MEDREG

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# THE IMPACT OF EMISSION REDUCTION

Natural Gas Working Group (GAS WG)

*Empowering Mediterranean regulators for a common energy future*

## ABOUT MEDREG

MEDREG is the Association of Mediterranean Energy Regulators, uniting 28 regulators from 23 countries across the European Union, the Balkans, and the MENA region. Established in 2007 and co-funded by the European Union, MEDREG acts as a platform for cooperation, knowledge sharing, and capacity building in energy regulation. It fosters coherent regulatory approaches and practices at the regional level, aiming at progressive market integration in the Euro-Mediterranean basin. To support its members, MEDREG organises training sessions, workshops, and tailored, hands-on initiatives that enhance the capacity of energy regulators.

MEDREG's goal is to establish an integrated Euro-Mediterranean energy market that strengthens energy security and drives the clean energy transition. This includes integrating renewable energy sources, reinforcing cross-border infrastructure, promoting innovation, enhancing energy efficiency, and advancing renewable gases like hydrogen. Additionally, MEDREG advocates for transparent and non-discriminatory regulation to attract infrastructure investments, modernise electricity and gas markets, and improve consumer protection.

The MEDREG Secretariat is located in Milan, Italy.

For more information, visit www.medreg-regulators.org


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# Executive Summary

Heavy decarbonisation efforts in the energy sector are of utmost importance, given the Mediterranean Region's vulnerability to climate change; hence, it has become a matter of regional security. As a critical component of the energy transition, and although natural gas is considered the cleanest form of fossil fuel, the gas value chain must address its significant climate footprint. This necessitates managing highly potent pollutants, specifically methane (released through leaks, venting, and incomplete combustion), and the long-term contribution of CO2 (resulting from combustion, processing, and transportation).

To guide this crucial transformation, a comprehensive report was developed, providing both the status quo and an in-depth analysis of the legal, technological, and strategic measures adopted by 13 key MEDREG member countries. The objective was to identify common challenges, showcase effective best practices, and draft a potential path forward. This path must enable the countries of the region to simultaneously achieve their nationally and internationally mandated climate goals while ensuring the robustness of their energy security.

The analysis reveals diverse approaches to emission mitigation across the region. On the technological and operational aspects, key strategies are already being implemented: efforts are underway to significantly enhance Leak Detection and Repair (LDAR) campaigns across extensive gas infrastructure networks, which are now being rapidly modernised through advanced, continuous Monitoring, Measurement, Reporting, and Verification (MMRV) systems for precise emissions quantification. Further, several nations are pioneering the use of advanced satellite monitoring and aerial surveillance to achieve broad-scale, high-fidelity detection of emission sources. To tackle combustion emissions, countries are prioritising the deployment of highly efficient power generation assets, particularly modern Combined Cycle Gas Turbines (CCGT), which drastically lower the $CO_2$ intensity per unit of electricity produced. Concurrently, nations like Greece and Algeria are spearheading the strategic development of Carbon Capture, Utilisation, and Storage (CCUS) hubs, positioning themselves to manage and permanently sequester $CO_2$ from industrial clusters and large-scale power plants. A critical strategy also involves the heavy and systematic integration of renewable gases into the existing gas network, with examples from countries like France and Portugal demonstrating the effective scaling of biomethane injection, providing a direct, fungible means of decarbonising gas consumption across various sectors.

However, the effectiveness and pace of this transition are significantly hampered by a sharply divided regulatory environment. EU Member States are subject to the strict, mandatory, and harmonised framework of the EU Emission Trading System (ETS) and the brand-new, legally binding EU Methane Regulation, which imposes unprecedented monitoring and abatement requirements. In contrast, non-EU members operate under a spectrum of diverse, often conditional, national targets

outlined in their Nationally Determined Contributions (NDCs). Crucially, the motivation for emission reduction in many non-EU countries is often driven less by stringent domestic climate mandates and more by compelling financial and competitive market imperatives. This includes the necessity of accessing global "green" finance and the strategic requirement of maintaining export competitiveness, particularly against the backdrop of the EU's impending Carbon Border Adjustment Mechanism (CBAM), which effectively imports the cost of $CO_2$ for goods entering the EU market. This heterogeneity, while encouraging in its market focus, reveals substantial institutional and financial gaps. These include the prohibitively high upfront capital cost of deploying cutting-edge abatement technology and the persistent, systemic risk of carbon leakage, where carbon-intensive production simply relocates to jurisdictions with weaker environmental policies, negating regional climate gains.

The weight of the collective evidence thus points to a mandate for a sustainable transition that must move decisively beyond reliance on pure regulatory enforcement. It demands a sophisticated dual strategy: one side focused on robust regulatory enhancement (especially in alignment with international standards) and the other on aggressive market mobilisation to channel private capital and innovation. To critically accelerate this progress and secure the region's climate-resilient future, MEDREG members and all stakeholders—governments, operators, and financiers—could take the following immediate, impactful actions: there must be an immediate, region-wide commitment to establishing measurable and verifiable MMRV systems, achieved by aligning comprehensively with leading international best practices, such as the rigorous transparency and methodology required by the Oil and Gas Methane Partnership (OGMP 2.0) framework, ensuring consistent and auditable reporting across the Mediterranean basin. Further, to overcome capital expenditure barriers, governments must actively implement sophisticated financial tools, including green financing mechanisms, targeted tax incentives, and innovative market instruments. This strategically includes fostering the development of voluntary carbon markets (as demonstrated successfully in nations like Egypt and Türkiye) to create commercial incentives that effectively draw private investment towards emission reduction projects that transcend minimum compliance thresholds. Lastly, National Regulatory Authorities (NRAs) should be empowered with clear, unambiguous authority over the technical compliance and infrastructure standards across the entire gas value chain, as giving NRAs the mandate to rigorously enforce LDAR protocols and infrastructure integrity standards is the most efficient way to optimise the region's collective decarbonisation effort and safeguard the critical energy infrastructure.

# 1. Introduction

## 1.1. Overview of Emissions and Limitations

In a global landscape increasingly defined by climate imperatives, the energy sector is undergoing a profound and rapid transformation. As a primary source of greenhouse gas (GHG) emissions, particularly $CO_2$ from combustion and methane from fugitive leaks, the natural gas value chain is a critical focal point for mitigation efforts. The shift towards a low-carbon energy system is a strategic priority for countries worldwide, but it holds particular urgency for the Mediterranean region. This region is warming at a rate 20% faster than the global average, leading to severe and disproportionate impacts such as prolonged heatwaves, extreme weather events, water scarcity, and coastal degradation. For many member countries of the Association of Mediterranean Energy Regulators (MEDREG), the challenge is to manage the transition of the gas sector so as to ensure energy security and economic competitiveness while simultaneously addressing these existential environmental threats. This makes the transition to a low-carbon economy not merely a policy objective but a matter of regional stability, security, and long-term sustainability.

While GHG emissions come in a variety of forms, including nitrous oxide, fluorinated gases, and water vapour, this report precisely scopes its analysis of the natural gas value chain by focusing on two dominant and chemically distinct contributors to climate change: CO2 and methane. As is common knowledge, $CO_2$ is abundantly present in our environment; however, it is also the major product of natural gas combustion and the established benchmark for long-term climate damage due to its persistence in the atmosphere for centuries. In contrast, methane, the primary component of natural gas, is also a climate pollutant on its own, without having to be combusted, possessing a Global Warming Potential approximately 27 to 30 times that of CO2 over a 100-year timescale, according to the Intergovernmental Panel on Climate Change (IPCC) reports[1]. The distinction between CO2 emissions (primarily from combustion and processing) and methane emissions (predominantly from fugitive leaks, venting, and incomplete flaring across the production, transmission, and distribution segments) is essential for developing effective, cost-efficient mitigation strategies[2]. Consequently, all discussions in the report regarding emission reduction paths to achieve climate objectives will be limited to these two gases.

[1] Intergovernmental Panel on Climate Change (IPCC)

[2] IEA (International Energy Agency)

## 1.2. Objectives and Methodology

Given the significance of the GHG emissions topic, MEDREG has undertaken a study to assess the status quo in Mediterranean countries. Accordingly, MEDREG drafted a report providing a comprehensive analysis of the strategies and actions being undertaken by member countries to address emissions, especially methane and CO2, from the natural gas value chain. By summarising responses to a detailed questionnaire, the report offers a unique, ground-up perspective on the diverse national approaches, from the European Union's harmonised, legally binding frameworks to the targeted, incentive-based policies of non-EU members.

The aim is to showcase the strategic and evolving approaches that integrate advanced monitoring, technological innovation, and a robust legal and regulatory framework to draw a path towards the set climate goals. The report seeks to discuss the specific measures being adopted, including the implementation of sophisticated monitoring systems, the deployment of cutting-edge technologies like CCUS, and the promotion of energy efficiency across the gas value chain in the different countries of the Mediterranean Region. The report also aims to highlight the numerous policies, technologies, and regulatory frameworks currently in place, and how they converge in some sub-regions. By identifying common challenges, best practices, and innovative case studies, this report serves as a foundational resource for understanding the current state of emission reduction in the Mediterranean gas sector and provides a comprehensive overview of the region's progress and the path forward in decarbonising the energy market.

This report is primarily structured as an analysis of the responses collected from MEDREG members to a detailed questionnaire. This questionnaire was drafted, reviewed, and approved by the three Working Group chairs and the members of the Working Group prior to circulation for compilation. The questionnaire was broken down into three different sections; Emissions Background, Measures to Limit Emissions, and Legal and Regulatory Framework.

Member replies were collected and comprehensive summaries drafted. This process involved qualitative analysis to identify common themes, some divergent and some convergent national approaches, and notable case studies, while also integrating quantitative data provided by members to provide a more holistic and evidence-based picture. Finally, this information was structured into the present report, which was submitted to MEDREG members for review and validation, ensuring that it reflects the collective knowledge and experiences of the association.

The MEDREG Secretariat collected the data and information from its members and collaboratively drafted the report with the GAS WG chairs. The replies from the NRAs of **Albania, Algeria, Cyprus, Egypt, France, Greece, Italy, Jordan, Lebanon, North Macedonia, Portugal, Spain,** and **Türkiye** are considered in this study.

# 2. Measures Adopted to Limit Emissions

This chapter showcases a strategic approach that combines advanced monitoring, technological mitigation, and a strong push for energy efficiency. The collective efforts underscore a shared commitment to a low-carbon energy transition, reflecting both national priorities and alignment with international and regional climate frameworks.

## 2.1. Monitoring, Measurement, Reporting, and Verification

A robust MMRV framework is the cornerstone of effective emission reduction, providing the data necessary to set targets and track progress. Mediterranean regulators have established distinct yet complementary systems to meet this challenge.

