021), stipulating that both funds must support activities that avoid significant harm to environmental objectives as defined in the EU Taxonomy Regulation. This integration ensures that cohesion policy financial instruments align with broader sustainability objectives and contribute to the EU's environmental targets (Miralles et al., 2023).

FINANCING AND INVESTMENT

Ensuring universal access to the necessary funding for renewable energy projects, particularly for member states with less robust economies, may highlight an additional knowledge and skills gap. These obstacles could be attributed to insufficient financial infrastructure, lower credit ratings, or heightened perceived political risk within the region. Managing authorities and local governments not only have limited budgets allocated to renewable energy projects but might face competing priorities, such as infrastructure maintenance and social services, when planning EU funding allocation. Traditional sources of financing, such as grants and loans, may have stringent eligibility criteria or limited availability, especially for smaller municipalities with less capacity for project development and implementation. Therefore, local governance often requires assistance in knowledge transfer and capacity building to adopt and sustain renewable energy investments successfully. Investing in renewable energy projects entails financial risks, including uncertainty about future energy prices, technological advancements, and regulatory changes. Local authorities may hesitate to undertake such investments due to concerns about potential financial losses or cost overruns. Public-Private Partnerships (PPPs) are advantageous for allocating risks and consolidating resources between the public and private sectors. Supporting private investment in renewable energy projects is of utmost importance, mainly by providing investors with assurance in light of changing regulations. Changes in subsidy schemes, support mechanisms, or carbon pricing mechanisms can affect sustainable energy investments' financial feasibility and attractiveness. Member states must establish regulatory frameworks that are transparent, consistent, and beneficial to attract private investment. This involves clear objectives for renewable energy, standardised laws, and accelerated approval processes (Taubenböck et al., 2019).

RISK MANAGEMENT

Energy initiatives entail many risks, such as technological obsolescence, market instability, and natural calamities. Communities and cooperatives face a challenge in effectively managing and reducing these risks. RET is seeing tremendous advancements. There is a potential for the technology selected today to become obsolete, less effective, or more costly to maintain when compared to newer alternatives in the future. Furthermore, the fluctuation in prices for energy commodities, along with government incentives and subsidies, can significantly impact the economic feasibility of renewable energy projects. However, renewable energy assets, similar to all types of energy infrastructure, are susceptible to harm caused by natural calamities such as hurricanes, floods, or earthquakes. To summarise, effectively handling risks in sustainable renewable energy projects necessitates a comprehensive approach encompassing technical, financial, and community-focused initiatives.

While some of these risk categories are beyond the direct control of policymakers and implementers, they should prioritise minimising political risks for renewable energy projects. Local or regional political uncertainty often raises concerns for financial institutions, increasing the cost of capital for projects and ultimately impacting the final price of energy for customers.

PUBLIC ACCEPTANCE, INVOLVEMENT AND BALANCING DIVERSE INTERESTS

Scholars' interest in the social acceptance of RES has grown since the 1990s, becoming a distinct area of research following a seminal publication by Ralph Wustenhagen et al. (Wüstenhagen et al., 2007) in 2007. This concept has gained importance as it often serves as a critical factor affecting the timely installation and commissioning of renewable energy projects. Societal attitudes toward energy technologies vary widely across time and space, particularly with decentralised RES generation occurring in small-scale systems, making project location decisions more complex. Unlike conventional energy resources, often unseen by the general public, RES power plants are typically more visible and tangible to local communities and end-users (Trifonova, 2022).

Social acceptance refers to the public's active or passive approval of low-carbon technologies, deployment policies, or implementation projects. The level of public engagement determines the extent of interaction between individual and collective behaviour in the socio-economic domain. Beyond mere tolerance or passive agreement, social acceptance entails active engagement and supportive actions from consumers and communities. More than merely tolerating RET is required for its successful implementation and widespread deployment. Unlike conventional energy technologies, adopting renewables necessitates active participation from citizens, local communities, and businesses.

On the one hand, the viability of renewable energy projects hinges on the incorporation of the local communities in the planning and decision-making stages and their acceptance of these endeavours. On the other hand, implementing cohesion policy requires inclusiveness and partnership arrangements in line with the EU's requirements for a better regulation system (European Commission, 2015).

Local communities exhibit diversity, and individuals may possess varying enthusiasm, commitment, and expertise about renewable energy initiatives (Hakiman & Sheely, 2023). Given the diversity of communities, it is imperative to develop tailored strategies for engagement that cater to different levels of interest and proficiency. For individuals with greater expertise, this could involve more specialised discussions; for others, it may involve simpler, more general information sessions. Utilising the local expertise and experience of community members can significantly enhance the creation and implementation of renewable energy projects. This may enhance the sense of pride and communal ownership in the project. To enhance support, it is imperative to explicitly outline the immediate benefits to the community, such as profit-sharing initiatives, reduced energy costs, or financial resources for community development. Additionally, it is vital to cultivate understanding and expertise in various types of participatory practices in renewable energy technology deployment (European Commission, 2023).

