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Decentralized Solar Energy as a Catalyst for Community Empowerment, Social Equity and Climate Action in the Euromed region [1]

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1. Executive Summary

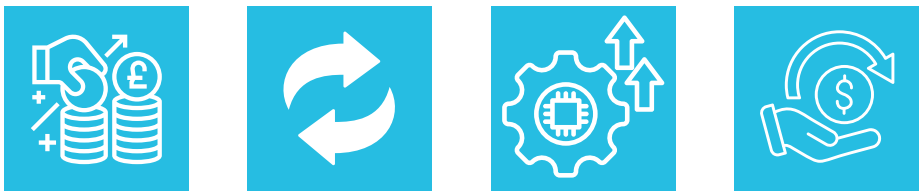
This policy brief examines the transformative potential of Decentralized Solar Energy (DSE) systems to address both climate change and socio-economic inequity in the Euromed region, spanning Southern Europe, North Africa, and parts of the Middle East. The region faces rising temperatures, water scarcity, and more frequent extreme weather, while rural and marginalized communities continue to suffer from energy poverty and economic disparities.

Local solar installations—ranging from community-owned projects to self-production models—offer clean, affordable electricity that bypasses the challenges of centralized grid expansion. By doing so, they not only lower greenhouse gas emissions and enhance energy security but also stimulate local economic growth, job creation, vocational training, and community participation in energy governance. Successful experiences in Spain, Tunisia, Morocco, and Lebanon underscore the benefits: Spain's cooperative models reduce household energy costs and invigorate local economies; Tunisia's decentralized self-production improves energy autonomy; Morocco's solar-powered agriculture enhances food security and rural livelihoods; and urban projects in Lebanon provide cost-effective alternatives to diesel generators, mitigating chronic power shortages.

However, the expansion of these systems faces significant hurdles. Regulatory frameworks in many Euromed countries currently favor centralized energy, leaving decentralized projects underfunded. High upfront costs and the lack of tailored financing mechanisms further restrict adoption. Targeted policy reforms —including streamlined administrative procedures, strengthened public-private partnerships, and innovative financial instruments like microfinancing and green bonds— can fully unlock the potential of decentralized solar energy as a cornerstone of a just and sustainable energy transition of the Euromed region.

2. Introduction

The Mediterranean region stands at a critical crossroads where environmental challenges and socio-economic disparities intersect, making the transition to renewable energy not just desirable but imperative. Decentralized solar energy systems offer a sustainable alternative to traditional, centralized power models. In regions marked by abundant solar resources and pressing energy poverty, such as those spanning Southern Europe, North Africa, and the Middle East, decentralized solutions promise enhanced energy security, reduced greenhouse gas emissions, and strengthened local economies.



Recent literature and best practices highlight both the successes and challenges of deploying community-based solar initiatives. For instance, case studies from Spain, Tunisia, Morocco, and Lebanon reveal that decentralized solar projects can lower energy costs, generate local jobs, and foster community resilience. However, debates persist regarding regulatory hurdles, financing mechanisms, and the scalability of these systems compared to conventional centralized grids.

This work adds value by synthesizing diverse experiences and identifying actionable policy recommendations tailored to the unique socio-economic and environmental context of the Euromed region. Its potential contribution lies in guiding policymakers to reform outdated frameworks, promote public-private partnerships, and ultimately ensure that the benefits of renewable energy transition are equitably distributed across communities.

3. Mediterranean Context

The Mediterranean region is uniquely positioned at the crossroads of Europe, North Africa, and the Middle East, characterized by its abundant solar resources and a mosaic of socio-economic realities. With some of the highest solar irradiance levels globally, the region holds immense potential for harnessing renewable energy, particularly through decentralized solar energy systems. However, this opportunity is juxtaposed with significant challenges, including energy poverty, infrastructural deficits, and stark socio-economic inequalities.