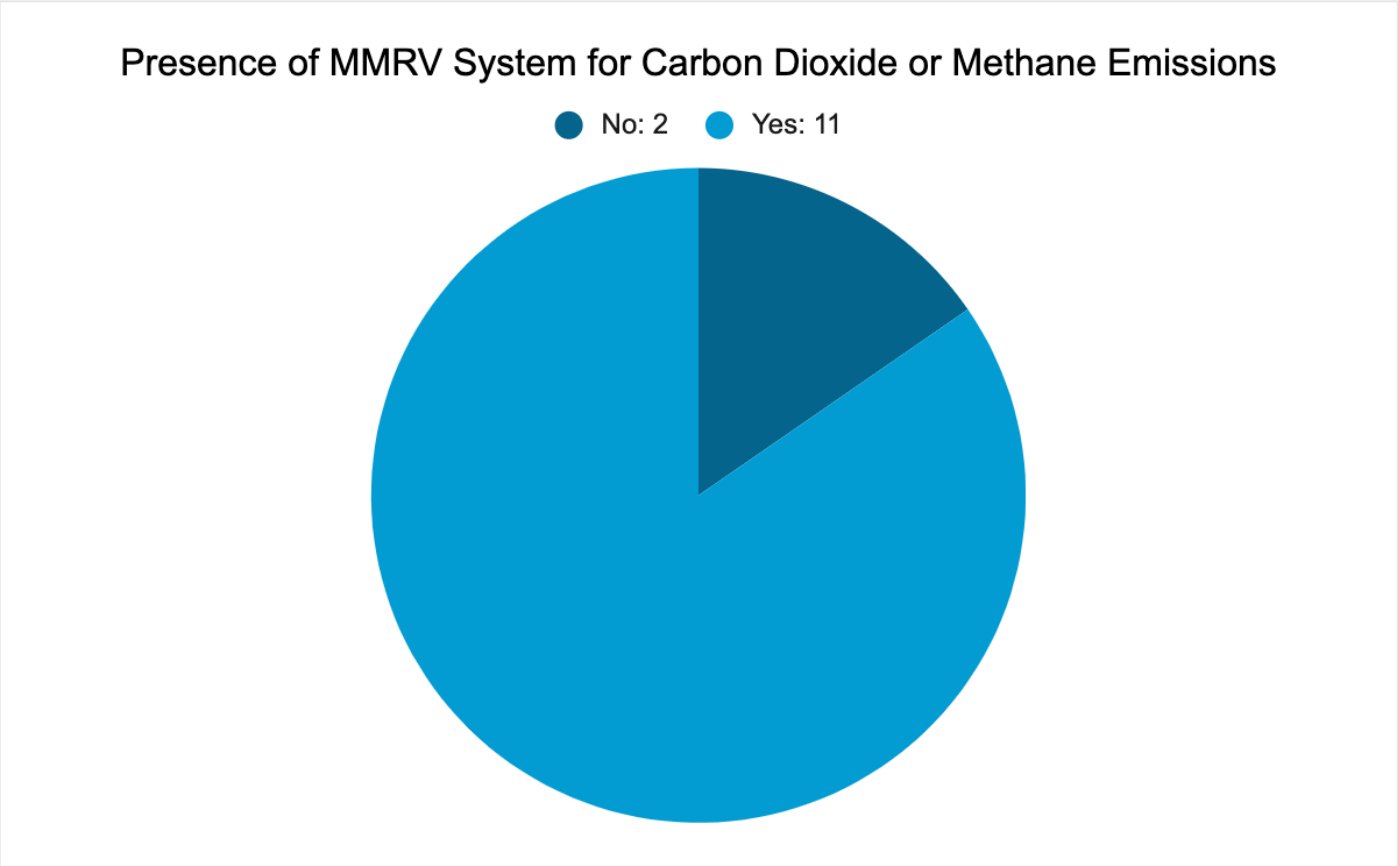


*Figure 1 - Presence of MMRV System for CO2 or Methane Emissions*

In **Algeria**, the regulatory framework is well-established and multi-layered. The Hydrocarbon Regulatory Authority (ARH) has mandated a monthly reporting system since 2014, covering emissions from the entire value chain, from exploration and production to gas liquefaction and transport. Data are meticulously collected through a combination of direct on-site measurements—using technologies like flow meters and infrared sensors—and estimation methods based on

international standards from the IPCC and the Oil & Gas Methane Partnership (OGMP). Operators are held accountable for their own monitoring and must submit detailed reports to the ARH, which in turn shares this information with the Ministry of the Environment for the National GHG Inventory. The **Algerian** National Agency for Climate Change (ANCC) further reinforces this system by compiling national inventories per the Paris Agreement's Enhanced Transparency Framework. These inventories are prepared by a dedicated committee for each sector and follow international best practices, including the 2006 IPCC Guidelines and their 2019 Refinement, ensuring a structured and transparent approach to national GHG accounting.

**Egypt** has streamlined its data collection through a centralised electronic system managed by the Ministry of Petroleum and Mineral Resources (MoPMR). Affiliated companies manually gather daily energy consumption data using standardised templates, which is then aggregated monthly at the holding company level before submission to the Ministry. This system enables the calculation of GHG emissions using IPCC Tier 1 methods and provides a clear overview of energy use and the impact of efficiency projects across the petroleum sector. The Ministry uses the energy consumption data to calculate GHG emissions by applying default emission factors.

In **Jordan**, the Ministry of Environment is the primary authority for the national MMRV system. The framework mandates regular reports from gas production, transport, and distribution companies, which include quantitative data on gas consumption, CO2, and methane emissions. The country uses a variety of tools, including on-site sensors, internationally accepted emission models (IPCC Guidelines), and satellite monitoring for detecting major leaks. The reports from companies and supervisory bodies are submitted quarterly and annually. Verification is a key component, with independent entities conducting periodic audits to ensure data accuracy and transparency in line with standards like ISO 14064.

Both **Cyprus** and **Lebanon**, while in the nascent stages of developing their gas markets, are laying the groundwork for future MMRV systems regarding emissions from the gas sector. Concerning gas sector emissions, apart from the legal obligations under the EU ETS (European Emissions Trading System) that operators/licensees must comply with, **Cyprus** has set terms for the licensees of the national natural gas market that will require annual reporting on emissions and mitigation, starting from the forthcoming gas market operations. As regards the EU ETS, the gas licensees operating in **Cyprus** will also have to comply with the national Law 110(I)/2011, which is the GHG Emissions Trading System Law, establishing the national system for trading GHG emission allowances in **Cyprus.** The Competent Authority for this Law is the Department of the Environment (DoE) of the Ministry of Agriculture, Rural Development, and Environment. This Authority is responsible for the implementation and supervision of the GHG emission allowance trading system. It takes all necessary measures to ensure that the procedure for granting GHG emission permits is carried out in accordance with the provisions of the said Law, that the licensees comply with the permit

obligations, that there are monitoring and verification mechanisms for the emissions, and that the GHG emissions are balanced with relevant GHG allowances through the EU ETS scheme. **Lebanon** relies on its existing National GHG Inventory, which follows IPCC guidelines, for national-level reporting to the United Nations Framework Convention on Climate Change (UNFCCC). These comprehensive inventories are typically reported periodically, such as every few years.

**North Macedonia**, which has minimal domestic gas production, estimates fugitive methane emissions via inventory methodologies rather than continuous site-level monitoring, with its Ministry of Environment and Physical Planning serving as the focal point for GHG inventories and reporting.

**Türkiye**, as an Annex I Party to the UNFCCC, submits annual National GHG Inventory reports, covering emissions and removals since 1990, per Decision 18/CMA.1 and the 2006 IPCC Guidelines. The Turkish Statistical Institute (TurkStat) is the designated lead agency, coordinating the preparation process with key bodies, including the Ministry of Energy and Natural Resources (MENR), etc. These reports track direct GHGs, such as CO2, methane, nitrous oxide, and fluorinated gases, as well as indirect GHGs like nitrogen oxides, carbon monoxide, non-methane volatile organic compounds, sulphur dioxide, and ammonia. These emissions are sourced from sectors including energy, industrial processes and product use (IPPU), agriculture, waste, land use, land-use change, and forestry (LULUCF), providing a critical tool for climate policy, although the current methodology does not distinguish between natural gas and oil.

In contrast, **on the northern shore of the Mediterranean**, in May 2024, the **EU** adopted the Regulation on methane emissions reduction in the energy sector (Regulation EU/2024/1787), which EU countries are bound to follow.

This regulation aims to reduce energy sector methane emissions in **Europe** and, hopefully, in global supply chains. It seeks to stop the avoidable release of methane into the atmosphere and to minimise leaks of methane by fossil energy companies operating in the EU. The rules introduced by the regulation will be applied to gas transmission, distribution, storage, and LNG, and include improved measurement, reporting, and verification of energy sector methane emissions, an immediate reduction in emissions through mandatory leak detection and repair, and a ban on venting and flaring practices. Other parts covered include methane transparency requirements on imports, collecting information on whether and how exporting countries are measuring, reporting, and abating methane emissions, to establish a methane intensity profile of those entities.

In EU member France, the national monitoring system is integrated in a larger regional framework. The Ministry of the Ecological Transition uses the National System for Inventory of Emissions and Pollutant Balances in the Atmosphere (SNIEBA) method to ensure a coherent and unified inventory. This method effectively addresses diverse requirements for emission inventories and fulfils both national and international commitments. The Interprofessional Technical Centre for Studies on Air

Pollution (Citepa), an external independent body, is charged with running the inventory. Citepa adopts a detailed methodology updated annually for continuous improvement. For natural gas, the system is highly granular, using daily chromatographic measurements to determine the emission factor from gas interconnections and LNG terminals. The CO2 emission factor is calculated from the daily averages of gas composition and the transactional volumes at each entry point into **France**. Further, the consumption of biomethane is determined based on the national energy balance and the overview of renewable gases production.

**Italy** maintains a National GHG Inventory System, integrating data collection, estimation, quality control, and reporting, in alignment with UNFCCC and EU obligations. ISPRA (the Italian environmental protection and research institute) is central to this system, serving as the technical authority for measuring, verifying, and reporting national GHG emissions.

In **Portugal,** the gas network operators are implementing new obligations vis-à-vis the EU regulation to meet regulatory deadlines and ensure technical and environmental compliance. The main measures include reducing the inspection cycle for the gas distribution network from five to three years, thereby increasing the frequency of inspections as part of the leak detection and repair (LDAR) programmes. Additionally, there is a strengthening of operational resources, specifically in terms of the technical and human resources needed to conduct inspections and corrective interventions. Further, the acquisition of specific equipment for LDAR and MMRV, with the capacity to ensure effective leak detection and direct measurement of emissions, is in line with the technical requirements to be defined by the European Commission. Lastly, specialised consultancy services are being contracted to implement the MMRV framework, based on the OGMP 2.0 framework.

In **Spain**, the collection process involves individualised questionnaires, data from business associations, and international statistics, which are integrated into a core emissions database for annual monitoring. This process distinguishes between methods based on direct measurement and those based on calculation procedures using emission factors. The following table furnishes additional details:

| Stage | What Happens | Key Details |
|---|---|---|
| **1. Data Collection** | Necessary information (activity data, emission factors, etc.) is gathered. | Requests are sent via email (questionnaires, forms) to private and public sector providers. Data are supplemented with public information (reports, statistics) from the Internet. |

| | | |
|---|---|---|
| **2. Data Processing & Quality Check** | The collected data are integrated into the Core Inventory Emissions Database (CIEDB). | This includes data processing and essential quality checks to ensure accuracy. For natural gas, specific sources include plant questionnaires, business associations, MITECO/Energy statistics, and EU ETS data. |
| **3. Emission Estimation** | Emissions are calculated through different methods based on the activity and data availability. | Two main categories of methods: 1. Observed Data: Direct or continuous measurement from plants (via questionnaires). 2. Calculation Procedures (Most Used): Methods like material balances, statistical models, or emission factors (the most common method when precise data are lacking). |
| **4. Abatement Correction** | The effectiveness of pollution control technology (abatement efficiency) is considered. | Corrections are applied to the calculation methods (like emission factors) to reflect the degree to which different activities use emission reduction techniques. |
| **5. Reporting** | Final data are reported following international guidelines. | They use the CLRTAP Convention guidelines (UN Decision 2022/1). |
| **6. Monitoring Frequency** | How often are emissions checked? | Once a year. |

**French Case**

The French monitoring structure aligns with the framework for national systems outlined in paragraph 1 of Article 5 of the Kyoto Protocol and Articles 3 and 4 of Decision 280/2004/EC of the European Parliament and Council (regarding a mechanism for monitoring GHG emissions and the implementation of the Kyoto Protocol and the Paris Agreement). The allocation of responsibilities for emission inventories is clearly defined. The Ministry, MTES, undertakes the overall implementation and coordination of the inventory system, defining and distributing responsibilities among the various organisations involved and overseeing processes related to emissions estimation, data collection and processing, archiving, quality control, and the dissemination of inventories at national and international levels. Given the

diverse requirements for developing emission inventories, MTES's role is key to ensuring a coherent and unified inventory system. Other ministries and public bodies play a supportive role by providing essential data and statistics for the creation of these inventories. The Citepa is appointed by the MTES to develop the emission inventories, as provided in Article 1 of the Decree of August 24, 2011, relating to the SNIEBA. This involves outlining the methods, collecting and processing data, archiving, generating reports, and managing quality control. Following procedures defined by the SNIEBA, Citepa conducts the inventory of numerous substance emissions, following different formats. This unique database enables **France** to meet different commitments made under international agreements or to fulfil the needs of public policies.