CITIZENS ENERGY AND ENERGY COMMUNITIES

A significant obstacle energy communities and cooperatives face is obtaining the required funding to establish renewable energy initiatives (Holzmann et al., 2022). These grassroots initiatives often rely on various funding sources, including community investments, grants, loans, or crowdfunding, which can be restricted or challenging to acquire. This issue is particularly acute in low-income areas, where residents may lack the financial resources to invest in such projects. Volatility in energy prices, lack of an effective tariff mechanism, the risk of stranded assets investments in the project development process, equipment expenses, and typical project funding structure not addressing the specifics of citizens' energy can present obstacles. While policymakers have moderate awareness regarding the importance of energy citizens, local energy markets, and energy communities, there remains room for improvement. It is imperative to enhance understanding of the pivotal role played by these stakeholders and to increase efforts to raise awareness at both the policymaking and local authority levels.

Cohesion policy managing authorities may benefit from assistance in navigating the complexities of funding sources and understanding the eligibility criteria and application processes associated with each. Furthermore, knowledge of innovative financing models, such as revolving funds, green bonds, or social impact investing, could provide alternative avenues for funding community-led initiatives.

Implementers and authorities may also require support in financial planning, budgeting for renewable energy projects, and identifying key performance indicators for monitoring progress. Tailoring funding solutions to address the specific needs and challenges of energy communities in low-income areas is crucial. This could involve developing customised funding programs or financial incentives prioritising inclusivity, affordability, and social equity.

SOCIAL AND ENVIRONMENTAL IMPACTS

Renewable energy deployment's social and environmental impacts are multifaceted and can have significant distributional implications. On the one hand, the transition to renewable energy is essential for mitigating climate change and reducing greenhouse gas emissions, which can help alleviate environmental pressures and improve public health outcomes. On the other hand, however, the distribution of these impacts across different socio-economic groups and geographical areas is not uniform and can exacerbate existing inequalities if not adequately managed.

Striking a balance between the costs of transitioning to clean energy and fostering economic growth and job creation is a challenging task. Apprehensions over the social and economic consequences of the transition arise due to the potential for specific businesses and communities to be disproportionately affected. Transitioning to RES may entail significant initial expenses, such as upgrading the power grid, adopting advanced technologies, and developing infrastructure. Local government should prioritise investments in energy generation and transmission infrastructure, along with related asset construction, viewing them as sources for long-term local value-added investments and attracting further investment in the region.

Renewable energy projects can enhance the economy and create employment opportunities, particularly in manufacturing, installation, maintenance, and research (Gajdzik et al., 2023). However, this expansion would be unevenly distributed. Transitioning away from fossil fuels may lead to job losses in communities reliant on traditional energy industries such as coal, oil, and gas. Individuals currently employed in conventional energy industries may require retraining and upskilling to secure employment in the renewable energy industry.

Striking a balance between the costs of transitioning to clean energy and fostering economic growth and job creation is a challenging task.

It is important to note that not all job positions in the renewable energy sector are suitable for transitioning workers from declining sectors. However, where feasible, efforts should be made to integrate skilled workers into new roles. Additionally, robotisation and artificial intelligence (AI) have automated various processes in renewable energy production, necessitating a shift in skill and training approaches within the workforce. While these developments also facilitate remote operations and efficiency improvements, a reduction in certain types of employment in the renewable energy sector can also occur. Renewable energy simultaneously creates new opportunities for skilled workers in data analysis, software development, and robotics maintenance (ETIPWind, 2023).

For EU regions to remain competitive, the energy transition should be conceptualised in a broader context, encompassing a multi-level transformation towards knowledge industries, digital processes, system flexibility, and fostering creative workers. Policymakers must recognise that a region comprises complex, interconnected networks of industries, occupations, and skills. These networks are intertwined with a region's resilience, equality, wages, productivity, and creativity. A region must dismantle and reconstruct elements of these hidden networks to facilitate economic transformation (Shutters et al., 2021).

Cohesion policy managing authorities must develop expertise in selecting appropriate Key Performance Indicators (KPIs) to measure the socio-economic impact of renewable energy projects, integrating non-price criteria in project selection, and mapping skills and workforce capabilities. By understanding regional goals and interconnected networks and selecting indicators that reflect progress toward those goals, managing authorities can ensure that projects align with broader development objectives. Incorporating qualitative factors such as environmental impact and social acceptance enhances project selection processes, while mapping skills helps retain expertise within the region. In planning the transition inclusively, transparently, and based on evidence, managing authorities can effectively manage the complexities of energy transition and promote regional development.

At the same time, transitioning to greener energy sources can substantially positively impact public health by reducing pollution and its associated health costs (EMBER, 2018). A fair debate with local communities in carbon-intensive regions on externalities in terms of environmental and health impact would inform decisions on the scope and scale of the planned transition to low-carbon energy sources.

Citizens are increasingly concerned about the environmental impact of new energy infrastructure, prompting a need for local governance to adopt a more open and inclusive approach. Extensive academic literature highlights the importance of minimising the environmental impacts associated with RET through careful selection and utilisation methods. These impacts vary depending on factors such as fuel/RES type, size/scale, method of use, and location (Rahman et al., 2022). EU legislation mandates environmental assessments for larger projects, with compatibility assessments under the DNSH principle required before submission of cohesion policy programmes to the Commission. While there is no obligation to assess DNSH for every project, managing authorities must conduct these assessments during the program definition stage, analysing potential harm to environmental objectives outlined in the Taxonomy Regulation. This approach also applies to program amendments.

