Summary and Key Takeaways

Environmentally Friendly Economic Tools and Finances : A Path Towards Sustainability in the Mediterranean

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SHAPING THE MEDITERRANEAN'S FUTURE: GREEN FINANCE AND ECONOMIC TOOLS FOR ADDRESSING ECOLOGICAL AND SOCIO-ECONOMIC CHALLENGES

The Mediterranean region faces a series of interconnected challenges that threaten its future sustainability. Rapid climate change, rising temperatures, and decreasing precipitation are only the beginning of a broader set of environmental pressures, compounded by the region's complex developmental landscape. As underscored by Plan Bleu's SOED2020 report (2020) and MedECC (2020), the Mediterranean is warming at a rate 20% faster than the global average, already reaching temperatures 1.5°C above pre-industrial levels. These changes exacerbate water scarcity, biodiversity loss, pollution, and the destruction of ecosystems, particularly in the region's coastal and urban areas. Additionally, economic disparities between the North and South further hinder the implementation of effective sustainable development policies. The persistence of social inequalities, high youth unemployment, and environmental degradation necessitate comprehensive, region-wide strategies to promote a more resilient, sustainable future.

By 2050, the Mediterranean is expected to face a significantly worse situation, with major transformations in its marine ecosystem, overall ecological degradation, and increasing vulnerability to external factors like climate change and geopolitical/economic shifts (MED2050 report, Plan Bleu 2025). As the Mediterranean faces ecological decline and socio-economic instability, it is crucial to accelerate the transition to a sustainable development model in order to meet the Sustainable Development Goals (SDGs) and ensure a fair and prosperous future for the region. This requires not only stronger environmental policies but also a realignment of economic and financial mechanisms, ensuring that economic policies support both environmental stewardship and socio-economic well-being.

A key step in this transformation is the gradual phase-out or reorientation of environmentally harmful subsidies (EHS) (Plan Bleu and UNEP/MAP 2024). The next step involves the proactive implementation of green public finances and economic tools (GFET) to drive sustainable change. These tools aim to channel financial resources towards ecologically sustainable projects and support the transition to a green economy by integrating environmental goals into economic planning. They help reduce environmentally harmful subsidies while fostering innovation and sustainable solutions to address ecological and socio-economic challenges. Green public finances encompass a variety of fiscal instruments all aimed at embedding environmental sustainability into the economic fabric of governments.

UNEP/MAP recognizes the critical need to promote economic instruments and sustainable finance within the region. As part of the ongoing revision of the Mediterranean Strategy for Sustainable Development (MSSD) for the 2026-2035 period, a strategic framework that guides sustainability actions in the Mediterranean, UNEP/MAP and Plan

Bleu play a key role in ensuring that sustainable finance is meaningfully integrated into the region's future environmental and socio-economic policies. The implementation of GFET in the Mediterranean must be tailored to the region's unique environmental, economic, and social contexts. With a diverse group of countries, ranging from high-income nations in the North to economies with differentiated development paths in the South and East, a one-size-fits-all approach is unlikely to be effective.

Aware of the urgent need to address Green Finance and Economic Tools, Plan Bleu initiated an Edited Volume report to provide insights for Mediterranean decision-makers. In 2024, an open Call for Papers invited researchers to explore Green Finance's role in key sustainability challenges. Thirteen proposals were selected and funded, with drafts that were discussed in a regional workshop in January 2025. These documents form the chapters of the Edited Volume, which truly resembles an encyclopedia of knowledge on the subject, providing a comprehensive and in-depth resource that is both applicable and adaptable to the diverse challenges faced by stakeholders in the region. While the majority focus on regional issues, some address specific countries as case studies, all providing recommendations that are relevant to the Mediterranean's broader context. This «by Mediterraneans, for the Mediterranean» approach offers invaluable insights, ideas, and practices from diverse perspectives.

Among the Key Takeaways:

BROAD RANKING OF SUSTAINABLE FINANCE AND GREEN ECONOMY TOOLS

The **first chapter** offers a comprehensive introduction to the field of Sustainable Finance, with a particular focus on green economy tools and public finance mechanisms across Mediterranean countries. It critically assesses a range of instruments, including environmental taxation, green bonds, carbon pricing, and renewable energy incentives, and evaluates their effectiveness in fostering sustainable economic development and environmental stewardship.

The chapter underscores the considerable regional disparities in the deployment of these tools. The effectiveness of green economic tools in the Mediterranean hinges on strong institutions, political stability, and adequate fiscal capacity. While robust governance enables effective implementation, disparities in institutional strength, economic structures, and political will lead to uneven progress. High-income and politically stable countries are generally better positioned to adopt green finance mechanisms, though this is not always the case, as some developing countries have also successfully implemented such reforms despite facing challenges. In fact, while developed countries have already significantly reduced harmful subsidies, these subsidies remain notably high in many developing countries. Some Southern Mediterranean countries have established stable frameworks and made strides in these areas. Regional cooperation remains essential but is often hindered by geopolitical tensions and fragmented governance.

While high-income countries like France and Italy stand out with the adoption of methods such as green budgeting and ecological taxation, others, such as Morocco and Tunisia, focus on targeted incentives to promote renewable energy and eco-labeling. However, obstacles remain, including limited technical capacities, sometimes fragile governance, and challenges related to regional harmonization, although some national reforms can be implemented without regional harmonization. Successful implementation depends on the strength of institutions, stakeholder involvement, and effective coordination. To enhance the impact of these initiatives, the region needs a shared vision, strengthened capacities, innovative financing, and regional cooperation to better align economic reforms with environmental sustainability goals.