The methods for estimating emissions are detailed in an annual report called Ominea, prepared by Citepa. The description of the inventory methodology is updated annually based on the principle of transparency and continuous improvement. The methods used for each category of emitting sources are specified for several dozen substances classified sector-wise. Sectoral indexes correspond to the international format defined by the United Nations within the framework of the Conventions on climate change and transboundary air pollution. The CO2 emission factor for natural gas (NAPFUE 301) is determined based on data from the transport network responsible for the majority of gas delivery in mainland **France** (gas interconnections at borders and GRTgaz LNG terminals). For values after 2019, the emission factor is calculated from the daily averages of chromatographic measurements determining the composition of natural gas and the transactional volumes at each entry point into **France**. Filtering and consistency checks are performed on these input data (low transit volume, discrepancy between density and GCV calculated from the gas composition), and the emission factors obtained at each entry are then weighted by the transactional volumes of natural gas received.

The consumption of biomethane, integrated with the natural gas consumed, is determined based on the national energy balance and the overview of renewable gases. It is accounted for in each sector consuming natural gas, whether for energy or non-energy use.

**Analysis**

The core patterns in the MMRV relate to the technical complexity of emissions reporting systems.

### 1. Regulatory Differences

There is a clear split in the drivers establishing the MMRV frameworks.

- **Regional Mandate:** A group of regulators is defined by their adherence to a larger, unified regional framework, specifically the recent EU Regulation on methane emissions reduction. This drives a focus on improved measurement, rapid leak detection, and regulatory oversight of import supply chains (as in **France**).
- **National Alignment:** Other regulators base their systems on national regulatory authority mandates and adherence to international standards set by bodies like the IPCC, and for compliance with global agreements like the Paris Agreement's Enhanced Transparency Framework (such as in **Algeria**).

### 2. Progression of Measurement

Measurement methodologies follow a general pattern of increasing complexity and accuracy.

- **Estimation-Based Systems:** The simplest frameworks rely on calculating emissions using default emission factors based on activity data, often following basic IPCC methodologies (Tier 1). This is sufficient for national inventories but lacks operational detail (as in **Egypt**).
- **Combined Measurement:** More mature systems blend estimation with direct, on-site measurements. This includes the mandated use of advanced technologies, such as infrared sensors and specific gas composition analysis to derive more accurate emission factors (as in **Algeria**).
- **Advanced Verification:** The most robust systems incorporate third-party audits and use innovative monitoring tools (such as satellite technology) for early and non-invasive detection of major leaks, ensuring transparency and data quality (as in **Jordan**).

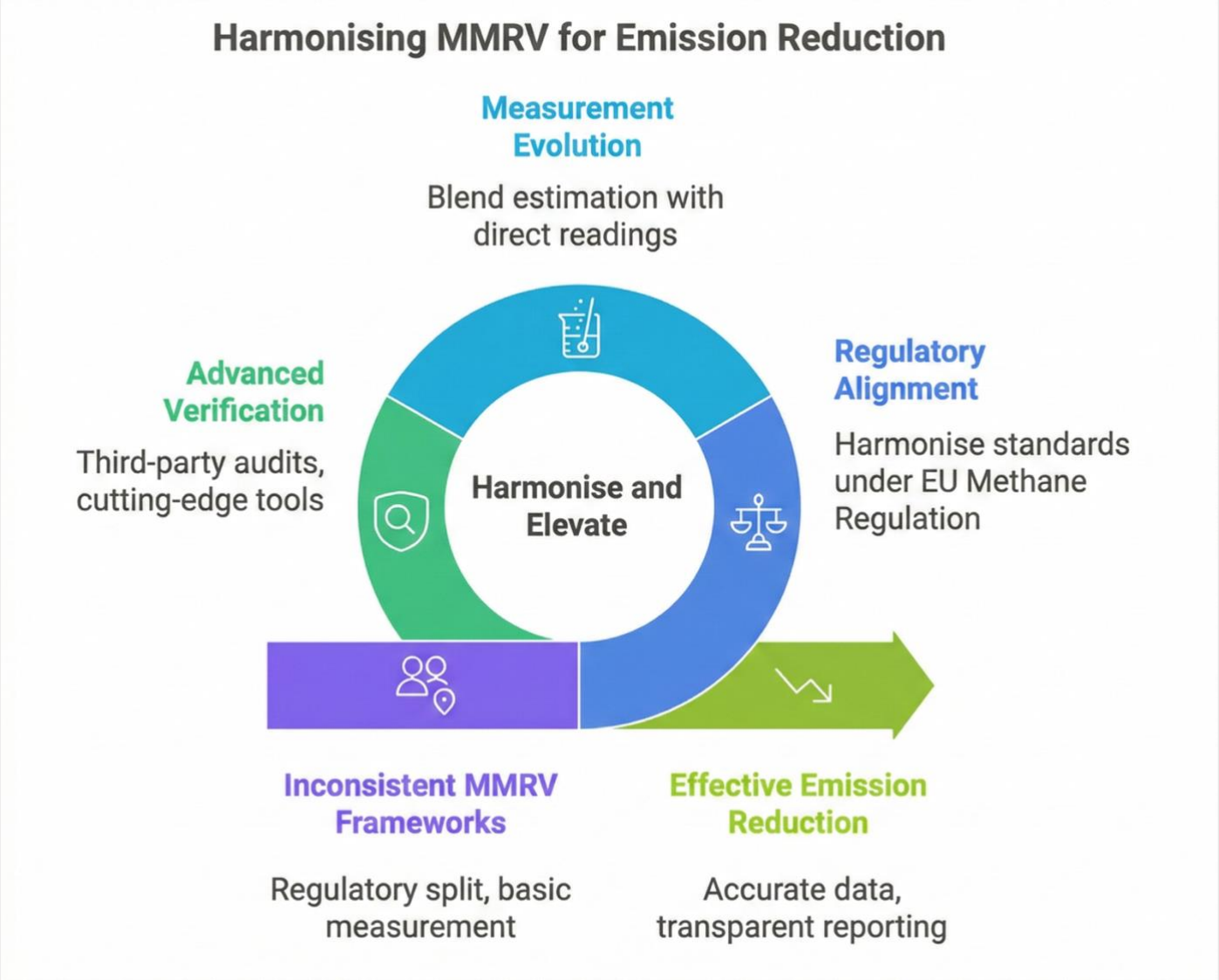


*Figure 2 – Harmonising MMRV for Emission Reduction*

## 2.2. Technological and Strategic Mitigation Mechanisms

Beyond monitoring, regulators and energy companies are deploying a range of technological and policy-driven mechanisms to directly reduce emissions.

### 2.2.1. Carbon Capture, Utilisation, and Storage (CCUS)

**Algeria** stands as a pioneer in the region with its historic **In Salah Gas Project**. Active from 2004 to 2012, this project demonstrated the commercial viability of injecting and storing over 3.8 million tonnes of CO2 in a deep saline formation. Building on this experience, **Algeria** is now pursuing new initiatives, including a Memorandum of Understanding between the national oil company Sonatrach and Equinor to conduct joint studies on CCUS and explore low-carbon energy pathways such as hydrogen and renewables.

## MEASURES TAKEN TO LIMIT EMISSIONS

**Greece** is at the forefront of CCUS development, with a strategic focus on decarbonising hard-to-abate sectors like cement production. The **Olympus Project** and **Ifestos Project** are flagship initiatives, both backed by substantial EU funding, which will capture over one million and 1.9 million tonnes of CO2 annually, respectively. The captured CO2 will be permanently stored at the **Prinos CCS** project, the first commercial-scale CO2 storage hub in the Southeast Mediterranean. This project is a key component of a regional strategy involving **France** and Italy, aimed at creating a new carbon storage industry to serve regional industries. Additionally, the **IRIS Project** at Motor Oil's refinery aims to use CCUS to create low-carbon hydrogen and methanol, further diversifying the application of this technology.

**France**'s CCUS strategy is focused on industrial hubs, with projects like the 'K6' Program and CalCC Project targeting emissions from cement and lime plants. These projects, which have secured significant European funding, will prevent the release of 1.5 million tonnes of CO2 annually. To facilitate these efforts, **France** is developing transport infrastructure, exemplified by the D'Artagnan project—a pipeline network designed to connect industrial emitters to a port terminal for transporting $CO_2$ to storage sites in the North Sea. At the Ministry's request, the French regulatory body, CRE, is considering a framework for this transport infrastructure to ensure equitable access and transparency.

**Egypt** and **Jordan** are actively laying the groundwork for future CCUS deployment. **Egypt's** Ministry of Petroleum is studying the necessary legal and regulatory frameworks, and both countries are exploring pilot partnerships with industrial facilities and engaging in international collaborations to advance this technology. **Jordan's** exploration of CCUS includes pilot partnerships focused on power plants and collaborations to study cryogenic carbon capture technologies.

**Italy** is also among the countries that have invested in CCUS technologies. An example of such projects includes the Ravenna CCS project, developed by Eni and Snam, which is **Italy's** first large-scale carbon capture and storage initiative. It aims to capture CO2 from industrial sources, transporting it via repurposed pipelines, and storing it in depleted offshore gas fields near Ravenna, with a potential capacity of 4 million tonnes per year by 2030.

**Portugal** is making a concerted effort in carbon projects, underscoring its commitment to climate change mitigation through innovation. These efforts span the entire CCUS lifecycle, from geological site characterisation in areas like the Lusitanian Basin and the Alentejo region, through European-funded initiatives, to the deployment of cutting-edge capture technology. This technology includes a 100% electrified pilot project at an energy recovery plant designed to capture industrial CO2. Further, the work focuses not just on storage but also on CO2 utilisation, exploring diverse applications, such as producing synthetic fuels, construction materials, and various chemicals, often leveraging green hydrogen in the process.

**Türkiye, meanwhile,** is proactively integrating CCUS technologies into its climate strategy to achieve its ambitious net-zero emissions target by 2053. While large-scale CCUS projects are currently in the planning and study phase, the groundwork is being rigorously laid through various domestic and international initiatives. A significant step in this direction is **Türkiye's** involvement in the EU-funded ZEN project, a collaborative effort to accelerate the practical adoption of CCUS in key industrial clusters across the country. This project focuses critically on conducting comprehensive impact assessments and developing sustainable business models encompassing the entire CO2 value chain: specifically, CO2 capture, transport, utilisation, and permanent storage. These foundational studies and preparatory efforts are essential for preparing **Türkiye's** energy and industrial sectors for the deployment and operationalisation of a robust CCUS infrastructure, marking a serious commitment to decarbonisation.

**Algerian Case**

The In Salah Gas Project is a landmark example of industrial-scale carbon capture and storage (CCS), and a testament to **Algeria's** pioneering role in this field. As the first industrial-scale CO2 storage project in the region, it was launched in 2004 as a joint venture between Sonatrach, BP, and Statoil. The project aimed to remove CO2 from several gas fields to meet sales gas specifications. Rather than venting the separated CO2 into the atmosphere, it was compressed, dehydrated, and injected into a deep saline formation at a depth of 1,900 metres. Over its operational period from 2004 to 2012, the project successfully stored over 3.8 million tonnes of CO2. While the project was eventually suspended due to technical challenges related to well integrity and seismic activity, it provided invaluable real-world experience and lessons that have informed and accelerated CCUS development globally, proving the viability of large-scale geological storage in the Mediterranean region.