TECHNOLOGICAL ASPECTS

Expanding and enhancing the power infrastructure to accommodate an increasing proportion of intermittent RES poses a substantial challenge. Enhancing cross-border grid infrastructure is vital to promote the exchange of RES among member states. It is crucial to develop and implement efficient energy storage systems to tackle the issue of intermittent RES (Rana et al., 2023). Nevertheless, this poses technological and financial obstacles. Incorporating renewable energy projects into the current power system can pose difficulties, particularly when managing dispersed or small-scale installations. Ensuring the stability of the power system and complying with regulatory standards can be complicated. Incorporating renewable energy into the power grid and constructing an intelligent, robust, and adaptable infrastructure entails substantial expenses and intricacy. Grid infrastructure must be modernised to manage the fluctuation and decentralised nature of RES effectively. While grid infrastructure development often falls under national jurisdiction, managing authorities must familiarise themselves with technical solutions, potential bottlenecks, and strategies to improve flexibility and interoperability. Additionally, they should explore emerging energy-sharing schemes facilitated by digital tools and smart meters. These approaches offer efficient models for maximising the utilisation of existing renewable energy-generating assets, while saving grid costs (Minuto & Lanzini, 2022).

TECHNOLOGICAL INNOVATION

Ensuring the EU's ongoing leadership in advancing renewable energy technologies is paramount. The advancement of technology in areas such as solar, wind, ocean energy, hydrogen, and energy storage plays a key role in achieving sustainability objectives. Predicting the most cost-effective RET in the future is difficult due to their constant development. Forecasting renewable energy technologies' future efficiency and cost-effectiveness is challenging due to their fast advancements. This uncertainty may influence investment decisions and long-term strategic planning. The EU is a frontrunner in onshore and offshore wind energy (Rusu & Onea, 2023). The challenge lies in minimising installation and maintenance expenses while preserving the efficiency of wind turbines. Technological progress in floating wind power is essential, especially for countries with more profound coastal seas. Floating wind power devices have the potential to enable the utilisation of wind energy in untapped locations. Through standardization, hybrid offshore wind farms have the potential to evolve beyond mere facilities transmitting electricity directly to shore. They could also function as interconnectors between countries and different wind farms, based on multi-terminal, multi-vendor, multi-purpose HVDC grids in Europe. This initiative aims to establish these wind farms as interconnectors between countries, thereby facilitating the transmission of electricity between different wind farms using multi-terminal, multi-vendor, multi-purpose HVDC grids across Europe. Battery technology developments are crucial for grid stability and energy storage due to the intermittent nature of renewable energy sources such as wind and solar. For grid stability and for accommodating surplus energy, it is imperative to make progress in alternative storage technologies. Such storage technologies include hydrogen storage, compressed air energy storage, and pumped hydro storage.

GRID INTEGRATION, ENERGY STORAGE & SMART ENERGY SYSTEMS

Expanding and enhancing the power infrastructure to accommodate an increasing proportion of intermittent renewable energy sources poses a substantial challenge. Enhancing cross-border grid infrastructure is vital to promote the exchange of renewable energy resources among member states. It is crucial to develop and implement efficient energy storage systems to tackle the issue of intermittent renewable energy sources (Sánchez, A. et al, 2022). Nevertheless, this poses technological and financial obstacles. Incorporating renewable energy projects into the current power system can pose difficulties, particularly when managing dispersed or small-scale installations. Ensuring the stability of the power system and complying with regulatory standards can be complicated. The process of incorporating renewable energy into the power grid and constructing an intelligent, robust, and adaptable infrastructure entails substantial expenses and intricacy. Grid infrastructure must be modernised to manage 'RES' fluctuation and decentralised nature effectively.

TECHNICAL EXPERTISE AND PROJECT MANAGEMENT SKILLS

Technical proficiency in project planning, engineering, and grid integration is essential for developing and operating renewable energy projects. Managing authorities or non-expert beneficiaries, such as energy communities, may lack requisite expertise and competencies, resulting in project delays, sunk costs or inefficiencies. The presence of appropriate RES, such as solar radiation or wind, might vary considerably depending on the geographical location. Energy communities may have constraints in resource accessibility, which can affect the viability of initiatives. Ensuring the continual upkeep and optimal functioning of renewable energy systems is crucial for long-term success.

2.2 Bottlenecks to be overcome

REGULATORY FRAMEWORK AND LEGAL HURDLES

The permitting and approval process for renewable energy projects can be impeded by bureaucratic and legal impediments, resulting in delays (Muoneke et al., 2023). Fluctuations in rules and government policies might generate ambiguity for investors. Energy communities and cooperatives face the challenge of navigating intricate regulatory and legal systems, which exhibit substantial variations across different regions. Comprehending and adhering to these requirements can consume significant time and incur substantial expenses. Obtaining government incentives, subsidies, and tax breaks for renewable energy projects may necessitate navigating intricate bureaucratic procedures, which can challenge energy communities. Creating enduring and consistent policy is crucial to entice investment in renewable energy. This entails establishing a stable regulatory framework that mitigates investor risks and fosters long-term strategic planning and dedication. Efforts should prioritise creating enduring, consistent strategies that can entice investment and offer assurance to stakeholders.