EVALUATING GREEN FINANCE INSTRUMENTS: EFFECTIVENESS OF CARBON PRICING, FITS, AND GREEN BONDS IN THE MEDITERRANEAN ENERGY TRANSITION

The **second chapter** focuses on the role of green finance in supporting the energy transition within Mediterranean countries. It explores how various economic instruments and finance mechanisms can drive climate change mitigation while contributing to the broader goal of transitioning to a low-carbon economy.

Discussions include the effectiveness of tools such as environmental taxation, feed-in tariffs (FiTs), carbon pricing, subsidies, and green bonds. By drawing on econometric analysis and policy evaluations, the chapter highlights how these instruments affect greenhouse gas (GHG) emissions and help facilitate the shift from fossil fuels to renewable energy sources. A key takeaway from the analysis is that green finance, while indispensable, must be embedded within a broader, coherent policy framework to effectively drive the transition. For instance, environmental taxes, though they can reduce GHG emissions, are most effective when accompanied by stringent regulatory measures.

Data for environmentally related tax revenue (% of GDP) for the period 1994-2021 and FiTs (USD) for the period 2000 – 2019 are extracted from the OECD database, whereas per capita GHG emissions (GHGPC) data (tonnes CO2e/year) is extracted from the IEA and Emissions Database for Global Atmospheric Research (EDGAR). The author employs "fixed effects" econometrics modelisation, with Models 1a and 1b examining how total environmental tax revenue (ENVTAX), as a percentage of GDP, affects greenhouse gas emissions per capita (GHGPC). Meanwhile, Models 2a and 2b specifically focus on the impact of taxes related to climate change (CLIMTAX) on GHGPC. Both sets of models show that a 1 percentage point increase in either ENVTAX or CLIMTAX results in a slight decrease (0.01-0.02%) in GHG emissions per capita. This implies that environmental taxes alone may not be set at levels high enough to significantly change behavior, especially if the cost of compliance is lower than the economic benefits of continuing high-emitting activities. However, strict environmental policies may increase the effectiveness of taxes by creating additional pressure to adopt cleaner technologies and practices. In the same analysis, GDP per capita (GDPPC) makes a significant contribution to emissions per capita; i.e. being a wealthier country in average per capita terms implies an increase in the GHG

each person emits on average. To be more precise, a 1% increase in GDPPC leads to a 0.5-0.6% increase in emissions per capita. On the other hand, renewable energy output, REO, contributes to the low-carbon transition significantly as it decreases emissions by 0.005% as REO increases by 1 percentage point. Higher shares of fossil fuel consumption contributes to increasing per capita emissions, as expected.

Feed-in tariffs are another policy tool discussed in this chapter, though they should be approached with caution, as they do not always ensure genuinely "green" outcomes. These tariffs guarantee a stable long-term purchase price for renewable energy, thereby reducing investment risks and encouraging private sector participation in renewable energy projects. However, the analysis highlights that the success of FiTs is not automatic and is more likely to yield positive results when they are supported by a political environment focused on reducing dependence on fossil fuels. Discussions also suggest that these tariffs should support a variety of renewable energy sources, with a particular emphasis on small producers and community-based projects, to promote energy democratization. In general, while FiTs have encouraged private investments, their impact is limited in certain sensitive areas where they may harm biodiversity. They can also encourage equipment imports rather than the development of local industries. Their overall effectiveness should therefore be very much nuanced.

Carbon pricing, whether through carbon taxes or emission trading systems, theoretically aims to internalize the social cost of carbon by reflecting the economic damage caused by CO_2 emissions. However, challenges such as carbon price volatility and the difficulty in accurately determining the true cost of carbon and setting the tax level at that cost limit the effectiveness of these mechanisms. Despite these challenges, the revenue generated from carbon quota auctions has been effectively used in several European Union member states to finance climate-related initiatives, such as renewable energy projects and energy efficiency. In addition to carbon pricing, green finance instruments, including green bonds and green loans, can directly channel investments into low-carbon projects. Green bonds, for example, have seen significant growth since their introduction, although they face criticism related to greenwashing and insufficient climate impact.

Green loans, similarly, are growing in popularity, with varying levels of success across regions. Central banks, particularly in developed countries, are also starting to incorporate green finance into their frameworks, though developing nations face more significant challenges due to economic instability. Multilateral finance initiatives, like the Clean Technology Fund and multilateral development banks (MDBs) such as the European Bank for Reconstruction and Development (EBRD), play a pivotal role in supporting the green transition by providing funding for renewable energy projects and climate initiatives. These financial instruments, when properly aligned with environmental goals, can significantly contribute to the low-carbon transition, though further research is needed to assess their long-term effectiveness in reducing emissions.

Policy Tool/Instrument	Evaluation	Reasoning
Environmental Taxation	Good	Promotes resource efficiency, fosters climate mitigation, encourages innovation, and targets high-emissions sectors effectively if well-designed and policy is highly stringent.
Feed-in Tariffs (FiTs)	Neutre	Can support renewable energy adoption but may fail without coherent energy policies or provisions prioritizing smaller producers/community-based projects. The impacts of FiTs to each renewable resource may differ depending on the country context. Damaging effects on biodiversity, landscapes, and imports
Other Subsidies for Renewable Energy	Good	Supports potentially the growth of infant renewable industries, aids the green transition, and fosters economic sustainability when designed effectively. Damaging effects on biodiversity, landscapes, and imports.
Carbon Tax	Good	Encourages emissions reductions by internalizing environmental costs, fostering a low-carbon economy, and driving innovation in green technologies.
Subsidies for Fossil Fuels	Bad	Anchors fossil fuels in the economic structure, hinders renewable energy development, and reduces fiscal space for green initiatives and development.
Grants/Loans/Bonds for Green Transition	Good	Targets high-emissions sectors like energy and transport, aiding the transition to a low-carbon economy.
Energy Efficiency Investments/ Incentives	Good	Reduces energy consumption and emissions while creating economic savings and fostering sustainable development.
Green Reporting and Transparency.	Good	Enhances monitoring of green finance, ensures accountability, and aligns investments with sustainability goals.
Fossil Fuel Subsidy (FFS) Removal	Good	Frees up potential financial resources for green investments and supports climate goals, provided that mechanisms are put in place to protect vulnerable populations.