**Portugese Case**

- The InCarbon Project is an initiative (PTDC/CTA-GEO/31853/2017) by the University of Évora and LNEG, supported by FCT and FEDER. Officially titled "Carbonatação in-situ para redução de emissões de $CO_2$ de fontes energéticas e industriais no Alentejo", its core goal is to assess the feasibility of storing industrial CO2 (captured from sources like the Sines Industrial Cluster) in the naturally occurring mafic and ultramafic rock formations across the Alentejo region.
- The project PilotSTRATEGY – CO2 Geological Pilots in Strategic Territories, coordinated at the University of Évora by Júlio Carneiro, a researcher at the Institute of Earth Sciences (ICT) and professor at the Department of Geosciences, was recently selected by the European Commission (EC) under the Horizon 2020 programme to characterise potential sites for pilot CO2 injection facilities in geological formations. At issue is the geological storage of CO2 as a technology to mitigate climate change, the geological characterisation, and the presentation of preliminary engineering studies that permit the technical and scientific support necessary for a final decision on the financing of pilot CO2 storage facilities in geological formations of the Lusitanian Basin (**Portugal**), Paris Basin (France), and the Ebro Basin (**Spain**).
- The first carbon capture project in **Portugal** was launched in February 2025 at the S. João da Talha Energy Recovery Plant, managed by Valorsul, the entity responsible for managing urban waste in Greater Lisbon and the Western Region (see Good Practice: Production of Energy from Urban Waste). It is a pilot project that tests an innovative technology that, through a 100% electrified process, captures CO2 from industrial gases, using a highly selective solvent and ensuring safe and efficient operation. The project will optimise the performance of the entire process at the Energy Recovery Plant and reduce its environmental impact. Currently, the captured CO2 can be reused through geological storage or chemical processes that allow the production of synthetic fuels, plastics, and construction materials such as carbonated concrete. It can also be used in the food industry, for instance, in the carbonation of beverages. Another possible application is the conversion of CO2 into useful chemicals, such as methanol or polymers, using green hydrogen.

**Analysis**

This subchapter reveals a two-part pattern focused on high-impact abatement and operational efficiency.

1. **Staging of CCUS Implementation**

The pattern for carbon capture, utilisation, and storage (CCUS) reflects different phases of technological adoption across the region.

- **Pioneer and Hub Development:** Some members have historic experience in commercial-scale CCUS or are currently developing large-scale regional storage hubs and projects aimed at decarbonising specific industrial clusters (as in **Greece**).
- **Enabling and Planning:** Other members are focused on the crucial preparatory steps of developing legal and regulatory frameworks, characterising geological storage sites, and establishing transport infrastructure to facilitate future CCUS deployment (as in **France**).
- **Exploratory/Framework Stage:** Some countries are engaged in studying the legal and regulatory frameworks necessary to attract CCUS investment and implement pilot partnerships (as in **Jordan**).

2. **Dual Operational Focus**

There is a simultaneous, parallel deployment of technologies aimed at different stages of the value chain:

- **Immediate Methane Abatement:** Operational strategies prioritise the rapid reduction of highly potent greenhouse gases by focusing on two key practices: systematic Leak Detection and Repair (LDAR) campaigns and projects for the recovery of flared gas (as in **Egypt**).
- **Systemic Carbon Reduction:** Long-term strategies target the carbon intensity of the energy supply by:
    - **Efficiency Upgrade:** The widespread adoption of high-efficiency power generation technologies (like Combined Cycle Gas Turbines) aims to reduce fuel consumption (as in **Algeria**).
    - **Low-Carbon Gas Integration:** Promoting and developing the market for renewable gases (biomethane/biogas) and planning for the future integration of hydrogen blending (as in **Portugal**).

### 2.2.2. Methane Leak Reduction and Flare Reduction

## MEASURES TAKEN TO LIMIT EMISSIONS

Focusing on subregions in the Mediterranean region, particularly the southern shore, countries are addressing methane leaks using various methods. **Algeria** systematically tackles methane leaks through Leak Detection and Repair (LDAR) campaigns, employing advanced infrared cameras to identify and rectify fugitive emissions. The country is also a participant in the "Zero Routine Flaring by 2030" initiative, with associated gas recovery programmes contributing to a 28% cumulative reduction in flaring since 2020. Additionally, to create natural carbon sinks, **Algeria** launched an ambitious reforestation programme in 2023, led by the National Hydrocarbons Company "Sonatrach" in collaboration with the General Directorate of Forestry. This initiative aims to plant 423 million trees over ten years, making it one of the largest ecological projects in the country. This large-scale afforestation effort will play a key role in offsetting emissions and enhancing ecosystem resilience.

In **Egypt**, the Ministry has successfully replaced cold venting with flaring at several well sites and implemented operational optimisations to minimise methane emissions from storage tanks. The country has also completed 23 projects to recover flared gas, avoiding emissions equivalent to over 1.3 million tonnes of CO2 annually. Overall, flaring appears to be a strategy for gas-producing countries. Meanwhile, **Jordan** has deployed specialised sensors in its gas distribution network for early leak detection and is using IoT-based monitoring to enhance supply chain integrity.

Shifting focus to the northern shore of the Mediterranean, **all EU member countries** are implementing the EU's new methane regulation, which mandates frequent equipment surveys and rapid repair of leaks. This regulation, combined with **France's** bonus-malus system for network operators, provides a clear mechanism and methodology for reducing methane leaks.

## 2.3. Energy Efficiency and Renewable Integration

Improving energy efficiency and integrating renewables are critical strategies for reducing the overall carbon intensity of the energy system. An overview of the adopted mechanisms in the Mediterranean reveals the following four pillars for improving efficiency and integrating cleaner technologies.

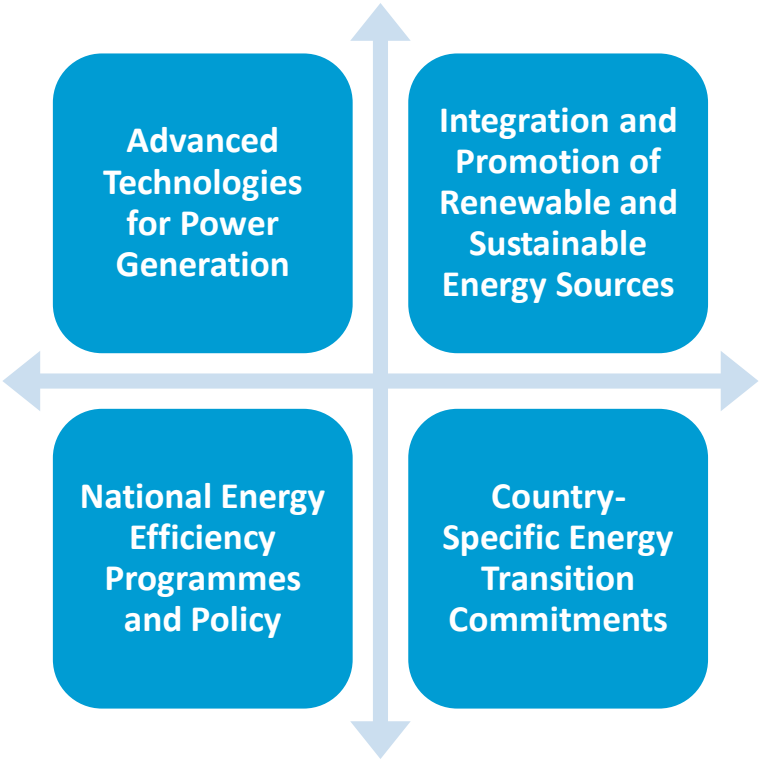


*Figure 3 - Measures of Energy Efficiency and Renewables Integration*

The shift to CCGT power plants is a common thread among the responses. **Algeria, Cyprus, Egypt, Jordan,** and **Lebanon** all cited the use of CCGTs as a key measure, observing their higher thermal efficiency and lower emissions compared to older thermal units. **Algeria's** Hassi R'Mel facility is a particularly innovative example, combining a CCGT with an integrated solar field to maximise efficiency and minimise fossil fuel use. CCGT is not limited to extra-EU countries; Portugal, as part of its National Energy and Climate Plan 2030, revised in 2024, has defined strategies for the energy transition. Among the planned measures are the use of CCGT and CHP, along with the substitution of gas demand through electrification and heat pumps.

Parallelly, **Algeria** has launched an ambitious renewable energy programme targeting 15 GW by 2035, primarily based on solar photovoltaic (PV) and wind power. Currently, around 3,200 MW of this capacity is under construction and expected to be operational shortly. This large-scale programme will significantly reduce dependence on fossil fuels, lower carbon emissions, and reinforce **Algeria's** path towards a more sustainable and resilient energy system.

**Jordan,** in contrast, is promoting Waste Heat Recovery (WHR) units in its industrial sector to capture heat from exhaust gases for productive use. **Egypt** has a major WHR project underway at a compression station, expected to save a significant amount of energy and reduce emissions equivalent to over 123,000 tonnes of CO2 annually, while generating 28 MWe of electricity.

Meanwhile, **France** is a leader in integrating biomethane into its natural gas grids, with 731 installations in place in 2024. The country's strategy aims for a substantial increase in biomethane production, which has a significantly lower carbon footprint than natural gas. In **Cyprus**, biogas production is done from the waste of large farms (anaerobic/aerobic treatment plants). The produced biogas is combusted onsite by Combined Heat Power generators to produce heat and electricity, which are primarily consumed at the farms. Similarly, in **Portugal**, the Biomethane Action Plan (PAB) 2024-2040 is the country's main strategy to reduce GHG emissions by promoting the biomethane market as a sustainable way to decarbonise the national economy, reduce imports of natural gas used in industrial and domestic sectors, including its use in mobility, while fully using existing endogenous resources across various sectors.[3] **Jordan** is using biogas from landfills to generate electricity as part of its commitment to the Global Methane Pledge. **Lebanon** and **Egypt** are also exploring biomethane from organic and agricultural waste. **Lebanon's** National Bioenergy Strategy and its national energy plans set ambitious renewable energy targets, which inherently reduce the need for fossil fuels. Similarly, **Egypt's** Ministry is focused on boosting renewable energy generation and moving towards green petrochemicals.

Broader energy efficiency programmes are also in place. For instance, Algeria has developed a National Energy Efficiency Programme (PNEE) targeting thermal insulation upgrades and widespread adoption of high-performance lighting to achieve significant energy savings by 2030. **Jordan**'s National Energy Efficiency Strategy includes mandatory energy audits for large industries and a grant programme that has funded over 100 audits, leading to substantial energy and emissions savings across various sectors. The country is also phasing out harmful refrigerants and promoting more efficient cooling systems. **North Macedonia**, through national plans and regulatory frameworks, is focusing on building renovation, cogeneration, and fuel switching to reduce energy consumption and emissions. These opportunities also include industrial flare reduction and the expansion of waste-to-energy systems.

**Türkiye, meanwhile,** has set a 2024–2030 Energy Efficiency Strategy and a second National Energy Efficiency Action Plan. The combination of the two aims to reduce energy consumption by 16% by 2030, targeting a reduction of 100 million tonnes of CO2 emissions. It encompasses 61 actions and 266 activities across sectors such as industry, buildings, energy, transportation, agriculture, and

[3] https://www.lneg.pt/wp-content/uploads/2024/01/Plano-de-Acao-para-o-Biometano-vpdf.pdf *(in Portugese)*

digitisation. An investment of $20.2 billion is planned, with projected energy savings of $46 billion by 2040.

Additionally, given the increasing role of hydrogen, numerous countries have cited that blending hydrogen with natural gas and studying grid adaptation are among the measures being adopted, with some countries in the region, including **Portugal,** citing the study of potential pilot projects.