In Southern Europe, for example, countries like Spain have leveraged community-owned solar projects to address rural energy poverty while simultaneously stimulating local economies. The success of such initiatives is supported by robust policy frameworks and substantial investments, with renewable energy sectors creating tens of thousands of jobs and lowering household energy costs. Yet, even in these advanced economies, regulatory and administrative hurdles sometimes slow the scaling up of decentralized energy solutions.

North African nations, such as Tunisia and Morocco, face a different set of challenges and opportunities. Tunisia's experience with decentralized solar self-production has shown that even modest investments in photovoltaic systems can significantly enhance energy autonomy in remote areas. Data from recent studies indicate that strategic support for these installations can lead to reduced reliance on conventional power sources and contribute to job creation, particularly in rural communities. In Morocco, the integration of solar-powered agricultural cooperatives has not only lowered operational costs for farmers but has also enhanced food security by providing a stable energy supply for irrigation systems. Nevertheless, both countries often struggle with outdated regulatory frameworks and limited access to tailored financing, which hamper the broader deployment of such systems.

In the Middle East, urban areas like Beirut in Lebanon confront chronic power outages and a heavy dependence on fossil fuels. Here, decentralized solar projects emerge as a cost-effective alternative to expensive and polluting diesel generators, alleviating both the financial and environmental burdens on households. However, fragmented policy environments and regulatory uncertainties continue to pose challenges for scaling these initiatives.

Overall, the Mediterranean context is defined by a significant potential for solar energy development that, if effectively harnessed, could transform regional energy landscapes. Addressing country-specific challenges—through streamlined regulations, innovative financing, and enhanced local capacity—is essential to unlock the full benefits of decentralized solar energy and ensure that the renewable transition is both inclusive and sustainable.

4. Approach and Results

This research adopts a mixed-method approach combining in-depth case studies and policy analysis to examine decentralized solar energy projects in the Euromed region. It focuses on analyzing successful projects to understand their socio-economic impacts—including community empowerment, job creation, and enhanced energy access—while also scrutinizing the governance models, challenges encountered during implementation, and the strategies employed to overcome these obstacles. Simultaneously, a comparative analysis of the regulatory frameworks across various Euromed countries identifies factors that promote or hinder the adoption of decentralized solar systems, underscoring the necessary reforms to ensure that national energy strategies are aligned with the specific needs of marginalized communities.

The approach began with the selection of representative case studies from Southern Europe, North Africa, and the Middle East. These case studies include community-owned solar projects in rural Spain, decentralized solar self-production models in Tunisia, solar-powered agricultural cooperatives in Morocco, and urban community solar initiatives in Lebanon. Each case study was chosen to reflect diverse geographical, economic, and regulatory contexts. By comparing these experiences, the study aimed to identify best practices and critical success factors that enable decentralized solar systems to reduce energy poverty and drive local economic development.

The research background is anchored in the increasing adoption of decentralized solar energy as a viable alternative to traditional centralized grids. In the Euromed region—characterized by high solar irradiance but also by significant energy and economic disparities—decentralized systems have emerged as a promising solution. They not only mitigate the environmental impacts of fossil fuel dependence by reducing greenhouse gas emissions but also provide localized energy solutions that empower communities. The study's methodology, therefore, bridges technical assessments with socio-economic evaluations to demonstrate how renewable energy can serve broader development goals.

In rural **Spain**, the Crevillent Local Energy Community illustrates how community-owned solar projects can lower energy bills, create local green jobs, and strengthen social cohesion. Despite initial investment challenges, decreasing technology costs and supportive government incentives enhance financial viability, while expanding vocational training helps address the growing demand for skilled solar professionals.

In **Tunisia**, a decentralized solar self-production model—reinforced by regulations since 2009 and 2015—has enabled low-voltage consumers to generate their own electricity while staying grid-connected. Through the Prosol Elec program, nearly 160 MW of solar capacity was installed by the end of 2022, significantly reducing reliance on conventional energy and lowering household costs. This approach has spurred local job creation, enhanced workforce training, and provided a cost-effective alternative to expensive centralized grid expansion, thereby supporting Tunisia's broader renewable energy and energy independence goals.