TABLE 1

Preliminary ranking of the policy measures and economic tools for the energy transition in the Mediterranean
Source: Author's own synthesis

ALIGNING FISCAL POLICY WITH DECARBONISATION GOALS: STRATEGIC APPROACHES FOR MEDITERRANEAN ECONOMIES

For effective climate action, there is a need for coordinating economic and environmental policies. This is the rationale behind the **third chapter** which focuses on the vital role that economic policymakers, particularly Ministries of Economy and Finance, play in shaping decarbonisation pathways that align with climate stabilisation goals. The chapter stresses how economic policymakers must work closely with ministries of environment, energy, agriculture, and transport to assess the fiscal, macroeconomic, and distributional impacts of climate policy. This collaboration is crucial to ensure that the technical aspects of decarbonisation, which are often not immediately apparent to economic policymakers, are fully integrated into economic planning.

The methods for calculating effective carbon prices and fossil fuel subsidies are outlined, with Cyprus serving as a case study, to help policymakers assess the real impact of carbon pricing across sectors. The analysis incorporates current schemes like the EU Emissions Trading System (ETS), excise taxes on fuels, and circulation taxes on vehicles and also considers future changes. A key feature is the concept of the «shadow cost of carbon,» which represents the price needed to achieve decarbonization goals by 2050. The analysis shows that while road transport is taxed adequately, many sectors, like industry, aviation, and shipping, are either under-taxed or untaxed. This creates implicit fossil fuel subsidies, estimated at about 2.5% of the GDP of Cyprus.

The analysis also highlights the importance of understanding the medium and long-term fiscal implications of decarbonisation policies. This is especially relevant as increasing portions of tax revenue are linked to the environmental performance of economic sectors. This is particularly evident with taxes on fossil fuels, which will decrease as sectors like transport shift to electric vehicles. For instance, excise taxes on oil products and annual circulation taxes based on vehicle emissions will gradually shrink, leading to significant fiscal implications. By 2030, public revenues from these sources could experience a gradual decline, although the extent of this decrease remains uncertain, especially in Mediterranean countries heavily dependent on fossil fuels and considering the volatility of oil prices. Nevertheless, this highlights the urgency of adapting fiscal systems in response to the ongoing energy transition. Policymakers must anticipate these changes and consider decoupling tax bases from emissions to maintain fiscal sustainability while continuing to incentivize green transitions.

A set of criteria for prioritising public investments in decarbonisation is also provided. This goes beyond traditional cost-effectiveness assessments and takes a more holistic approach that includes environmental and broader socio-economic considerations, which is critical for economic ministries to make informed decisions. The criteria include measures of GHG emissions savings (Criteria 1), energy efficiency (Criteria 3), and climate resilience (Criteria 6), which ensure that investments deliver substantial environmental benefits. Additionally, the framework assesses economic multiplier effects (Criteria 9), job creation (Criteria 10), and economic resilience (Criteria 15), providing ministries with a broader understanding of how decarbonisation can also drive economic growth and social stability. The approach is highlighted as being applicable to non-EU Mediterranean countries, with the caveat that analyses and inter-ministerial collaboration must be adapted to each country's unique challenges and contexts, such as restricted access to international climate funds or technical expertise.

FINANCING THE RESTORATION OF MEDITERRANEAN MARINE BIODIVERSITY: LEVERAGING THE NATURE RESTORATION LAW AND INNOVATIVE INSTRUMENTS

How can we leverage the Nature Restoration Law (NRL) and what innovative financing instruments for restoring Mediterranean marine biodiversity should we privilege? This is the question that drives the **fourth chapter**, which explains how the NRL establishes explicit targets for restoring key marine habitats and presents an ambitious framework that requires substantial financing from both public and private sources, while also leveraging EU co-financing instruments.

The chapter presents various financing mechanisms and tools that could support the restoration of marine biodiversity in the Mediterranean. Conservation Trust Funds are considered particularly effective due to their long-term financial sustainability, targeted conservation efforts, and scalability. Conservation fees and charges, especially in tourism-heavy areas, have strong revenue-generating potential and can directly support restoration efforts in Marine Protected Areas (MPAs). Blended finance and private sector investment can mobilize private capital for restoration, though their success depends on attractive returns and low risk for investors. Payments for Ecosystem Services (PES) offer direct rewards for conservation efforts and perform well in well-structured, small-scale projects, but face implementation and monitoring challenges. Public subsidies have the potential for large-scale impact if well-designed, but require strong political support to avoid creating perverse incentives. Blue bonds can attract significant funding, particularly for large-scale or transboundary projects, but they demand strong institutional capacity. Finally, although carbon markets and biodiversity credits have significant potential, they are mainly focused on so-called «blue carbon» ecosystems (seagrass beds, macroalgal forests and soft sediments). However, they need to be supported by strict regulatory frameworks to ensure their effectiveness and credibility. It is also worth noting that biodiversity credits exist for other types of ecosystems, including coastal and terrestrial ones, and they too require appropriate regulation.
While these tools offer significant potential, their success is contingent upon their design, the regulatory frameworks in place, and the need for strong governance. The chapter emphasizes that these mechanisms should be part of a comprehensive, integrated policy approach, as their efficiency is highly dependent on their complementarity with other tools.