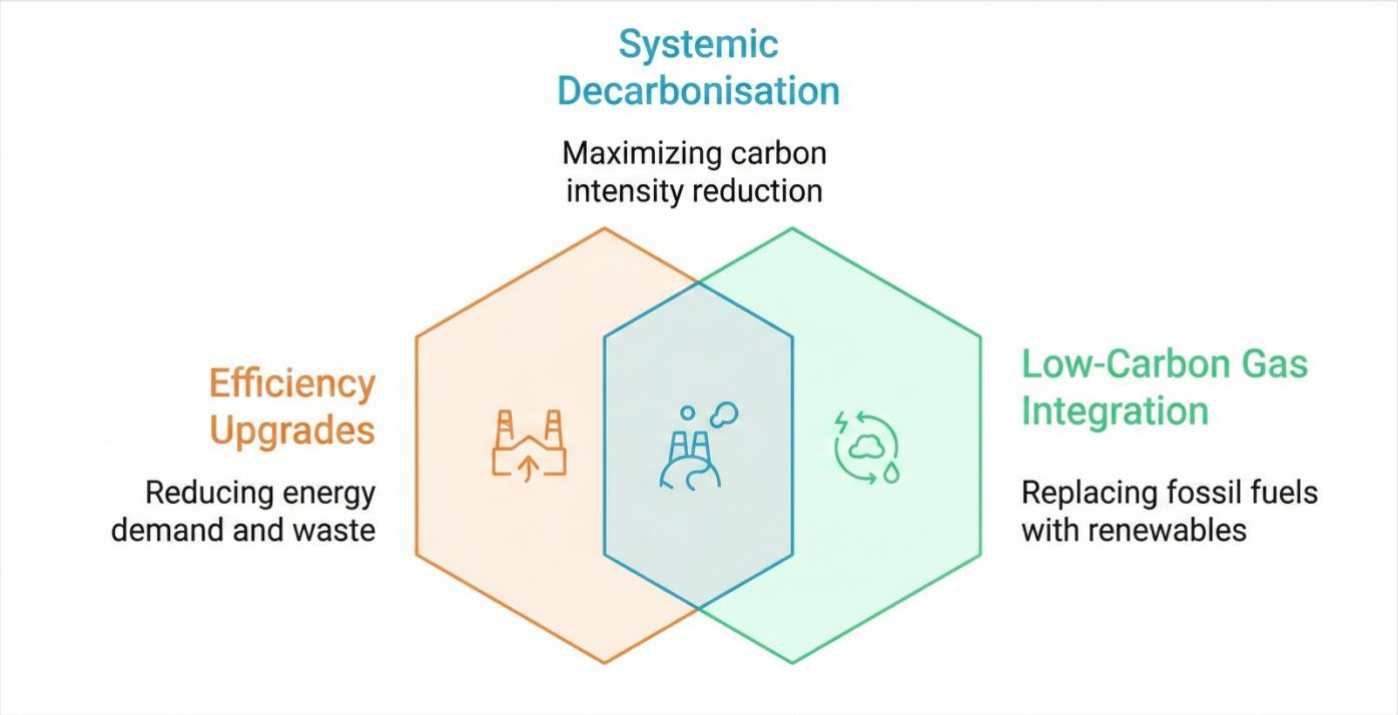


*Figure 4 - Decarbonisation through Efficiency and Renewable Integration*

**Chapter Analysis**

Progressive approaches across the Mediterranean region aim to limit emissions, characterised by the dual pillars of robust data management (MMRV) and the deployment of technological and strategic mitigation mechanisms. The regional landscape is defined by regulatory divergence and a clear progression in technical capability towards low-carbon energy systems.

**1 The Foundational Role of MMRV**

Effective emission reduction is predicated on accurate data, and the region's MMRV frameworks reveal a fundamental split in regulatory drivers and a maturation in measurement techniques.

- Regulatory Alignment: A clear division exists between the EU Northshore, which is rapidly harmonising and elevating standards under the EU Methane Regulation (EU/2024/1787)—driving immediate Leak Detection and Repair (LDAR)—and the Southshore/Türkiye, which prioritise national mandates and adherence to global standards like the IPCC Guidelines and the Paris Agreement's Enhanced Transparency Framework.

- Measurement Evolution: The region is moving away from basic, estimation-based systems (IPCC Tier 1, e.g. Egypt) towards combined measurement frameworks that blend estimation with direct, on-site readings (e.g. Algeria). The most mature systems, like those in France and Jordan, incorporate advanced verification, including third-party audits and the use of cutting-edge tools like chromatographic analysis and satellite monitoring to ensure transparency and granular data accuracy.

### 2 Mitigation Mechanisms: Staging and Dual Focus

Mitigation efforts display a strategic dual operational focus—simultaneously tackling long-term CO2 abatement and immediate, high-impact methane reduction—with CCUS readiness varying across jurisdictions.

- Staging of CCUS Implementation:
  - Pioneers and Hub Developers: Countries like Algeria (with historic experience) and Greece (developing major regional storage hubs) are leading the commercial-scale deployment and planning of CCUS.
  - Enablers and Planners: Other countries are focused on crucial preparatory steps, such as establishing transport infrastructure (e.g. France's D'Artagnan project), characterising geological storage sites (e.g. Portugal), and drafting the necessary legal and regulatory frameworks (e.g. Türkiye, Egypt).
- Immediate Methane Abatement: Operational strategies prioritise the systematic reduction of fugitive methane emissions. This is primarily achieved through mandatory LDAR campaigns (accelerated in EU members) and extensive flared gas recovery programmes in gas-producing countries (e.g. Egypt, Algeria), often linked to the "Zero Routine Flaring by 2030" initiative.
-

### 3 Decarbonisation through Efficiency and Integration

Underpinning these efforts is a broad, systemic commitment to lowering the carbon intensity of the energy supply through efficiency and the integration of cleaner fuels.

- Efficiency Upgrades: The shift to CCGT power plants is a widespread foundational measure for improving thermal efficiency across both shores (e.g. Algeria, Portugal). This is supplemented by Waste Heat Recovery (WHR) units (e.g. Egypt, Jordan) and comprehensive National Energy Efficiency Programmes that target the industrial and building sectors (e.g. Türkiye's $20.2 billion investment plan).

- Low-Carbon Gas Integration: The development and integration of biomethane/biogas from organic waste is a mature strategy in many countries (e.g. France, Portugal's PAB) to directly displace natural gas consumption. Further, numerous countries are actively studying or planning the future blending of hydrogen with natural gas, signalling the next phase of decarbonisation in gas network management.

# 3. Legal and Regulatory Framework

## 3.1. International and Regional Frameworks

A combination of international climate agreements and regional obligations significantly shapes the legal and regulatory foundations for emission reduction across MEDREG member countries. These external commitments serve as a primary catalyst for the development of national policies, providing a mandate and framework for domestic action. The relationship between national regulatory bodies and government ministries is central to this process, as it dictates how these international obligations are translated into enforceable, on-the-ground regulations.

### 3.1.1. Role of International Agreements (Paris Agreement, etc.)

The **Paris Agreement** and other international climate conventions, such as the UNFCCC and its protocols, act as a foundation for national climate strategies. Across the Mediterranean region, countries have used these agreements to create new policies or strengthen existing ones. This influence is most evident in the development of **Nationally Determined Contributions (NDCs)**, which directly translate global commitments into specific national targets.

**EU member states** align their national policies with the EU's overarching framework. The **European Green Deal** and the binding targets of the European Climate Law provide the legal impetus for action, turning the goal of climate neutrality by 2050 into a legal obligation. Besides the European Climate Law and the Fit-for-55 package, complemented by initiatives such as REPowerEU and the Green Deal Industrial Plan, binding targets are set. According to the European Commission, the EU is well on track to achieve a 55% reduction in emissions by 2030 compared to 1990 levels. This shared legal framework implies that their national commitments are simply part of a broader, more ambitious, and legally enforceable regional strategy. In the respective countries of the EU, these European and international commitments lead to the adoption of a climate law, such as the Climate Basis Law of **Portugal** (LBC – Law No 98/2021 of 31 December 2009), which consolidates objectives, principles, and obligations of the different levels of governance for climate action through public policies and establishes new provisions on climate policy.

For **non-EU members**, the influence of international agreements is often translated through dedicated national strategies and decrees. **Albania**, for example, has aligned its National Energy Strategy with the EU's "Low-carbon Economy Roadmap", demonstrating how an international commitment can directly inform national policy. Similarly, **Algeria** highlights that its participation in global and regional climate dialogues has motivated the formulation of its National Climate Plan (PNC) and driven reforms in renewable energy and energy efficiency. Its commitment is solidified by a series of presidential decrees that formally ratify international treaties, such as the Paris Agreement.

In **Egypt**, a comprehensive legal structure is in place, with the country's NDC serving as the foundation for a wide range of national strategies, including the National Climate Change Strategy 2050 and the National Hydrogen Strategy. This proactive approach includes a specific NDC target to reduce GHG emissions from the oil and gas sector by 1.682 million tonnes of CO2 equivalent by 2030. Both **Jordan** and **Lebanon** directly link the Paris Agreement to the development of their updated NDCs, national climate legislation, and the establishment of MMRV systems, with **Lebanon** specifically pledging an unconditional 20% GHG reduction by 2030. In **North Macedonia**, international agreements work in tandem with the country's EU accession process and Energy Community obligations, providing a clear, structured path for its climate policy. **Türkiye** ratified the Paris Agreement in 2021. In the Paris Climate Agreement, **Türkiye** has pledged net-zero carbon emissions by 2053 and a 41% GHG reduction by 2030.

### 3.1.2. Defining Institutional Roles and Responsibilities

The effective implementation of international agreements requires a clear division of tasks between government bodies. The questionnaire responses reveal a common pattern: ministries typically set the overarching policy and are responsible for international reporting, while regulators and other agencies handle the technical and enforcement aspects.

In countries with a more centralised approach, like **Cyprus, France**, **Italy**, and **Spain**, the national regulatory authorities (CERA, CRE, ARERA, and CNMC, respectively) have limited involvement in emissions reduction. Instead, all compliance responsibilities rest with the ministries. In **Cyprus**, the Ministry of Agriculture, Rural Development and Environment acts as the Competent Authority, with its Department of the Environment (DoE) serving as the executive arm responsible for the national GHG inventory and EU ETS implementation. The NRA in **Cyprus** (CERA) has an advisory role as one of the members of the relevant Advisory Committee established under the national GHG Emissions Trading System Law. In **Spain**, the Ministry for the Ecological Transition and the Demographic Challenge holds this central authority, while in **Greece**, the Ministry of Environment and Energy formulates strategy and proposes targets, with a Government Committee for Climate Neutrality making the final policy decisions. This model of ministerial authority is clearly defined by legal frameworks, such as **Greece's** Law 4936/2022. In **Italy**, the Ministry of the Environment and Energy Security (MASE) defines national climate and energy strategies and represents the country in international reporting. ISPRA supports the ministry as the technical body responsible for compiling the national GHG inventory and ensuring methodological consistency with EU and UNFCCC requirements.

In other countries, responsibilities are more widely distributed among various government bodies. In **Albania**, the Ministry of Infrastructure and Energy (MIE) and the **Albanian** Energy Authority (AEE) share the responsibility of implementing the National Energy Strategy, with the AEE tasked

with submitting annual reports to the MIE to ensure the achievement of emission reduction targets. **Algeria** has a multi-faceted approach, with the Ministry of Environment and the Ministry of Energy, Mining and Renewable Energies (MEMRE) serving as primary policy coordinators. The **Algerian** Hydrocarbon Regulatory Authority (ARH) and the Electricity and Gas Regulatory Commission (CREG) have distinct yet complementary roles; ARH ensures environmental compliance in the oil and gas sector, while CREG validates GHG inventory data as an active member of the Energy Sector Climate Committee. **Egypt** has a highly coordinated system led by the National Council for Climate Change (NCCC), chaired by the Prime Minister. The Ministry of Environment leads national climate policy, while the Egyptian Environmental Affairs Agency (EEAA) manages the technical work on MMRV and climate reporting. In **Jordan**, the Ministry of Environment handles UNFCCC reporting, while the Ministry of Energy integrates climate goals into energy policy. The Energy & Minerals Regulatory Commission (EMRC) enforces compliance in the energy and gas sectors based on its legal authority to grant licences and permits. Similarly, in **Lebanon**, the Ministry of Environment is the primary government body for climate change, while other entities like the Lebanese Petroleum Administration (LPA) have a legal mandate to ensure environmental compliance within their specific sectors. Lastly, **North Macedonia's** legal framework clearly assigns policymaking to the Ministry of Environment and Physical Planning (MoEPP) and independent regulatory oversight to the Energy Regulatory Commission (ERC).