LIMITED LAND AVAILABILITY

Allocating only 1% of land to renewable energy production could meet the EU's electricity demand (Ruiz et al., 2019). This underscores the importance of a nuanced approach to land use that balances the need for renewable energy expansion with ecological preservation and community interests. Innovative solutions like agrivoltaics, which combines agriculture with photovoltaics, or floating solar panels on reservoirs and lakes, are examples of how this challenge can be addressed.

These strategies represent a synthesis of energy production and land conservation, aiming to harmonise the advancement of renewable energy with the stewardship of natural and communal resources. Incorporating the role of spatial planning into this context is pivotal. Effective spatial planning, including the designation of "no-go" and "go-to" zones for renewable energy deployment, is essential for mitigating community opposition. "No-go" areas are defined based on ecological sensitivity, cultural importance, or community use, where renewable energy projects are restricted to protect the local environment and cultural heritage.

The permitting and approval process for renewable energy projects can be impeded by bureaucratic and legal impediments, resulting in delays.

In contrast, "go-to" areas are identified as suitable for development, often with incentives to promote renewable energy installations. These zones are selected through a participatory process, balancing environmental protection with the need for clean energy. Nevertheless, identifying suitable sites for large-scale renewable energy projects that do not disrupt other land uses can be challenging. The concepts of multi-use, where land serves multiple functions simultaneously, and synergies between different economic sectors (such as agrivoltaics) still need to be discovered by many EU citizens. Their concerns arise when renewables are installed in unsuitable areas, potentially causing harm to natural ecosystems and disrupting the land's existing use by rural communities (such as agriculture, leisure, and tourism).

Hence, the important task is to address this challenge by exploring innovative solutions, such as "fish hotels" (Tennet, 2021) or energy tourism, which enable renewable energy deployment without compromising environmental integrity or rural livelihoods. Furthermore, the process of obtaining licenses for renewable energy projects and resolving land use issues can be lengthy and may encounter resistance from residents or local environmental organisations. Tackling environmental issues is a significant obstacle, particularly in cases where land is scarce for implementing renewable energy initiatives.

A comprehensive land-use strategy is necessary, considering the ecological consequences, community requirements, and the possibility of renewable energy expansion. The strategy of delineating "no-go" and "go-to" areas, introduced in REPowerEU to streamline approval processes for large-scale renewable energy deployment, has been proposed as a potential administrative solution. However, while this approach, reliant on wildlife sensitivity mapping and robust spatial planning (WWF, 2022), holds promise, it might be misused in some regions due to a lack of knowledge and expertise. Often, local authorities introduce too many constraints (WindEurope, 2022), pre-emptively excluding renewable energy sites in environmentally sensitive areas without adequate assessment and not in line with the European Commission's guidelines on the Birds and Habitats Directives (European Commission, 2022).

COMMUNITY OPPOSITION

Local communities may express opposition towards renewable energy projects due to apprehensions about land utilisation, noise pollution, visual aesthetics, or other factors (Maleki-Dizaji et al., 2020)(Nazir et al, 2020). Renewable energy initiatives, particularly wind and solar farms, necessitate substantial land allocation, which can raise apprehensions regarding the potential loss of agricultural land, natural ecosystems, or recreational spaces. Wind turbines, such as those used for generating electricity, are frequently criticised for their noise levels and impact on the visual landscape. Moreover, extensive solar arrays have the potential to modify the visual aesthetics of a given area significantly. Although environmentally friendly, renewable energy projects can still have adverse effects on the local environment, such as disturbing wildlife habitats or migration routes. There is a commonly held belief that the presence of renewable energy projects might negatively impact property values in the nearby vicinity. Projects situated near cultural or heritage assets may encounter resistance due to potential adverse effects on these significant places. Communities may object to projects if they do not perceive any tangible advantages, such as the creation of employment opportunities or reduced energy expenses.

The partnership principle of cohesion policy is pivotal in ensuring that rural communities have ownership of infrastructure projects and can directly benefit from them. Furthermore, evaluating counterfactual scenarios, such as the long-term impact of global warming on fishing compared to the effects of constructing an offshore wind farm, could inform and change public opinion.

The cohesion policy's partnership principle is essential in addressing these issues, ensuring that rural communities gain ownership of renewable energy infrastructure and can benefit directly from it. This principle fosters collaboration between stakeholders, including local and regional authorities, private entities, and civil society, to facilitate the planning and implementation of projects in a way that respects local needs and values. By involving communities in the development process, the partnership principle aims to secure local buy-in and distribute the socio-economic benefits of renewable energy, like job opportunities and energy savings, within the community. This inclusive approach under cohesion policy can help to mitigate opposition by aligning renewable energy developments with the interests and welfare of local populations.

> **Local communities may express opposition towards renewable energy projects due to apprehensions about land utilisation, noise pollution, visual aesthetics, or other factors.**

HIGH INITIAL COST

Renewable energy technologies sometimes entail substantial initial expenses, posing a difficulty for investors in securing the required funds. Although renewable energy projects have the potential to be financially lucrative in the long run, the immediate and consistent return on investment may not be as favourable as that of fossil fuel initiatives, which dissuades certain investors (Donovan, 2020). Rising rivalry within the renewable energy industry could result in reduced profit margins for investors. Energy communities and cooperatives frequently function within competitive energy markets. Challenging larger, firmly established energy firms may be arduous, especially regarding pricing and market entry. Financial assistance options such as subsidies and tax incentives can help reduce the substantial upfront expenses associated with renewable energy projects. Financial support is essential to enhance the viability and appeal of renewable energy initiatives for potential investors.