Ranking	Financing Instrument	Impact	Efficiency	Scalability	Feasibility	Limitation
1	**Conservation Trust Funds**	Long-term support (e.g., MedFund) Depends on the initial funding or its renewal	Targeted use, low leakage	Can expand to wider MPAs	Needs strong governance	Focused on conservation, not restoration
2	**Conservation fees and charges**	High potential via tourism/resource use	Direct if well-targeted	Applicable mainly in tourist MPAs, but also to islands or ports.	Easier than public reform	Depends on visitor flows, needs earmarking
2	**Private investment & blended finance**	Unlocks private capital	Dependent on returns and risk	Expandable with incentives	Limited by regulation, investor interest	Can only complement public funding
2	**Payments for Ecosystem Services**	Rewards conservation	Effective when structured well	Small/local in scale	Complex to monitor and implement	Relies on ecosystem valuation
3	**Public subsidies**	High potential if well-designed	Depends on activity targeted	Aligns with NRL goals	Needs political will	Risk of perverse effects, equity concerns
3	**Taxes**	Generates revenue, indirect restoration support	Efficient if well-designed	Expansion faces resistance	Needs strong political support	Equity and social acceptability challenges
3	**Blue bonds**	Large-scale restoration funding	Efficient but may have risks	Suitable for big/transboundary projects	Requires high capacity and major funders	Greenwashing risk if poorly monitored
4	**Carbon markets & biodiversity credits**	Potential in 'blue carbon' areas	Investor interest, low legitimacy	Dependent on demand	Needs strong science/regulatory frameworks	Early stage, needs alignment with EU/international rules

TABLE 2

Preliminary ranking of financial mechanisms and tools for marine restoration in the Mediterranean

Source: the author's own qualitative assessment.

ENHANCING MEDITERRANEAN IAS MANAGEMENT: FROM PIGOUVIAN TAXES TO PUBLIC-PRIVATE PARTNERSHIPS FOR SUSTAINABLE SOLUTIONS

The **fifth chapter** also addresses biodiversity, but through a more targeted lens: it examines the substantial economic burden caused by invasive alien species (IAS) in the Mediterranean. These species have led to financial losses exceeding $27.3 billion, particularly affecting key sectors such as fisheries, aquaculture, and tourism. Despite these substantial costs, current IAS management approaches remain predominantly reactive, emphasizing control and mitigation rather than prevention. The discussion highlights the potential of economic tools to enhance financial sustainability and improve long-term management effectiveness.

A range of economic instruments are examined as mechanisms to internalize the costs of IAS while incentivizing proactive management. Prevention-focused tools like Pigouvian taxes, tradable permits, and performance bonds have high potential but face challenges in enforcement, particularly in non-EU Mediterranean countries. Adaptation tools such as compensation and subsidies seem more feasible and widely applied, especially under EU funding schemes, but require stable financial support. Notably, direct financial incentives, such as removal subsidies for pufferfish and lionfish, have proven successful in integrating IAS control into commercial fishing activities. Compensation mechanisms for fishers affected by IAS-driven stock declines further illustrate the importance of economic support structures. Liability insurance, while ensuring long-term remediation funding, remains underutilized due to complex liability assessments. Overall, challenges persist, including the difficulty of quantifying invasion risks, enforcing tax policies, and ensuring the long-term sustainability of financial incentives.

Public-private partnerships are identified as a critical yet underutilized opportunity for IAS management. The private sector can also play a vital role by investing in detection and removal technologies, funding control programs, and developing commercial markets for certain invasive species. Gaps remain in funding stability, governance coordination, and policy implementation, particularly in non-EU Mediterranean countries. The chapter underscores the need for stronger financial mechanisms, greater multi-stakeholder engagement, and the integration of economic models into broader conservation frameworks. Strengthening regional cooperation through initiatives such as a dedicated action plan under the Barcelona Convention could provide clear guidelines for tax policies, incentives, and liability schemes.

FINANCING THE SUSTAINABLE USE AND PROTECTION OF MEDITERRANEAN WATER RESOURCES: EVALUATING GRANTS, BANK LENDING, GREEN BONDS, PPPS, AND OTHER INSTRUMENTS

What policies and financing mechanisms necessary for the sustainable use and protection of water resources in the Mediterranean? This is the central question behind **chapter 6**. It highlights key EU strategies such as the Water Framework Directive, the Green Deal, and the Biodiversity Strategy for 2030, and examines their implications for Mediterranean countries. The paper emphasizes the importance of adequate funding for water-related innovations and uses SWOT analysis to assess modern financing alternatives in the region. Case studies, including the crowdfunding platform Zoomaal in Lebanon, are discussed to illustrate the conditions for deploying novel financing approaches. The paper concludes by ranking financial instruments for water management in the Mediterranean, highlighting the varied accessibility, regulatory support, scalability, environmental impact, and investor appeal of each option.

Grants offer moderate ease of access but are highly supported by regulations, making them particularly useful for funding specific sustainability initiatives. They are strongly aligned with environmental objectives, offering significant environmental benefits. However, grants lack scalability due to their dependence on time and budget constraints, and they do not attract significant investor appeal because they do not provide direct returns. Grants are generally one-time funding sources, which limits their capacity for long-term project growth.

Bank lending is moderately accessible with strong regulatory backing, particularly from institutions like the World Bank and the European Investment Bank. These loans provide structured financing with clear terms, which can be helpful for borrowers. While they can support sustainable water projects, bank lending is often limited by restrictive loan terms and interest rates, which make it harder for new water technologies, especially those with long repayment periods, to access financing. The scalability of bank loans is moderate, as they support large projects but sustainability loans still represent a small portion of overall lending. Investor appeal is relatively high due to the predictable financial returns, although the focus on profitability can limit their environmental impact.