In **Morocco**'s Souss-Massa region, a local agricultural cooperative replaced diesel generators with a solar-powered system to run irrigation and other equipment, significantly reducing operational costs and environmental impact. Supported by the Green Morocco Plan, the initiative improved crop cultivation and food security in a semi-arid climate, while also fostering community involvement through local skills training. This example underscores the benefits of decentralized solar energy as a cost-effective alternative to centralized grid expansion, enhancing both economic viability and community resilience.

The urban community solar initiative in **Beirut, Lebanon,** demonstrates how decentralized solar energy can address frequent power outages and high costs associated with diesel generators. By utilizing public buildings for solar installations, the project not only improves power reliability and reduces energy expenses for both residents and local governments, but also fosters community participation through training programs. Despite facing regulatory and financial challenges, the initiative has spurred job creation, reduced installation costs, and provided a scalable model that aligns with Lebanon's renewable energy goals.

A cost-benefit analysis across the case studies shows that decentralized solar projects yield substantial savings on household energy bills, generate employment opportunities, and reduce carbon emissions. The data also reveal that regions with more progressive regulatory environments tend to experience faster uptake and greater socio-economic benefits from these initiatives.

In summary, the approach taken in this research—combining case studies and policy analysis—has provided robust evidence of the potential benefits of decentralized solar energy systems in the Euromed region. The results demonstrate that, despite challenges such as regulatory barriers and high initial investment costs, the benefits in terms of energy affordability, local economic development, and environmental sustainability are significant. These findings underscore the need for coordinated policy reforms and targeted investments to overcome existing obstacles and fully leverage the transformative potential of decentralized solar energy.

5. Learnings and Recommendations

The comprehensive analysis of decentralized solar energy initiatives across the Euromed region reveals both promising opportunities and critical challenges. The implications of our findings extend beyond mere energy cost savings; they point to far-reaching socio-economic and environmental transformations that can reshape regional development. However, realizing these benefits on a broader scale requires deliberate and coordinated policy interventions, innovative financing mechanisms, and robust capacity-building efforts. The following sections detail the implications of current trends and provide concrete, actionable recommendations for policymakers, regional institutions, and stakeholders.

5.1.Main learnings

Decentralized solar energy systems have already demonstrated their capacity to transform energy landscapes in diverse contexts. In rural areas, such as those in Spain and Tunisia, community-based models have led to significant reductions in household energy expenses while simultaneously creating local employment opportunities. These systems not only foster energy autonomy but also stimulate local economic development by generating green jobs and promoting skill development. The resulting empowerment enhances community resilience, which is critical in regions where centralized grids are unreliable or entirely absent.

In Morocco, the integration of solar-powered agricultural systems has direct implications for food security and sustainable rural livelihoods. By lowering operational costs through stable energy supplies for irrigation and other agricultural processes, solar cooperatives support both economic viability and environmental sustainability. Meanwhile, in urban settings like Beirut, Lebanon, decentralized solar installations have emerged as a pragmatic solution to chronic power outages and high dependence on diesel generators. Their successful deployment suggests that even in complex urban environments, renewable energy systems can reduce both financial and environmental burdens.

These case studies also underscore significant implications for policy frameworks. Current regulatory environments, which are predominantly designed for centralized energy systems, frequently hinder the deployment of decentralized models. The persistence of high upfront costs and limited access to tailored financing options further exacerbates the challenges of widespread adoption. In essence, while the technical feasibility and socio-economic benefits of decentralized solar energy are well documented, existing policy and financial frameworks in many Euromed countries do not yet provide the conducive environment necessary for rapid scaling. Moreover, the implications extend to the regional governance and coordination level. In the fragmented policy landscape of the Euromed region, harmonizing national strategies and aligning regulatory measures across borders could enable more effective knowledge sharing and resource pooling. Such regional integration is essential for overcoming the inherent disparities in energy access and for fostering a cohesive approach toward sustainable development.

5.2. Policy Recommendations

In light of these implications, the following recommendations are proposed to ensure that the transformative potential of decentralized solar energy is fully realized.