TECHNOLOGICAL CONSTRAINTS AND RISK OF OVERCAPACITY

Renewable energy sources like wind and solar are not constant, which results in difficulties in maintaining a steady energy supply without reliable energy storage and grid infrastructure. Efficient and cost-effective energy storage solutions help mitigate the intermittent nature of RES. These technologies are crucial for guaranteeing a consistent and dependable energy supply and are essential for the widespread use of renewable energy. While technological advancements like Li-ion batteries have seen successful implementation in various sectors and have proven profitable in ancillary electricity markets, other technologies like hydrogen storage, P2X, and CAES are still in active development and have limited utilisation (Chehade et al., 2019).

Before investing in energy storage technologies, which are not yet market mature and require financial support, managing authorities and local governments should strive to achieve a well-balanced energy mix and analyse evolving energy demand patterns. Detailed assessments of demand profiles and energy efficiency measures, particularly in buildings, can help alleviate seasonal peaks, reducing the need for costly baseload or storage capacity and new investments in RES generation. In light of increased interconnectivity, considering neighbouring countries' transition plans would also help avoid regional overcapacity and mitigate potential negative impacts on the financial models of new investments. Moreover, sector coupling is reshaping consumption patterns in the long term. Addressing technological and regulatory barriers to energy sharing is essential to harness the potential of smart consumption of green energy fully.

2.3 General Policy: Policy questions and potential solutions

ENERGY TRANSITION STRATEGIES

What are the most effective strategies for phasing out fossil fuels and transitioning to renewable energy sources in different regions and sectors? How can a just transition be ensured that the economic and social impacts on communities and workers affected by the shift away from fossil fuels are considered?

Potential Solutions

- Recognising the socio-economic specifics of each region to formulate tailor-made energy transition strategies accounting for varying needs, resources, and capacities.
- Supporting towns reliant on the fossil fuel industry through economic diversification and the implementation of job retraining initiatives based on the strategic clustering approach.
- Elaborating clear strategic roadmaps would provide predictability and signals to stakeholders, facilitate resource planning and allocation, and gradually manage workforce reskilling, upskilling, and new job occupations.
- Engaging impacted communities and workers in the planning process to guarantee a fair and comprehensive transition.
- Gradually diminishing reliance on fossil fuels while expanding renewable energy capacity, prioritising energy efficiency measures.
- Utilising EU-level collaboration platforms to track progress and exchange knowledge and best practices, such as leveraging technical assistance programs such as C4T Groundwork for additional support.
- Implementing policies that promote balanced growth of renewable energy (solar, wind, hydro, and geothermal) and discourage the utilisation of fossil fuels.

POLICY AND REGULATION

What regulatory and policy frameworks are most effective in promoting renewable energy deployment while providing long-term stability for investors? How can policy and regulation support equitable access to RET for all communities, including marginalised and low-income groups?

Potential Solutions

- Setting ambitious yet attainable targets for the implementation of renewable energy.
- Revising regulations to make it easier to incorporate decentralised and fluctuating RES.
- Offering reliable and market-based incentives, such as price risk-stabilisation instruments,contracts for difference, support for citizens projects (grants for feasibility studies, low or zero interest financing, ESCO schemes), investment and operating aid for hybrid projects and yet not mature low-carbon technologies.
- Ensuring that policies encourage fair access to renewable technologies, particularly for marginalised and low-income communities, potentially through targeted subsidies or community energy programs.
- Including non-price criteria in the selection of RES projects.
- Introducing opportunities for green procurement by the managing authorities.

How can more private investment into renewable energy projects be attracted, and what financial mechanisms or incentives can help reduce the cost of capital? What are the potential risks and returns associated with renewable energy investments, and how can these be mitigated and optimised?

Potential Solutions

- Offering assurances or insurance products to mitigate political, regulatory, and technological risks might incentivise investment.
- Providing precise details regarding the possible hazards and profits associated with renewable energy projects, such as market trends and technology improvements, can assist investors in making well-informed choices.
- Encouraging the use of green bonds and other sustainable finance products can appeal to investors who are specifically interested in supporting environmentally friendly enterprises.
- Utilise public funds to entice private investment, especially for projects of significant magnitude.

PUBLIC AWARENESS AND EDUCATION

How can public awareness be raised and people be educated about the benefits of renewable energy and sustainability transitions? What strategies can be employed to build public support for renewable energy policies and investments?

Potential Solutions

- Ensuring transparency to the broader public through comprehensive citizen engagement initiatives, utilising various forms of communication and involvement methods. For example, see guidelines under Action 2, Outputs of the Just Transition Platform Working Groups) (Library of the Just Transition Platform Working Groups Outputs).
- Integrating renewable energy concepts into school curricula (starting from primary school groups) and providing public seminars to normalise the new technologies.
- Promoting local renewable energy initiatives to cultivate collaboration and demonstrate practical advantages (for instance, OCEAN and BSREC are networks for collaboration of stakeholders with conflicting interests in marine renewable energy).
- Dispelling myths and countering anti-RES propaganda with the assistance of fact-checking communication channels.
- Collaborating with esteemed community leaders and groups to disseminate awareness.
- Utilising various forms of media, including social media platforms and public events, to distribute information about the benefits of decarbonisation, good practices (especially showcasing regional experience) and highlighting political priorities for promoting RES.