Innovation competitions stand out for their high ease of access, as they encourage creativity and provide non-repayable funding to winners. These competitions are particularly useful for funding novel water innovations, and their environmental impact is high. However, the one-time nature of the funding limits scalability, and while regulatory support is moderate, it often comes from NGOs, universities, or corporate sponsors rather than government institutions. Furthermore, public-private partnerships offer moderate ease of access but are highly supported by regulations, particularly in large-scale water projects. These partnerships allow for the mobilization of both public and private finance, making them scalable and highly attractive for investors. The high environmental impact is a key benefit of these partnerships, but there is a risk that the private sector may prioritize profit over long-term sustainability. Nevertheless, investor appeal is high due to the financial returns and risk-sharing mechanisms involved in these arrangements.

Green bonds are a scalable financing option for sustainable water projects, driven by growing ESG investment interest. However, they are hard to access due to high issuance costs and transparency issues, with moderate regulatory support. Meanwhile, blended finance combines multiple funding sources, reducing risks for private investors and benefiting from strong regulatory backing. This approach is scalable and has high environmental impact, attracting investors by mitigating risks with public funds and mobilizing institutional capital for sustainability. Private equity is another tool, which offers scalability for water businesses but is difficult for early-stage innovators to access. While attractive to investors seeking high returns, its profit-driven nature and regional instability can limit its effectiveness. Lastly, crowdfunding provides easy access for small-scale, innovative water projects, with global reach. However, it lacks regulatory support, scalability, and reliability for large projects.

Financial Instrument	Ease of Access	Regulatory Support	Scalability	Environmental Impact	Investor Appeal
Grants	Moderate	High	Low	High	Low
Bank Lending	Moderate	High	Moderate	Moderate	High
Innovation Competitions	High	Moderate	Low	High	Moderate
Public-Private Partnerships	Moderate	High	High	High	High
Green Bonds	Low	Moderate	High	High	Moderate
Blended Finance	Moderate	High	High	High	High
Private Equity	Low	Moderate	High	Moderate	High
Crowdfunding	High	Low	Low	Moderate	Low

TABLE 3

Ranking of financial instruments for water management in the Mediterranean

Source: Author's assessment following SWOT analysis

GREEN BONDS IN THE ENERGY TRANSITION: NEED FOR ADDRESSING REGULATORY FRAGMENTATION, UNCLEAR GREEN CRITERIA, AND INVESTOR AWARENESS CHALLENGES

Green bonds are at the focus of several remaining chapters, including **chapter 7** which evaluates their role in Türkiye's energy transition using a financially extended social accounting matrix (FSAM). The analysis focuses on the economic impact of green bond issuance, highlighting sectoral linkages and financial constraints. The FSAM integrates input-output analysis, financial-real linkages, and green bond issuance data to evaluate systemic impacts across sectors. The findings highlight the importance of the energy sectors in Türkiye's economy. Gas energy, despite being crucial to the system, faces challenges. If removed, it would result in an 18.7% output loss, underlining its critical role in driving demand for industries like metallic manufacturing and supplying inputs to sectors such as construction. In contrast, wind energy, though prioritized in policy, struggles to integrate effectively into the broader economic system. This difficulty reflects the broader structural challenges in Turkey's energy transition, which are noted in the National Energy Plan 2023 that prioritizes renewable energy development while recognizing the need to overcome obstacles, particularly in integrating wind energy. It is also worth noting that the coal sector, in contrast, demonstrates its inefficiency, with production gains of nearly 30% projected in the event of its removal. This heavily subsidized sector—receiving close to 750 million dollars annually—could serve as a key lever for redirecting financial efforts toward more sustainable energy production.

The chapter also examines the financial constraints that limit the effectiveness of green bonds. These constraints reduce output multipliers across all energy sectors, with the average decline ranging from 25-30%. For instance, the multiplier for gas energy drops from 5.87 in a basic social accounting matrix (SAM) to 4.87 in the FSAM, reflecting a reduction in financial system integration. Wind energy experiences an even sharper decline, from 5.70 to 4.44, highlighting the significant financing hurdles that renewables face in Türkiye. These results align with previous studies that have pointed to liquidity constraints as a key barrier to sustainable financing in emerging economies. While green bonds show some improvement across sectors, their overall impact remains limited. For example, the forward linkage for wind energy slightly increases from 0.340 to 0.342, but this improvement is insufficient to drive systemic change. The coal sector shows no change in its multipliers, which aligns with the ongoing phase-out commitment. The limited impact of green bonds reflects several challenges, including regulatory fragmentation, the absence of clear criteria for qualifying green projects, and a lack of investor awareness.

To maximize the effectiveness of green bonds in Türkiye's energy transition, it is suggested to strengthen regulatory frameworks around green finance, increase investments in renewable energy infrastructure, and enhance investor education. Establishing clear and consistent rules to define what qualifies as a "green" investment will help reduce opportunities for greenwashing and, consequently, strengthen investor confidence. Moreover, the expansion and modernization of renewable energy infrastructure will enhance intersectoral linkages and support a more efficient energy system. Finally, increasing investor awareness of the benefits and opportunities of green financial instruments will stimulate demand for sustainable investments. This approach serves as an illustrative example for other Mediterranean countries, which face similar challenges in aligning their financial mechanisms with their renewable energy and sustainability goals—making such strategies highly relevant for broader regional integration and progress toward a greener economy.

THE IMPACT OF GREEN BOND ISSUANCE ON AIR POLLUTION IN THE MEDITERRANEAN: SECTORAL DIFFERENCES, STRATEGIC DEPLOYMENT, AND MATURITY EFFECTS

The **eighth chapter** analyzes the impact of green bond issuance on air pollution in 21 Mediterranean countries from 2012 to 2022. The results show that green bond issuance reduces air pollution, with the maturity and number of green bonds issued having the most significant effect.