Optimize Regulatory Frameworks and Incentives

National governments should undertake a comprehensive review of existing energy policies to eliminate barriers that hinder the integration of decentralized solar systems. Simplifying permitting processes, harmonizing grid integration rules, and updating regulatory measures to keep pace with rapid technological advancements in solar energy are essential. At the same time, targeted fiscal incentives—such as tax credits, feed-in tariffs, and low-interest loans—should be introduced to ease the initial capital burden. Tailored financial instruments like microfinancing and green bonds can also make solar installations more accessible to underserved communities. Finally, establishing a collaborative framework among Euromed countries to align energy policies and share best practices can foster a unified market environment, facilitate cross-border investments, and enable the pooling of resources to address common challenges.

Promote Public-Private Partnerships (PPPs)

Encouraging the development of public-private partnerships is key to leveraging private sector expertise and funding while ensuring public interests are safeguarded. Such partnerships should target both large-scale deployment of decentralized solar systems and community-based projects. It is also important to develop risk-sharing mechanisms that lower financial risks for private investors; government-backed guarantees or subsidies can help de-risk renewable energy projects, making them more attractive. Moreover, incorporating provisions for vocational training and technical education within PPP agreements will ensure the[5] proper installation and maintenance of solar systems, create local job opportunities, and foster economic empowerment.

Strengthen Financing Mechanisms

Developing innovative financial instruments designed specifically to support decentralized solar projects is indispensable. This approach may include blended finance models that combine public funding, philanthropic contributions, and private capital. Additionally, establishing regional or national investment funds dedicated to renewable energy initiatives should be prioritized, particularly for projects with strong community involvement and tangible socio-economic benefits. Collaborating with financial institutions to create tailored credit lines for small-scale solar installations, especially in rural and marginalized areas, could significantly enhance the affordability and attractiveness of decentralized energy systems.

Invest in Local Capacity Building and Technical Training

Investing in comprehensive training programs in collaboration with local technical schools, universities, and industry associations is essential to ensure that communities can sustain and expand their renewable energy initiatives. Organizing community workshops and information sessions to educate local stakeholders on the benefits and operation of decentralized solar systems will enhance local understanding and technical know-how, ensuring long-term project success. Furthermore, establishing platforms for knowledge exchange among communities, experts, and policymakers is vital for sharing best practices, technological innovations, and lessons learned from successful projects in other regions.

Develop Comprehensive Monitoring and Evaluation Systems

Implementing robust monitoring and evaluation systems for decentralized solar projects is critical to their success. Key performance indicators—such as energy cost savings, job creation, reductions in carbon emissions, and improvements in local energy autonomy—should be systematically tracked. Transparent data collection and dissemination will build public trust, attract further investments, and provide policymakers with the evidence needed to refine and scale successful models. Additionally, establishing effective feedback loops will enable continuous improvement of policies and practices, ensuring they remain responsive to evolving conditions and emerging challenges.

Foster Community Participation and Ownership

Promoting initiatives that encourage community ownership of renewable energy projects is essential to ensure that local populations directly benefit from the economic gains associated with solar energy. Models such as cooperatives and community funds can play a crucial role in achieving this goal. Integrating local stakeholders into the decision-making process regarding energy projects not only enhances the legitimacy and acceptance of these initiatives but also ensures that projects are tailored to the unique needs of each community. Supporting grassroots initiatives and start-ups focused on renewable energy solutions further encourages social innovation that addresses specific local challenges.

Strengthen International and Regional Cooperation

Leveraging support from international organizations such as the European Union, the World Bank, and regional development banks is crucial to secure technical assistance, funding, and policy guidance. Organizing regional forums and conferences that bring together policymakers, industry leaders, and community representatives can serve as incubators for innovative ideas and facilitate the alignment of strategies across countries. In addition, promoting cross-border renewable energy projects that harness the solar potential of the entire Mediterranean basin can lead to economies of scale, increased efficiency, and shared benefits across national boundaries.