**Türkiye, meanwhile,** manages its compliance with international emission reduction agreements like the Paris Agreement through a multi-level governance structure led by the Ministry of Environment, Urbanisation and Climate Change (ÇŞİDB), the primary authority responsible for climate policy, including preparing Nationally Determined Contributions (NDCs) and managing the national GHG inventory. The Ministry of Energy and Natural Resources (ETKB) holds a crucial sectoral role, focusing on decarbonising the energy sector by promoting renewable energy, energy efficiency, and market-based mechanisms such as carbon pricing. Supporting these efforts are the Turkish Statistical Institute (TÜİK), which publishes official emissions data, the Presidency of Strategy and Budget, which integrates climate goals into national development plans, and local governments, which implement municipal climate action plans. This entire framework is being formalised and strengthened by **Türkiye's** first-ever Climate Law (İklim Kanunu), which was submitted to the Turkish Grand National Assembly in February 2025 and completed its legislative process in July 2025. This law provides the legal basis for the country's climate policies, aligning them with its international commitments and its ambitious 2053 net-zero emissions target.

## 3.2. National Legal Instruments and Mechanisms

While international agreements provide the overarching legal context, the practical implementation of emission reduction policies is achieved through specific national legal instruments and regulatory mechanisms. These tools vary across the region, reflecting differences in national priorities, institutional structures, and alignment with regional blocs like the EU. This section examines the specific market-based mechanisms, monitoring and verification systems, and other legal tools employed by MEDREG members.

### 3.2.1. Market-Based Mechanisms

For countries that are part of the EU, the EU ETS serves as the primary legal mechanism for managing and trading CO2 emissions. This cap-and-trade system legally obligates sectors like power generation and energy-intensive industries to account for their GHG emissions. **Cyprus**, for example, operates its emissions trading through this system, with the Department of the Environment (DoE) being the competent authority responsible for its implementation and supervision under national law. For **EU members,** the EU ETS is also the key mechanism, with the legal competence for its operation residing with the respective government ministries rather than the energy regulators. The EU ETS represents a harmonised, market-driven approach that is legally binding and central to its climate strategies. The system works on a "cap and trade" principle, where a continuously declining cap on emissions ensures that the price of allowances serves as a strong incentive for companies to reduce their emissions most cost-effectively. In **Spain**, a voluntary Carbon Footprint Registry was established in 2014 by Royal Decree. This registry encourages companies to calculate their footprint and offset their emissions through forestry projects, providing a complementary, non-mandatory tool that enhances **Spain's** overall climate action. **Portugal is a**mong the countries following the EU ETS. The Portuguese Environment Agency (APA) is the national authority responsible for managing and supervising the Portuguese Emissions Trading Registry (RPLE), ensuring the correct operation of the system at the national level. Its responsibilities include approving and verifying monitoring plans submitted by covered installations, monitoring compliance with reporting and surrender obligations, and managing the RPLE, which is integrated into the common European registry infrastructure. Natural gas power plants are subject to the EU ETS.

Outside the EU, the development of market-based mechanisms is more nascent. **Jordan** and **Lebanon** mention carbon credit mechanisms as part of their national regulations, while **Algeria** highlights a legal framework for the hydrocarbon sector that includes technical data collection and a rigorous verification system to reduce emissions. These frameworks indicate a move towards more structured, quantifiable approaches, but are not yet as comprehensive as the EU ETS. In **Algeria**, there are currently no carbon trading mechanisms, but a 2003 law on the Environment and Sustainable Development provides the legal basis for future fiscal and financial incentives. Similarly,

## LEGAL AND REGULATORY FRAMEWORK

**North Macedonia** does not yet have a mandatory national emissions trading system but is steadily building the legal and institutional infrastructure for future participation. **Egypt** stands out as a country actively developing a full-fledged voluntary carbon market. Legal decrees now recognise carbon reduction certificates as tradable financial instruments, and a supervisory committee drafts rules for their issuance, verification, and trading. This initiative, launched during COP27, reflects **Egypt's** ambition to become a regional hub for carbon trading and maximise the economic and environmental benefits of its climate actions.

### Turkish Case

The first attempt was made through voluntary carbon markets in 2007. However, as of October 2023, the Energy Market Regulatory Authority has published a draft for compulsory carbon markets, which would require electricity companies emitting CO2 to participate. The Climate Law was passed in July 2025, which is the legal basis for the Turkish ETS Market. The Emissions Trading System in **Türkiye**, as defined by the Climate Law, is a market-based mechanism designed to reduce GHG emissions. It is established and regulated by the Climate Change Presidency, while the market operations are managed by the Energy Markets Operation Co. (EPİAŞ). The system sets a cap on total emissions and allows trading of emission allowances to incentivise reductions.

Allowances represent the right to emit one tonne of CO2 equivalent. These can be distributed for free or sold in the primary market. A National Allocation Plan is prepared and published in the Official Gazette. The system includes flexibility mechanisms such as the use of allowances from previous or future periods and offsetting through carbon credits. A market stability mechanism is also in place to prevent excessive price fluctuations.

Facilities covered by the ETS must obtain a GHG emission permit, submit annual verified emissions reports, and deliver allowances equivalent to their verified emissions. Several institutions are involved in the governance of the ETS. The Carbon Market Board, chaired by the Minister and comprising representatives from key ministries and institutions, approves the allocation plan and sets policies. The Advisory Board, led by the President of TOBB, provides strategic input. The Climate Change Presidency manages the technical and administrative aspects, while the Energy Market Regulatory Authority (EMRA) oversees market surveillance. The Central Clearing Institution handles financial settlements and collateral management.

The system also includes voluntary carbon markets and a national carbon crediting and offsetting framework. Projects generating carbon credits must be registered with the national registry. Non-compliance with ETS obligations attracts administrative fines and, in cases of repeated violations, revocation of emission permits.

**Analysis**

The approach to carbon pricing and market tools is sharply divided, primarily based on regional alignment and the legal maturity of the instrument.

A harmonised **Mandatory Cap-and-Trade system** is implemented by EU member states. These countries universally rely on the EU ETS, which is a legally binding, supranational system serving as the central market tool. The operation and legal competence rest with the respective government ministries.

Meanwhile, outside the EU, there are **developing and diverse National** systems observed among non-EU members, representing varied stages of regulatory maturity. **Türkiye** and **Egypt** are leading in establishing their own structures, with **Türkiye** transitioning to a compulsory national ETS under its new Climate Law, while **Egypt** is legally establishing a voluntary carbon market. Other countries are in the foundational phase, focusing on creating the legal framework for future fiscal incentives or building the necessary legal infrastructure for eventual market participation.

This divergence highlights the difference between a legally imposed, established regional carbon price and varied national efforts to build market signals from the ground up.

### 3.2.2. Certifications for MMRV

A robust MMRV system is the backbone of any legal framework for emission reduction, as it ensures transparency and accountability. Most of the countries that responded have established or are in the process of establishing such systems. All countries in the Mediterranean region have legal frameworks for MMRV.

In **Algeria**, the Hydrocarbon Regulatory Authority (ARH) plays a critical role in the MMRV process in the hydrocarbon sector, leveraging a strong legal framework and a rigorous verification system to ensure compliance. This is complemented by monthly reporting requirements for operators. The **Albanian** Energy Efficiency Agency (AEE) is legally mandated to monitor and verify energy savings, submitting annual reports to the Ministry of Infrastructure and Energy to track progress towards

national targets. **Cyprus** relies on its Department of the Environment to manage its national GHG inventory, with responsibilities and procedures for monitoring and verification legally defined by the GHG Emissions Trading Scheme Law of 2011.

In **Egypt**, a national MMRV working group was recently established by ministerial decree to track progress towards the country's NDCs and manage emissions data from key sectors, highlighting a commitment to building a centralised, verifiable system. The system is also aligned with the UNFCCC and the Paris Agreement's Enhanced Transparency Framework (ETF), but faces challenges with data infrastructure and funding. The legal pillars of **North Macedonia's** MMRV system are the Law on Environment and the Law on Air Quality, which assign the Ministry of Environment and Physical Planning the responsibility for developing GHG inventories and reporting. It is also aligned with EU regulations and voluntary certifications like ISO 14064. **Jordan** has developed an open-source digital MMRV and GHG registry, aligning with Article 6 of the Paris Agreement to track emissions and reductions, which serves as a foundational step for future carbon markets.

The system for monitoring and verifying gas emission reductions in **France**, as established by the Decree of August 24, 2011, is a structured process leveraging external expertise and rigorous data handling. The Ministry responsible for ecology can delegate key tasks—including the technical execution of national emission inventories to ISO 9001 certified organisations and the development of methodologies for territorial inventories and GHG balances—to certified bodies or those with recognised expertise, ensuring procedural consistency. Further, the official CO2 emission factor for natural gas (NAPFUE 301) is determined with precision, calculated from daily averages of chromatographic measurements and transactional volumes at all major entry points into mainland **France** (interconnections and GRTgaz LNG terminals). These input data undergo thorough filtering and consistency checks before the final factor is calculated as a volume-weighted average, thereby guaranteeing an accurate and verifiable basis for emission reporting.

In **Italy**, guarantees of origin (GO) for biomethane are mandatory. For natural gas transmission, ARERA envisages all emissions to be monitored and annually reported.

Like **Italy**, in **Spain**, the GO system is managed by Enagás GTS (TSM), the Responsible Entity operating the online GO platform, with oversight from the Ministry of Energy Transition and NRA (CNMC). Key participants, known as Account Holders, include producers, consumers, suppliers, and traders who maintain a book-entry account. The system also involves a Measurement Body for determining production and consumption values, and an Auditing Entity to verify data accuracy. The GO life cycle has three phases: Expedition, which is limited to producers; Transfer (exchange), which involves all account holders; and Redemption, the final phase due to consumption or expiration, involving only consumers and suppliers. Further, sustainability certifications are a mandatory

requirement for compliance with the RED III (Renewable Energy Directive) and for accessing various incentives.

### 3.2.3. Other Legal Instruments and Incentive Programmes

Beyond trading and MMRV, countries are employing a variety of other legal instruments to support emission reduction. **Algeria** has an Executive Decree (21-330) specifically for granting exceptional authorisation for gas flaring, reflecting a targeted legal approach to a significant source of emissions in its key sector. It is also preparing for future green finance mechanisms, including tax exemptions and preferential loans for low-carbon investments.

In **Lebanon**, a new law on decentralised renewable energy (318/2023) provides a legal framework to accelerate the deployment of clean energy, directly contributing to its NDC targets. The country also uses International Renewable Energy Certificates (IRECs) as a voluntary market-based instrument for companies to reduce their Scope 2 emissions. The **Lebanese** Ministry of Finance also has the legal authority to formulate fiscal policies and offer incentives to encourage green investments, showcasing a legal pathway for using financial tools to support emission reduction goals.

**Egypt**'s legal framework is particularly broad, including laws on renewable energy, waste management, and even building codes to support climate resilience. It also uses targeted decrees to promote alternative fuels in industries and incentives for electric vehicles. **Jordan** does not have a carbon tax, but its legal framework supports financial incentives through the **Jordan** Renewable Energy and Energy Efficiency Fund (JREEEF), which provides grants for projects that reduce emissions. Finally, while **North Macedonia** does not yet impose an explicit carbon tax, it is actively preparing a roadmap and technical economic assessments for future implementation. The country is also exploring voluntary carbon projects, particularly for nature-based solutions and the early retirement of coal plants.