What are the environmental and land use challenges associated with large-scale renewable energy projects, and how can these be minimised or mitigated? How can community acceptance and participation be ensured in renewable energy projects, and how can social and equity considerations be addressed?

Potential Solutions

- Conducting a thorough mapping of land and surfaces suitable for RES and prioritising these plots with minimal impact, for instance, priority for urbanised areas where to install solar PV or agrivoltaics approaches for stand-alone systems.
- Developing tools for monitoring stakehoder participation in the phases of policy shaping and implementation (i.e. STEP Index)
- Providing equitable remuneration and concrete advantages to impacted communities, like nearby job prospects.
- Ensuring easy access to the results of EIAs, Social Impact Assessments (SIAs) and Monitoring Programs, including databases equipped with analytical features such as GIS mapping and filtering, among others.
- Implementing environmentally conscious project designs and methods to reduce ecological footprints, including implementing approaches for co-existence, specifying technology design to minimise visual noise, among other.
- Identifying sites and analysing the feasibility and costs of site recultivation to minimise ecological impact, including degraded fields or existing infrastructure locations.
- Engaging local communities at the outset of the planning process to secure approval and tackle social and equality concerns.

LOCAL OWNERSHIP AND BENEFITS

What are the economic, social, and environmental benefits of local ownership and community control of renewable energy assets? How can the benefits of renewable energy projects be distributed equitably within communities, including job creation and reduced energy costs?

- Local ownership guarantees the community retains financial advantages, such as profits and decreased energy expenses.
- Communities directly engaged in renewable projects are more inclined to give more importance to environmental sustainability.
- Renewable energy projects have the potential to generate employment opportunities at the local level in several areas, such as installation, maintenance, and administration.
- Local control cultivates a more robust affiliation with the initiative, augmenting community backing and involvement.

How can the development and deployment of advanced RET be accelerated, such as next-generation solar panels, energy storage, and grid management solutions? What are the most promising emerging technologies for improving renewable energy production and consumption efficiency, and sustainability?

Potential Solutions

- It is imperative to enhance the allocation of funds and resources towards pilot projects to advance less mature technologies. This entails the cooperation of governments, academia, and industry to test, stimulate and replicate innovation.
- Streamlining the regulatory approval procedure for novel technologies can expedite their market introduction.
- Developing a proficient workforce capable of managing new technologies is crucial for effective implementation and uptake.
- Offering financial incentives, such as grants, subsidies, and investment in research infrastructure, might motivate corporations and researchers to engage in the development of new technologies.
- Encouraging collaborations between the public sector and private enterprises helps speed up the transfer and implementation of technology.

Cutting-edge Energy Storage Technologies and their Applicability

By integrating some cutting-edge technologies, the energy grid can manage the variability of wind and solar power, ensuring that renewable energy is a reliable and consistent source of electricity. What follows are a few indicative examples:

Lithium-Ion Batteries: These are currently the most common form of energy storage, used both on a small-scale in-home energy system and on a large scale in grid storage to balance supply and demand.

Pumped Hydroelectric Storage: This is one of the oldest and most mature methods of energy storage. Excess electricity is used to pump water uphill to a reservoir. When energy is needed, the water is released to flow downhill through turbines, generating electricity.

Compressed Air Energy Storage (CAES) involves storing compressed air in underground caverns. When electricity is required, the stored air is released to turn a turbine.

Thermal Storage Systems: These systems store energy in the form of heat. For example, concentrated solar power plants can use molten salt to store heat, which can later be used to generate steam and turn a turbine.

Flywheel Energy Storage: Flywheels store electricity in the form of kinetic energy. They can respond to energy demands in seconds, making them useful for stabilising the grid.

Flow Batteries: These batteries store energy in liquid electrolyte solutions in external tanks, which can be scaled up easily to increase capacity.

Green Hydrogen: Produced via electrolysis using surplus renewable energy, green hydrogen can be stored and used in fuel cells to generate electricity.

Demand Response Programs: These programs adjust the demand for electricity rather than the supply. Consumers are incentivised to use less energy during peak demand times.

Smart Grid Technology: Advanced grid technologies can predict and respond to fluctuations in energy supply and demand, integrating various renewable sources and storage solutions more effectively.

Vehicle-to-Grid (V2G) Systems: Electric vehicles (EVs) can be storage units. When plugged in, an EV's battery can absorb excess energy and feed it back into the grid when demand is high.

GRID AND INFRASTRUCTURE

How can grid infrastructure be enhanced to accommodate a higher share of renewables, including integrating decentralised energy sources and improving cross-border interconnections? What are the best practices for grid resilience, reliability, and incorporating smart grid technologies?

Potential Solutions

- Enhancing the current grid infrastructure to accommodate the fluctuating nature of RES.
- Implementing cutting-edge technologies to enable instantaneous monitoring and administration enhances the grid's robustness and dependability.
- Stimulating the construction and utilisation of microgrids.
- Investing in extensive energy storage technologies to effectively handle the issue of intermittency and guarantee a consistent power supply.
- Integrating distributed energy sources, such as residential solar panels, with advanced technology like smart meters and grid control software.
- Strengthening cross-border grid connections to facilitate energy sharing and balance supply-demand fluctuations.