Implement Adaptive Policy Frameworks

Finally, ensuring that energy policies are flexible and regularly updated to reflect technological advancements and shifting market dynamics is vital. A responsive legislative environment will accommodate emerging innovations in solar technology and financing. Supporting pilot projects that test new models of decentralized energy deployment can provide valuable insights and pave the way for scaling up successful initiatives. Policymakers should adopt a long-term perspective that addresses not only immediate energy needs but also future challenges such as climate change, population growth, and urbanization, thereby building resilient energy systems capable of withstanding future shocks.

5.3. Call for Action and Responsibility

The transformation of the Euromed energy landscape through decentralized solar energy is not an automatic process—it requires the coordinated action of multiple stakeholders. National governments must take the lead in reforming regulatory frameworks and incentivizing renewable energy investments. Regional bodies and international donors have a critical role in financing and technical support, while local communities must be empowered to take ownership of these projects. The successful implementation of these recommendations hinges on a shared commitment to a sustainable, inclusive energy future.

In conclusion, the policy recommendations outlined above are grounded in rigorous analysis and real-world evidence from across the region. They offer a roadmap for overcoming current barriers and fully harnessing the potential of decentralized solar energy to drive socio-economic transformation. By streamlining regulations, fostering public-private partnerships, enhancing local capacity, and promoting regional cooperation, the Euromed region can create a more resilient, equitable, and sustainable energy system. The time to act is now, and it is incumbent upon all stakeholders—governments, financial institutions, industry leaders, and community representatives—to collaborate in turning these recommendations into reality.

6. Conclusion

The findings of this policy brief underscore the transformative potential of decentralized solar energy systems for the Euromed region. By analyzing case studies from Spain, Tunisia, Morocco, and Lebanon, it becomes evident that localized solar solutions not only reduce energy costs but also foster significant socio-economic benefits. In rural communities, community-owned and self-production models have led to measurable reductions in household energy bills, enhanced energy autonomy, and the creation of green jobs. These initiatives have empowered local populations, strengthening community resilience and catalyzing economic revitalization.

The integration of solar-powered systems into agricultural cooperatives has demonstrated that renewable energy can directly contribute to food security and sustainable agricultural practices. Similarly, urban projects highlight the ability of decentralized systems to mitigate the challenges of unreliable power supply and high dependency on diesel generators, ultimately easing the financial burden on households while advancing environmental sustainability.

Despite these positive outcomes, the analysis reveals persistent challenges, including regulatory barriers, high initial investment costs, and fragmented policy frameworks. These obstacles hinder the full realization of the benefits offered by decentralized solar initiatives. Therefore, it is imperative for policymakers to address these issues by streamlining regulations, enhancing financing mechanisms, and investing in capacity building. The evidence presented in this brief suggests that with targeted policy reforms and coordinated efforts, decentralized solar energy can be a cornerstone for a just and sustainable energy transition across the Mediterranean region, paving the way for long-term social and economic development.

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About FEMISE

FEMISE, the Forum Euroméditerranéen des Instituts de Sciences Économiques, is a Euro-Mediterranean network of over 100 economic and social research institutes from both shores of the Mediterranean. Established in Marseille, France, in 2005 as an NGO, FEMISE promotes dialogue on economic and social policies to foster cooperation and mutual benefit between Europe and its Mediterranean partners. Coordinated by the Economic Research Forum (ERF) in Egypt, FEMISE focuses on strengthening research capacity, fostering public-private dialogue, disseminating research findings, and building partnerships to support regional collaboration and sustainable development.

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The European Institute of the Mediterranean (IEMed), founded in 1989, is a think-and-do tank focused on Euro-Mediterranean relations. Guided by the Euro-Mediterranean Partnership (EMP), European Neighbourhood Policy (ENP), and Union for the Mediterranean (UfM), it promotes cooperation, mutual understanding, and intercultural dialogue to build a shared space of peace, stability, and prosperity. IEMed is a consortium of the Catalan Government, the Spanish Ministry of Foreign Affairs, the EU, and the Barcelona City Council, with contributions from civil society through its Board of Trustees and Advisory Council.

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