In **Cyprus**, even though there is no operational gas market yet, according to the obligations imposed on the Gas Transmission System Operator, the LNG Terminal Operator and the Gas Supplier (the Gas Supplier is responsible for the operation of any virtual natural gas pipelines), through their licensing terms, must provide annual reporting regarding their emissions due to gas leaks and the measures taken to mitigate them.

## 3.3. National Targets and Future Regulatory Improvements

While many countries have adopted mandatory, legally binding goals, others are pursuing conditional or voluntary targets, highlighting a diverse range of national commitments and approaches to climate policy. This subchapter discusses the national emission reduction targets and presents forward-looking suggestions for strengthening the legal and regulatory framework to better support emission reductions, particularly in the gas sector.

### 3.3.1. Mandatory National Targets

The establishment of clear, mandatory emission reduction targets provides a critical legal foundation for climate action. For EU members and accession countries, these targets are often directly tied to the EU's binding commitments. **Spain** and **Italy**, for example, have legally binding national reduction commitments that are simply part of the larger EU targets, such as the EU Effort Sharing Regulation, which sets specific annual targets for sectors not covered by the ETS. **Cyprus** has adopted the European Climate Law by setting a national mandatory target of a 32% reduction in GHG emissions by 2030 compared to 2005 levels. Similarly, **Greece** has a national legal framework with highly ambitious, mandatory targets for significant GHG reductions by 2030, 2040, and 2050, aiming for near climate neutrality. **France** also operates with mandatory national targets, guided by its National Low Carbon Strategy (SNBC) and Multiannual Energy Plan (PPE), aiming to drastically reduce the share of fossil fuels and increase energy savings by 2035.

For non-EU members, the legal status of targets varies. **North Macedonia** has set an ambitious, unconditional, economy-wide target of an 82% net GHG reduction by 2030 compared to 1990 levels, which is a key part of its enhanced Nationally Determined Contribution (NDC) under the Paris Agreement. **Albania's** NDC is also binding, committing the country to a 20.9% CO2 emission reduction by 2030 compared to its baseline. In contrast, **Algeria** and **Lebanon** have set conditional targets. **Algeria's** NDC aims for a 7% unconditional reduction in GHG emissions, with a more ambitious goal of up to 22% contingent on international support. **Lebanon** has a similar dual approach, with a 20% unconditional reduction target and a more ambitious 31% conditional target. **Jordan's** targets are also outlined in its NDCs, but are not legally binding national mandates. Finally, **Egypt** has no mandatory national target, opting instead for non-binding, conditional sectoral targets as voluntary benchmarks, relying on international finance and technology to achieve its goals. **Türkiye**, in the Paris Climate Agreement, has pledged net-zero carbon by 2053 and a 41% reduction in GHG emissions.

### 3.3.2. Feedback from Regulators

Besides defining targets, regulators provided insightful suggestions on how to improve the legal and regulatory frameworks to enhance emission reduction efforts. These recommendations reflect the practical challenges and opportunities faced in the respective countries.

**Cyprus** stated that its legal and regulatory framework for the gas sector would be strengthened in the coming year by aligning and harmonising the national law with the recent European Directive (EU)2024/1788 on renewable gases, establishing specific incentives to reduce methane leaks, and creating a certification scheme for renewable and low-carbon gases. The regulator also proposed the

establishment of new grid codes to facilitate the injection of biomethane and hydrogen into the natural gas grid.

From the perspective of a developing economy, **Egypt** suggested a gradual, incentive-based approach to avoid placing additional burdens on the industrial sector or risking carbon leakage. Its recommendations include introducing financial and market-based incentives for companies that invest in emission reduction technologies, facilitating participation in carbon markets, and enhancing institutional coordination and capacity building to de-risk investments and demonstrate the commercial viability of low-emission technologies.

For a country in the foundational phase of its gas sector, **Lebanon**'s suggestions for future implementation are comprehensive. They include setting specific emission standards for all parts of the gas supply chain, implementing mandatory, standardised MMRV of emissions, and integrating climate considerations directly into gas project licensing.

Finally, **North Macedonia** provided specific, actionable suggestions, such as enacting LDAR regulations, launching a public methane emissions registry, and providing fiscal incentives for pipeline modernisation. The regulator also mentioned the importance of undertaking legal work to integrate renewable gases into the grid.

To support emission reductions in **Türkiye's** natural gas sector, a combination of infrastructure upgrades, regulatory reforms, clean energy integration, and financial incentives is essential. The sector can significantly reduce its carbon footprint by modernising its systems, adopting cleaner fuels, and aligning with national and international climate goals. **Türkiye's** Climate Law and its upcoming ETS provide a legal and policy foundation for these efforts. Additionally, integrating green hydrogen and biomethane into the gas grid, along with deploying carbon capture technologies, can help decarbonise the sector while maintaining energy security.

**Chapter Analysis**

The legal and regulatory landscape for emission reduction across the Mediterranean region reveals a system driven by international obligations and characterised by two distinct governance models based on regional alignment. Analysis indicates a clear distinction in practices between EU member states and non-EU members.

**1. External Drivers and Institutional Models**

The foundation of climate action is set by international agreements (e.g. the Paris Agreement) and regional obligations (especially the EU's binding European Green Deal and Climate Law). These external commitments mandate the development of national policies and Nationally Determined Contributions (NDCs).

The implementation of these obligations is defined by two primary governance models:

- **Centralised/Ministerial Authority Model:** Ministries hold the central authority for policy setting, international reporting, and compliance in EU member states. National Regulatory Authorities (NRAs) typically maintain a limited, advisory, or secondary role in emission reduction.
- **Distributed/Shared Responsibility Model:** In non-EU member states, responsibilities are shared among multiple ministries and regulatory bodies, often with a coordinating council. Sectoral regulators (NRAs/Hydrocarbon Authorities) play a complementary enforcement role, managing technical compliance, data verification, and sectoral environmental standards.

This contrast between centralised ministerial control and distributed regulatory enforcement represents a strong analytical pattern.

**2. National Instruments and Regulatory Maturity**

The adoption of specific legal tools illustrates a clear divergence in regulatory maturity between the two blocs.

| Mechanism | EU Member States | Non-EU Members |
|---|---|---|
| **Market-Based Mechanisms** | Harmonised and Mandatory: There is universal reliance on the EU Emissions Trading System (EU ETS), a legally binding cap-and-trade system for carbon pricing. | Developing and Diverse: Varied stages of regulatory maturity are evident. Examples include Türkiye's transition to a compulsory national ETS and Egypt's proactive development of a voluntary carbon market. Other countries are focused on establishing legal foundations for future fiscal incentives. |
| **MMRV and Certification** | Robust, legally defined systems are aligned with EU and UNFCCC requirements. This includes mandatory Guarantee of Origin (GO) systems for renewable gases (e.g. Italy, Spain). | Efforts are underway to establish or enhance systems, often aligned with the Paris Agreement's Enhanced Transparency Framework (ETF). These systems rely heavily on sectoral regulators for technical verification (e.g. ARH in Algeria for hydrocarbons). |
| **Other Legal Instruments** | Compliance with EU Directives (e.g. RED III) and specific national laws for | Targeted legal decrees (e.g. Algeria's decree on gas flaring), new laws for renewable energy deployment, and fiscal incentives/green |

| | | |
|---|---|---|
| | energy efficiency and low-carbon investment is common. | finance mechanisms (e.g. Lebanon, Jordan) are also being implemented. |

**3. National Targets and Future Focus**

National emission reduction targets vary significantly in their legal status.

- Mandatory and Binding: This is common among EU members (tied to EU targets) and some non-EU members like Albania and North Macedonia.
- Conditional and Voluntary: This is observed in countries like Algeria, Lebanon, and Egypt, where achievement depends on international financial and technological support.

Feedback from regulators highlighted the practical need for regulatory improvements in the gas sector, including:

- Implementing specific LDAR regulations.
- Enacting new grid codes and certification schemes to facilitate the injection of renewable and low-carbon gases (biomethane, hydrogen).
- Introducing targeted financial and market-based incentives to de-risk investments in emission reduction technologies.

While all countries are anchored to global climate goals, the EU framework creates a legally mature and mandatory policy environment. Outside the EU, progress is characterised by a distributed governance structure and diverse, evolving national efforts to build legal foundations and market signals from the ground up.

# 4. Outlook, Challenges, and Opportunities

## 4.1. Future Regulatory and Market-Based Mechanisms

The responses from MEDREG's member regulators reveal a clear consensus on the need for a multi-faceted approach to incentivise emission reductions that extend beyond existing mandatory targets. This forward-looking perspective highlights a strategic shift from pure regulation to a combination of enhanced standards, fiscal tools, and market-based mechanisms. The responses indicate a growing recognition that future success depends on creating an environment where low-emission practices are not only required but also financially and commercially attractive.

There appears to be a shift in emission reduction policy, moving beyond mandatory targets towards a more complex approach. This strategy centres on two key pillars: adopting rigorous, internationally harmonised standards to ensure data credibility and transparency across the Mediterranean countries, and implementing widespread financial and fiscal incentives to overcome high investment costs. This implies that future success requires compliance, but more importantly, actively making low-emission practices commercially and financially attractive for market players.

### 4.1.1. Importance of International Standards


*Figure 5 - International Standards*

Many regulators foresee a future where compliance is measured against more rigorous, internationally recognised standards. **Egypt** proposes establishing a **national certification programme for GHG** auditors and energy managers, which would build local capacity and ensure the credibility of reported data. This is a critical foundational step that aligns with the specific technical measures proposed by other countries.

**Jordan** and **Lebanon** both point to the adoption of international standards as a key future requirement. **Jordan** specifically mentions the Oil and Gas Methane Partnership 2.0 (OGMP 2.0), a

leading global framework for methane measurement and reporting.[4] By encouraging or mandating adherence to such standards, regulators can ensure greater transparency and accuracy in emission reporting, a crucial step for credible reduction efforts. OGMP 2.0 is the only comprehensive, measurement-based international framework for the oil and gas sector, requiring companies to transition from using generic emission factors to actual, science-based measurements of methane leaks. Companies joining the partnership commit to reporting on all material sources of methane across their entire value chain, to achieve a "Gold Standard" in reporting based on reconciled, source-level measurements (Source: OGMP).

**Jordan** also highlights the use of ISO 14067 for product-level carbon footprinting and ISO 14064 for organisational-level GHG accounting (Source: ISO). Similarly, **Lebanon** emphasises ISO 14064 certification for transparency and the importance of integrating environmental considerations into the licensing of new gas infrastructure projects. **North Macedonia** echoes this by suggesting the adoption of several international standards and alignment with the upcoming EU Methane Regulation. This landmark regulation introduces mandatory methane measurement, reporting, and verification requirements, bans routine flaring and venting, and mandates regular LDAR for EU operators. It also contains a key import provision, requiring new contracts for oil, gas, and coal imports to adhere to equivalent monitoring and reporting standards as EU producers, effectively extending its influence on global markets (Source: European Commission). The focus on these standards demonstrates a collective desire to harmonise methodologies across the Mediterranean region and leverage global best practices.

[4] Source: UNEP

### 4.1.2. Financial and Fiscal Incentives


*Figure 6 - Financial and Fiscal Incentives*

A central theme across the responses is the use of financial and fiscal incentives to drive behavioural change among market players. **Albania**, in a highly detailed response, outlines a comprehensive strategy for the transport and building sectors. Proposed measures include a broad range of tools, such as grants, soft loans, rebates, and subsidies for purchasing green vehicles.