The results show that green bond issuance significantly reduces air pollution in both non-polluting and polluting sectors, with a stronger effect in the latter. Specifically, the Green Bond (GB) coefficient for non-polluting sectors is -0.482, while for polluting sectors it is -1.853, indicating a more pronounced reduction in high-emission industries like manufacturing and energy production. Energy intensity (ENER_INT) also has a greater impact on pollution reduction in polluting sectors (0.669) compared to non-polluting ones (0.387). Other factors, such as government intervention and GDP growth, influence pollution levels but vary in significance across sectors.

The analysis of green bond issuance shows a negative coefficient of -0.221, indicating a trend toward reducing air pollution with increased issuance, though the result is not statistically significant. In advanced EU economies like France, Italy, and Spain, large green bond amounts fund various environmental projects, but the direct impact on air quality is not evident. For smaller economies like Cyprus and Greece, more modest issuance may still be effective if targeted properly. In emerging markets like Egypt, Morocco, and Türkiye, the size of green bond issuance alone does not guarantee improvements in air quality. The findings suggest that the strategic deployment of funds—rather than their volume—plays a more crucial role in achieving environmental impact, emphasizing the importance of project selection, implementation efficiency, and fund allocation.

The results also suggest that maturity plays a key role, specifically moderate-maturity green bonds (5-10 years) are the most effective at reducing air pollution, being roughly twice as effective as short- or long-maturity bonds. This optimal timeframe aligns well with renewable energy project cycles and industrial modernization, offering a balance between flexibility and accountability. It is suitable for both advanced economies like France, Italy, and Spain, as well as emerging markets such as Egypt, Morocco, and Türkiye, providing enough time for meaningful implementation while maintaining momentum. Long-maturity bonds (over 10 years) are ideal for major infrastructure projects and long-term climate goals, particularly in emerging Mediterranean economies, though they may face challenges in maintaining efficiency. Short-maturity bonds (under 5 years) work best for quick-implementation projects, particularly in smaller economies.

TOWARDS MEDITERRANEAN-SPECIFIC GREEN BOND GUIDELINES: ADDRESSING LEGAL GAPS AND ENHANCING PROJECT IMPLEMENTATION

The **ninth chapter** highlights the lack of specific legal regulations for green bonds in the Mediterranean, which could limit the adaptation of financial projects to the region's ecological and economic characteristics. Although existing frameworks could serve as references, the absence of local standards may hinder the mobilization of investments tailored to the Mediterranean's specific environmental challenges. While various European and international regulations, both hard and soft law, define what a green bond is and its required characteristics, there are no practical guidelines on how to encourage their development in the Mediterranean region. The creation of Mediterranean-specific guidelines on green bonds could offer several benefits, such as increasing their visibility, making them more attractive, and supporting the implementation of funded projects. Currently, the legal texts aim for harmonization across different legal systems, but this approach does not emphasize the unique characteristics of the Mediterranean region.

The chapter highlights how it is crucial to highlight in a soft law text, such as guidelines, the practical considerations that would be most relevant for Mediterranean countries. The goal of these guidelines is to create a virtuous cycle: by strategically communicating about the projects or activities that businesses wish to finance in the Mediterranean based on the region's needs, the appeal of this financial tool will be enhanced.

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ENERGY TAXES PROMOTE INNOVATION IN ENERGY EFFICIENCY IN ENERGY-INTENSIVE FIRMS WITH VOLUNTARY MANAGEMENT PRACTICES IN SOUTHERN MEDITERRANEAN COUNTRIES

The findings of **chapter 10** highlight the significant role of energy taxation in driving energy-efficient innovation across the private sector in Southern Mediterranean Countries (SMCs), with a particularly strong impact on the retail and service industries.

The analysis confirms that energy taxes can encourage firms to innovate in energy efficiency, particularly for energy-intensive sectors and firms with proactive environmental management practices. Subsample regression results reveal that energy taxes significantly promote innovation in energy efficiency among firms with voluntary energy management practices, especially in industries like metal and machinery manufacturing, where energy costs are a major burden. However, energy taxes have no significant effect on innovation in less energy-intensive sectors. The findings also suggest that energy tax-induced innovation is more effective when firms recognize its environmental benefits, emphasizing the role of environmental awareness.

In manufacturing versus non-manufacturing firms, energy taxes are more impactful for non-manufacturing firms like services and retail, which face fewer operational disruptions when implementing innovations. In contrast, manufacturing firms, due to their capital-intensive production processes, are more constrained in adopting regulatory changes. The results underline that the effectiveness of energy taxes in driving innovation depends on both the sector's energy intensity and the firm's environmental awareness and capacity for innovation.

Overall, the results highlight several implications for policymakers. First, energy taxation serves as an effective tool to accelerate national energy transition strategies in SMCs by encouraging clean energy innovation at the firm level. Second, this market-based instrument (MBI) is particularly effective in promoting energy-efficient production processes within energy-intensive sectors, which are key barriers to the region's decarbonization efforts. Third, the positive impact of energy taxation on eco-innovation is more pronounced in firms that voluntarily manage their energy consumption and are committed to offsetting their negative externalities. Fourth, fostering clean energy innovation at the firm level supports SMCs' commitment to carbon neutrality as part of their pollution control measures. Fifth, unlike non-manufacturing businesses, manufacturing firms are more likely to view energy taxes as a compliance requirement rather than a driver for innovation, unless they consider innovation as a means to reduce their environmental impact.