What breakthroughs in energy storage technologies and grid flexibility solutions are needed to overcome RES's intermittency? How can energy storage be integrated into the energy system effectively and affordably?

Potential Solutions

- The objective is to advance the development of battery technologies that are more efficient, cost-effective, and have a longer lifespan, such as solid-state batteries.
- Developing solutions to integrate storage seamlessly into the energy system while balancing affordability and efficiency.
- Investing in expansive storage technologies, such as grid-scale battery storage, pumped hydro storage or compressed air energy storage, to offer support at the grid level.
- Improving grid flexibility through implementing demand response technology and enhanced forecasting models.

How can data collection, monitoring, and reporting track progress toward renewable energy goals and ensure transparency and accountability are improved? What metrics and indicators are most relevant for assessing the success of sustainability transitions?

Potential Solutions

Utilising smart meters, Internet of Things (IoT) devices, and cloud computing to gather and analyse data in real-time. Establishing standardised metrics and indicators to monitor progress, such as reductions in CO_2 emissions, energy output, and economic advantages.

Ensuring transparency and accountability by facilitating easy access to data for stakeholders and the public. Implementing mechanisms for continuous monitoring and evaluation of renewable energy projects.

2.4 Energy Community-related: Policy questions and potential solutions

ENERGY COMMUNITY FORMATION AND GOVERNANCE

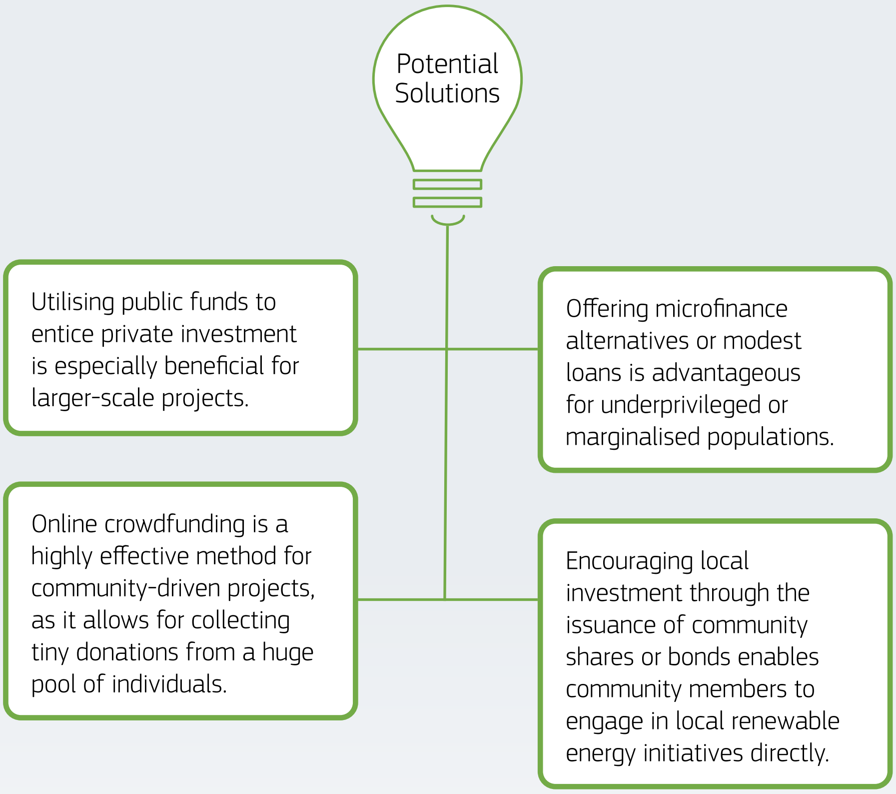
How can the formation of energy communities and cooperatives be encouraged to promote decentralised and community-owned renewable energy projects? What governance structures and legal frameworks are most conducive to the effective operation of energy communities and cooperatives?

Potential Solutions

- Implementing legal frameworks that acknowledge and endorse energy communities, such as enacting dedicated cooperative legislation and thoughtfully implementing EU regulations.
- Developing transparent and participatory governance frameworks to ensure efficient functioning and involvement of the community.
- Offering financial assistance to facilitate the early expenses of establishing and running community energy initiatives.
- Providing instruction and materials to educate individuals in the community about renewable energy and project management and to support them in organising communication campaigns (for instance, by providing tailor-made white label materials; see national portals of SHAREs project).

FINANCIAL MODELS AND ACCESS TO CAPITAL

What financial models, such as crowdfunding and community-based financing, can support energy communities and cooperatives in raising capital for renewable energy projects? How can barriers to accessing financing for community-based renewable energy initiatives be addressed, particularly in underserved or marginalised communities?



SYSTEM INTEGRATION AND INTERACTION WITH UTILITIES

How can energy communities and cooperatives integrate their renewable energy projects into the grid and collaborate with utilities to ensure reliability and stability? What regulatory mechanisms and market designs can facilitate the interaction between energy communities and the broader energy system?