While energy taxation serves as a valuable policy tool, it must be complemented by broader structural reforms, such as the phased removal or reform of fossil fuel subsidies, the implementation of fiscal incentives, and support for businesses to enhance their technological capacities and access to green financing. Targeted support for small and medium-sized enterprises (SMEs) in strengthening capacities and providing financial assistance is also crucial to overcome barriers to energy efficiency adoption.

Moreover, it should be noted that many energy-intensive sectors benefit from preferential tariffs or tax exemptions, which can sometimes limit the impact of energy taxes and prevent the intended energy innovation incentives from being fully realized. Furthermore, while greenhouse gas emission taxes are more effective when accompanied by strict regulations, certain rules may actually hinder their application, creating contradictions between fiscal and regulatory instruments.

BUILDING A REGIONAL ENERGY HUB IN THE MEDITERRANEAN: LEVERAGING GREEN FINANCE AND RTAS FOR RENEWABLE ENERGY TRADE AND COOPERATION

Energy security and independence are key goals for countries, with the energy sector being the highest carbon emitter, accounting for 40% of global emissions. Yet, renewable energy trade in the Mediterranean remains limited. This is the rationale behind **chapter 11** which argues that to drive the region's energy transition, a regional energy hub (REH) supported by green technologies and green finance could foster collaboration among Mediterranean countries. A Regional Trade Agreement (RTA) focused on renewable energy trade, with the EU's central role and compliance with State Aid Mechanisms for fiscal incentives, is crucial for this model's success.

For the REH to succeed, regional cooperation, particularly in transmission infrastructure investment, is essential. RTAs, like Free Trade or Economic Integration Agreements, can provide the legal framework for this cooperation.

It is suggested that a new institution be established that would be responsible for overseeing the creation of a regional fiscal aid monitoring body. The revenue generated from the introduction of carbon taxes, as well as green fiscal incentives, would be managed by this body. The design of these fiscal incentives must align with the EU State Aid Mechanism to ensure compliance with EU regulations and standards. Key green finance policy tools, such as tax credits, green bonds, and guarantees for future tax incentives, are essential to accelerate the transition. These financial instruments offer stability and incentivize investment in renewable energy, ensuring that green projects are prioritized over fossil fuel investments. Tailoring these instruments to the region's socio-economic contexts will be vital for a smooth and effective energy transition, while ensuring that green finance remains efficient and impactful in supporting long-term sustainability.

TAILORING THE SOCIAL COST OF CARBON IN THE MEDITERRANEAN: REGIONAL VARIATIONS, CARBON TAX SCENARIOS, AND POLICY IMPLICATIONS

What is the optimal Social Cost of Carbon ? The **twelfth chapter** attempts to answer that using an extended Regional Integrated Climate Economics for Mediterranean Region (RICE-MED) model, it measures the Social Cost of Carbon (SCC) for each country, evaluates different carbon tax scenarios, and assesses their implications for emissions reductions and economic performance.

The model used projected carbon costs from 2020 to 2100, providing an overview of the temporal and geographical distribution of climate-related damages. The results show a general upward trend, reflecting the growing economic and social damages due to the increase in greenhouse gas emissions. Southern European countries, such as France, Spain, and Italy, exhibit higher SCC projections, reaching \$750–800 per ton of CO_2 by 2100, due to their significant economic activity and emissions. In contrast, North African and Eastern Mediterranean countries,

like Algeria and Egypt, show lower SCC values, ranging from $400 to $600 per ton of CO_2, despite their high vulnerability to climate impacts. Others, such as Greece and Turkey occupy an intermediate position, with SCC projections of $650–750 per ton of CO_2.

The analysis also highlights the sensitivity of SCC to key economic and climate parameters. Climate sensitivity exerts the strongest influence, particularly in regions already facing high temperatures and heatwaves. The discount rate, which determines the weight of long-term climate damages, varies by country depending on their economic stability. The analysis underscores the importance of tailoring carbon pricing policies to specific regional contexts to ensure they are both economically viable and socially equitable. The carbon tax scenarios analyzed in the chapter highlight complex trade-offs between environmental benefits and economic costs across Mediterranean countries. Southern European nations, with diversified economies and strong renewable energy infrastructure, would be better equipped to handle higher carbon taxes. Their industrial bases and alignment with EU climate policies may enable them to lead in decarbonization and adopt ambitious tax strategies. In contrast, North African countries, more reliant on fossil fuels and less diversified, face challenges in implementing higher carbon taxes, at least in the immediate-run. While they have renewable energy potential, a gradual approach is necessary to avoid economic disruption.
Ultimately, successful carbon pricing in the Mediterranean requires addressing social equity. Public acceptance increases when revenues are transparently recycled. In North Africa, carbon tax revenues could fund cash transfers, rural energy access, and subsidies, using existing programs like Egypt's Takaful or Morocco's RAMED. In Southern Europe, carbon pricing can offer co-benefits like home retrofits and green jobs. Tailored approaches should be preferred instead of a unified Mediterranean carbon tax, which would be politically unfeasible due to regional differences in fiscal capacity, energy dependence, and public support for reform.

Regions	Countries	Characteristics	SCC	Plan A: Optimal Tax Scenarios	Plan B: Potential for Aggressive Tax
Eastern Mediterranean	Turkiye	High reliance on coal and natural gas; emerging renewables	650–750 USD/ tCO_2 by 2100	50% SCC progressing to 100%	Moderate; post-2050 or in select sectors
North Africa	Algeria	Largest fossil fuel exporter in the region; high emissions	500–600 USD/ tCO_2 by 2100	50% SCC; gradual move to 100%	No; requires significant diversification and renewable capacity
	Egypt	Energy-intensive industrial base; natural gas reliant	450–600 USD/ tCO_2 by 2100	100% SCC	Moderate; requires enhanced renewable capacity
	Morocco	Renewable energy leader in the region; low emissions	450–500 USD/ tCO_2 by 2100	100% SCC	High; strong renewable base supports implementation
	Tunisia	Moderate fossil fuel use; growing renewables	400–500 USD/ tCO_2 by 2100	50% SCC progressing to 100%	Low; dependent on renewable growth
Southern Europe	France	High reliance on nuclear energy; strong industrial base	750–800 USD/ tCO_2 by 2100	100% SCC with gradual progression	Yes; specific sectors or post-2050
	Greece	Economy in transformation; moderate emissions	600–700 USD/ tCO_2 by 2100	100% SCC; phased approach from 50%	Moderate; dependent on renewable expansion
	Italy	Energy-intensive industries; moderate renewable adoption	650–750 USD/ tCO_2 by 2100	100% SCC; phased approach from 50%	Yes; post-2050 in energy-intensive sectors
	Spain	Growing renewable energy investments; diversified economy	650–700 USD/ tCO_2 by 2100	100% SCC	Yes; feasible with existing renewable infrastructure

TABLE 4
Findings summary
Source: calculations by the authors

CLIMATE CHANGE AND MUNICIPAL FISCAL REVENUES: IMPACTS, SCENARIOS, AND POLICY MEASURES FOR RESILIENCE

The **final chapter** is more local in focus, it explores the potential impacts of climate change on municipal fiscal revenues in Italy, highlighting the essential role municipalities play in local service provision and infrastructure management. Climate change threatens to disrupt their financial stability, which could hinder local redistribution policies and the ability to respond effectively to climate challenges. The chapter presents two main scenarios, optimistic and pessimistic, for municipal fiscal revenues. The optimistic one predicts an overall increase in fiscal revenues for municipalities, with Milan seeing the largest absolute increase of €252,360 and Turin the largest relative increase at 3.5%. The total net gain for all municipalities is estimated at €567 million (in 2005 euros). The Pessimistic Scenario presents a stark contrast, with Catania potentially losing 5% of its revenue, Turin losing over 6%, and Milan losing more than 5%. For all municipalities, the total loss could exceed €1.2 billion. The chapter then outlines several policy measures aimed at mitigating the adverse fiscal impacts of climate change on municipal revenues, providing a roadmap for cities to strengthen resilience while maintaining fiscal stability. One proposed measure is the implementation of Pigouvian taxation, levies designed to reflect the external costs of economic activities that harm society or the environment. In the municipal context, such taxes could target activities contributing to climate change, including carbon emissions and pollution. By internalizing these social and environmental costs, municipalities could generate a steady revenue stream to reinvest in climate resilience initiatives. In this context, tools such as urban tolls, already implemented in several Italian cities, could be explored. This mechanism, which aims to reduce congestion and pollution while generating revenue for municipalities, could be adapted to finance climate change adaptation initiatives.

Another recommendation involves reforming cadastral systems, which are used to assess land and property values for taxation purposes. These systems should be updated to account for climate-related

risks, enabling municipalities to adjust property valuations based on factors such as flood exposure, extreme heat, or drought vulnerability. Such reforms would help align property taxes more closely with actual environmental risks, fostering more equitable taxation and encouraging sustainable land use.
The chapter also advocates for an expansion of climate-related tourist taxes, particularly in destinations that depend heavily on coastal or cultural tourism. This additional revenue could be allocated to fund adaptation measures in tourism-dependent areas, such as flood protection, heat mitigation infrastructure, or conservation efforts. By doing so, municipalities can both mitigate the environmental impact of tourism and create new fiscal space for climate action.

THE ROAD AHEAD

Across the diverse contributions of the edited volume, a set of shared conclusions emerges, underscoring the strategic importance of economic tools and green finance for advancing sustainability in the Mediterranean. First, the progressive phase-out or reform of environmentally harmful subsidies and the alignment of fiscal policy with sustainable development goals are widely recognized as foundational to ecological and economic reform. Second, while a range of green instruments—from carbon pricing to green bonds and conservation trust funds—show significant potential, their effectiveness hinges on strong governance, inter-ministerial coordination, and context-sensitive design. Third, regional disparities in institutional capacity, fiscal space, and regulatory maturity underline the need for tailored approaches, rather than one-size-fits-all solutions. A recurring message is that financial mechanisms must be embedded in coherent policy frameworks and supported by robust monitoring, stakeholder engagement, and long-term commitment. Finally, several contributions emphasize the urgent need to develop a Mediterranean taxonomy of sustainable activities, supported by operational guidelines. Such a taxonomy, tailored to the economic, social, and environmental realities of the Mediterranean basin, would help better direct financial flows toward genuinely sustainable projects in the region. It would clarify the signals sent to investors, reduce the risk of greenwashing, and ensure transitions that are not only fair and effective but also aligned with local specificities—such as resource dependencies, climate vulnerabilities, and economic structures.

A significant shift toward more sustainable economic practices is within reach, provided the right national and regional frameworks are in place and actively supported, enabling green tools to flourish.

Looking ahead, much remains to be done, particularly in areas that require deeper exploration. The integration of private sector involvement and the potential of blended finance are key areas that warrant further research. Additionally, developing a comprehensive Framework and Taxonomy for Sustainable Activities is vital to provide clarity and guide investments effectively. These topics will be further addressed in upcoming reports under the 2026-2027 Program of Work.

This process is ongoing, change is gradual, and while progress has been made, much more is needed to drive the transformation required. Political will, coupled with continued research, collaboration, and innovation, is crucial to ensuring the region's transition to sustainability is not only successful but lasting. Achieving sustainability will demand collective effort, sustained commitment, and coordinated action across all sectors and stakeholders. The ongoing efforts within existing frameworks such as the MSSD can support this transformation, but they must be complemented by continuous momentum and strong political support.

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