Potential Solutions

- Implementing measures such as net metering or feed-in tariffs to enable the selling of surplus energy back to the power grid.
- Establishing agreements or collaborations between towns and utilities is crucial for effectively managing energy and financial flows and ensuring grid stability.
- Implementing smart grids to enhance energy management and facilitate the integration of decentralised energy sources.
- Establishment of conflict-resolution mechanisms (including rules and institutional responsibilities) and coordination bodies to enhance trust and alignment of interests between large-scale utilities and citizen initiatives.
- Developing regulatory frameworks that facilitate the connection between energy communities and the wider energy sector, guaranteeing equity and inclusivity.

KNOWLEDGE SHARING AND CAPACITY BUILDING

How can knowledge and best practices be shared among energy communities and cooperatives to facilitate their success and replication in different regions? What capacity-building initiatives can help communities develop the skills and expertise to manage renewable energy projects effectively?

Potential Solutions

Developing digital platforms that facilitate the exchange of experiences, best practices, and resources among communities is crucial. These options may encompass forums, webinars, and online workshops. Social media groups can facilitate communication and engagement amongst various energy cooperatives.

When seasoned cooperatives provide guidance to their less experienced counterparts, implementing a mentorship initiative can yield significant effectiveness. This kind of peer-to-peer learning enables the exchange of implicit knowledge that may not be documented in official training resources.

Comprehensive training tools, including manuals, guidelines, and instructional films, can assist newly formed cooperatives in navigating the intricacies of renewable energy projects. These tools should be readily available and customised to accommodate different proficiency levels.

Collaborations with universities and research organisations offer chances to access cutting-edge research, specialised knowledge, and training programs. Possible forms of collaboration encompass cooperative research endeavours, internships, and the delivery of guest lectures.

SCALING UP AND REPLICATION

How can successful energy community models be scaled up and replicated to accelerate the adoption of renewable energy at the community level? What barriers exist to the widespread adoption of community-based renewable energy, and how can they be overcome?

Potential Solutions

- Document the successful models comprehensively, providing detailed information on their business plans, technology selections, community engagement methods, and financial frameworks. Extensively disseminating these case studies can offer standardised models for other areas.

- Allocate resources towards implementing training programs aimed at developing local expertise and skills. This entails providing community people with knowledge on renewable energy technologies, project management, and sustainable behaviours.

- Develop energy community models that can be replicated in diverse circumstances. This encompasses the utilisation of scalable technologies and flexible management approaches.

3. Policy recommendations and takeaways

Takeaway 1:

Utilise cohesion policy funds smartly with a holistic perspective on leveraging private investment, achieving local value-added, and controlling energy distribution.

Strategically utilising cohesion policy funds is paramount for leveraging private investment and achieving local value addition in renewable energy endeavours. This involves carefully designing policies and incentives that not only encourage private investment but also prioritise local economic development and sustainability. This approach should include establishing regulatory frameworks that provide incentives for gradually increasing renewable energy integration, promoting innovative energy storage solutions, and implementing demand response initiatives to optimise energy usage.

Furthermore, ensuring the resilience and adaptability of the energy grid is crucial for accommodating the evolving energy landscape and fostering a robust environment for investment. This may involve developing smart grid technologies and fostering collaboration between adjacent grids to exchange resources efficiently. Additionally, offering stakeholders educational programs and training sessions can enhance understanding and support for renewable energy initiatives, ultimately driving local value creation.

Takeaway 2:

Promote energy communities and citizen-energy initiatives to involve citizens directly in the energy transition and allow them to benefit from it.

Establishing unambiguous legal definitions and unified organisational form requirements allows energy communities to be recognised officially as pivotal participants in the energy sector, providing them with the necessary legitimacy and support. Simplifying regulatory procedures for establishing and running energy community initiatives is essential, as it streamlines processes such as grid connection and licensing requirements for small-scale renewable energy plants, reducing barriers to entry. Offering monetary incentives, such as subsidies, grants, or tax exemptions, specifically aimed at supporting renewable energy initiatives at the community level is crucial for providing financial support and incentivising participation. Additionally, providing technical assistance and capacity-building initiatives supports communities in project development by offering resources such as feasibility studies, technical planning, and management training. Promoting collaborations between energy communities and local governments leverages the latter's ability to contribute significantly to community energy advancement through policy implementation, financial support, and resource exchange. Finally, establishing systems to systematically monitor and evaluate the performance and impact of energy communities ensures they effectively achieve sustainability goals and provide valuable insights for policy improvement, ensuring their long-term success and contribution to the energy transition.

Takeaway 3:

Strategies to address community opposition, improve planning and stakeholder engagement, and deliver projects on time.

Strategic planning and proactive stakeholder engagement are essential to address community opposition and ensure timely project completion effectively. Engaging with the community early in the planning process facilitates understanding and resolution of concerns, fostering a sense of ownership and acceptability. Transparent communication about project details and benefits helps mitigate misconceptions and build stakeholder confidence. Comprehensive impact studies, including visual and noise assessments, address specific concerns and ensure transparency in decision-making. Providing tangible benefits to the community, such as employment opportunities and local funding, enhances project acceptance. Additionally, responsiveness to community feedback, including evaluating alternate sites and safeguarding cultural heritage, demonstrates a commitment to addressing concerns. Assuring property value protection further alleviates economic worries, fostering positive community relations and project success.

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