**Albania** suggests implementing a feebate system, which levies a fee on high-emission vehicles and uses that revenue to provide a rebate for low-emission ones, creating a self-financing incentive model. Feebates are designed to be revenue-neutral, providing a powerful and constant price signal to both consumers and manufacturers to choose and produce more efficient vehicles. It also mentions scrappage schemes to encourage the replacement of older, more polluting cars with modern, efficient models, directly removing high-polluting vehicles from the road (Source: The International Council on Clean Transportation).

Exemptions from VAT, registration fees, and annual vehicle taxes, as well as reduced roadway and motor fuel taxes, are proposals to make green vehicles more affordable.

Beyond transport, **Albania** also recommends a combination of finance, fiscal incentives, and regulatory frameworks for the building sector, using tools like Energy Service Companies (ESCOs) to finance energy-saving investments. **Cyprus** suggests that incentives such as Green Tax Credits and Green Financing could also be examined to make low-carbon investments more financially viable. **Lebanon** and **Jordan** echo this by suggesting enhanced green financing, tax breaks, and performance-based grants for projects that exceed mandatory targets. This consistent emphasis on financial incentives highlights their perceived effectiveness in overcoming the initial investment barriers of green technologies.

### 4.1.3. Market-Based Mechanisms and Carbon Pricing

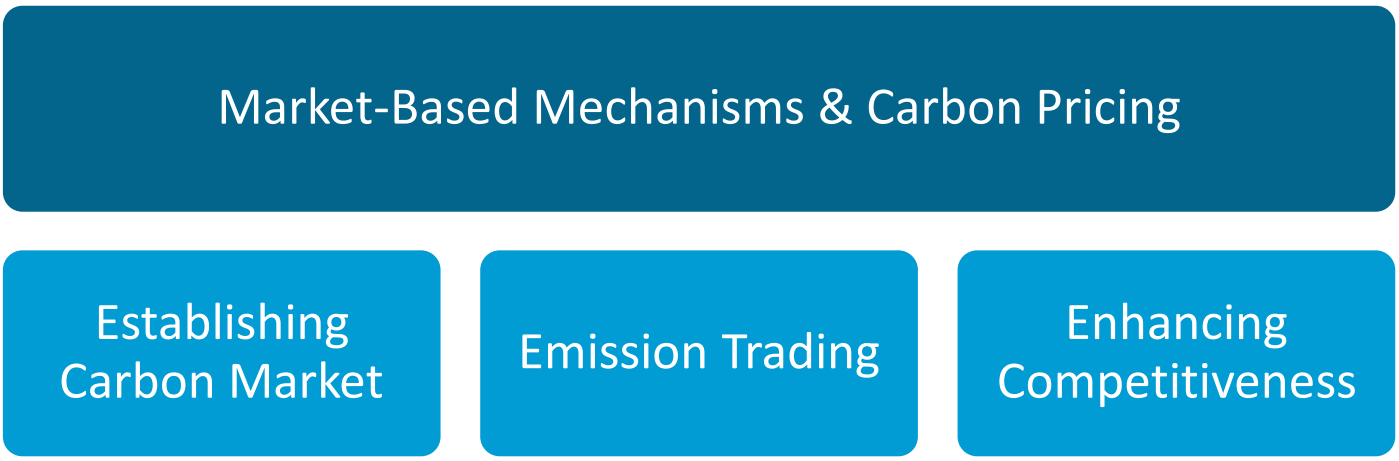


*Figure 7 - Market-Based Mechanisms and Carbon Pricing*

The responses also point to the future implementation of market-based mechanisms that leverage economic principles to reduce emissions, with several countries expressing interest in carbon markets and trading schemes.

**Egypt**, while lacking binding national targets, highlights the need for voluntary action and suggests facilitating the participation of gas sector projects in carbon markets, allowing them to generate and trade carbon credits. Carbon markets are broadly divided into compliance markets, which are legally binding systems (like the EU Emissions Trading System), and voluntary carbon markets, where companies and individuals buy credits to offset their emissions out of a voluntary commitment. This mechanism is echoed by **Lebanon**, which proposes facilitating participation in voluntary carbon markets and introducing green certification for lower-emission gas. **Jordan** provides the most comprehensive vision in this area, suggesting the introduction of a voluntary carbon market or an ETS and linking these to tax incentives and export competitiveness.

**Spain** highlighted the EU Taxonomy Regulation. While it is relevant, it can be considered more as a tool that can enable a market-based mechanism. This regulation is a classification system that defines which economic activities can be considered environmentally sustainable, guiding investment decisions and serving as a powerful tool for channelling capital towards green projects. The EU Taxonomy's classification system is a cornerstone of the EU's sustainable finance strategy. It sets technical screening criteria for a wide range of economic activities, providing a clear benchmark for investors to identify and invest in activities that genuinely contribute to climate change mitigation, among other environmental goals. This demonstrates how regulators are considering broader market frameworks to influence private investment.

**Türkiye** can promote deeper emission reductions in the private sector by expanding its carbon-pricing infrastructure, particularly through the development of a national ETS and voluntary carbon

markets. Companies that exceed their reduction targets could benefit from tradable carbon credits, tax incentives, or preferential access to green financing. The government could also introduce performance-based subsidies, public recognition programmes, and regulatory flexibility for early adopters. These mechanisms not only reduce emissions but also enhance competitiveness, especially considering international trade pressures like the EU's Carbon Border Adjustment Mechanism.

### 4.1.4. Other Supportive and Strategic Initiatives


*Figure 8 - Other Strategic and Supportive Initiatives*

**Jordan** proposes using Green Public Procurement to prioritise low-emission suppliers in government contracts. This mechanism aims to leverage the government's purchasing power to stimulate the market for greener goods and services and can be a major driver for innovation by creating a steady demand for sustainable products. Both **Jordan** and **Lebanon** suggest creating Recognition and Certification Programmes or a national "Green Industry" label to publicly honour top-performing companies. This non-financial incentive enhances corporate reputation and provides a competitive advantage.

**North Macedonia's** response emphasises the importance of leveraging existing international frameworks and funding, such as those from the Energy Community Secretariat, EBRD, and EU IPA funds. This pragmatic approach recognises that many future initiatives will depend on technical and financial support from international partners. Additionally, the proposal to establish a robust MMRV system and begin with pilot projects (for LDAR incentives, etc.) shows a commitment to evidence-based policymaking and risk mitigation before full-scale implementation. This approach ensures that future policies are grounded in credible data and proven concepts.

## 4.2. Challenges and Opportunities

### 4.2.1. Challenges for Regulators

The responses from MEDREG's member regulators reveal a range of significant challenges in promoting emission reductions in the gas sector. These obstacles are often systemic and require broad-based solutions that extend beyond the typical scope of regulatory authority.

Among the main challenges are institutional and Legal Gaps, where some regulators lack direct competence over emissions, leading to a fragmented regulatory landscape. Other challenges include technical and financial Barriers, including the high cost of advanced methane abatement technology and the associated risk of carbon leakage if strict regulations are imposed without compensatory financial support. The lack of robust data availability and quality is also among the main obstacles to designing effective policies.

#### *4.2.1.1. Institutional and Legal Gaps*

A primary challenge for many regulators is their limited scope of authority. As **Italy**, **France**, and **Greece** state, their national regulatory bodies have limited or no competence in emission reduction, with the responsibility falling to other governmental entities. This highlights a critical, region-wide challenge: a fragmented regulatory landscape can hinder a coordinated and efficient response to climate change. Without a clear mandate, regulators face significant hurdles in enforcing environmental standards, particularly when they conflict with purely economic objectives.

Further, a lack of cohesive national legal frameworks is a major barrier. As **Albania** notes, consolidating its legal framework to align with the EU's Third Energy Package is a necessary but challenging task. This legislative package is crucial for establishing clear rules for the gas market and for empowering national regulatory authorities. Without such a framework, it is difficult to implement consistent and enforceable policies.

#### *4.2.1.2. Technical and Financial Barriers*

Another set of interconnected challenges revolves around technical capacity and financial constraints. **Cyprus** and **Egypt** both highlight the difficulty of keeping abreast of the latest technological advancements for methane abatement and the need for specialised training. This technical gap is compounded by the high cost of new technologies, which, as **Egypt** notes, poses a significant financial barrier. The expense of deploying cutting-edge equipment, such as satellite monitors and advanced sensors, is a major hurdle, especially in the absence of dedicated funding or market incentives.

Carbon leakage is a major concern related to these financial barriers. **Egypt** warns that imposing strict regulations without providing supportive incentives could lead to industries relocating to countries

with less stringent climate policies to avoid compliance costs. This would ultimately shift emissions rather than reduce them on a global scale, undermining the very purpose of the regulations.

In **Türkiye**, while challenges such as infrastructure modernisation and data consistency remain, the country is well-positioned to address them through strategic investments, public-private collaboration, and alignment with international frameworks like the CBAM. By fostering a supportive regulatory environment, **Türkiye** can encourage voluntary action from market players and accelerate the transition to a low-carbon economy.

#### *4.2.1.3. Data and Policy Implementation*

Finally, the lack of robust data presents a fundamental challenge. **Egypt** notes that data availability and quality remain weak, making it difficult to design effective policies and track emissions accurately. Without reliable data on emission sources and volumes, regulators struggle to set effective targets or verify compliance. This data gap is a major obstacle to creating credible and transparent monitoring systems.

### 4.2.2. Opportunities for Regulators

Despite the challenges, the regulators identified numerous promising opportunities for proactive engagement. These opportunities often serve as direct solutions to the challenges they face, leveraging innovation and collaboration to drive a low-carbon transition.

#### *4.2.2.1. Leveraging Technology and Digitalisation*

Regulators see a significant opportunity in embracing advanced technology to overcome the data challenge. **Egypt** and **Jordan** both see strengthening digital MMRV systems as a strategy to enhance data quality and attract international climate finance. This includes using innovative technologies like satellite monitoring and drone-based sensors equipped with LiDAR and optical gas imaging (OGI) to pinpoint methane leaks with high precision. Further, IoT (Internet of Things) sensors placed on gas infrastructure can provide continuous, real-time data, moving away from older, less reliable methods of manual inspection and inventory-based estimates. By establishing these systems, regulators can ensure the credibility of emissions data, a prerequisite for participation in carbon markets.

#### *4.2.2.2. Mobilising Capital through Innovative Mechanisms*

To address the financial barriers, regulators see an opportunity to mobilise private investment through innovative financial models. **Egypt** suggests facilitating Public-Private Partnerships (PPPs), which can de-risk investments in emission reduction infrastructure and pilot projects. These partnerships combine the public sector's regulatory oversight with the private sector's capital and expertise, making large-scale projects more feasible. This is a crucial strategy for funding the high-cost technologies needed for deep emission cuts.

Further, regulators are looking to harness the power of carbon markets. **Egypt** and **Lebanon** see an opportunity to facilitate participation in voluntary and Article 6 carbon markets. Article 6 of the Paris Agreement provides a framework for countries to cooperate in reducing emissions by trading carbon credits. This mechanism provides a clear pathway for funding emission reduction projects by creating a financial incentive for companies to go beyond mandatory targets.

#### *4.2.2.3. Fostering Regional Cooperation and Strategic Alignment*

Strategic cooperation and integration represent a major opportunity for the region. **North Macedonia**, for instance, sees its alignment with the Energy Community Treaty and its own National Energy and Climate Plan (NECP) as a key strategic opportunity. This integration with the broader EU framework provides access to vital technical and financial support. Similarly, **Algeria** (ARH) recognises the indispensability of international collaboration for modernising infrastructure and ensuring it remains a competitive and responsible gas producer in the global market.

Finally, for countries like **North Macedonia**, the growing gas sector presents an opportunity to use it as a bridge fuel to reduce dependence on more polluting coal. While this is a transitional step, it provides an immediate opportunity to improve air quality and reduce emissions while fostering a long-term shift towards a cleaner energy mix and strengthening regional interconnections to share resources and best practices.

**Chapter Analysis**

This chapter showcased the future direction for incentivising emission reduction, demonstrating a uniform understanding among NRAs in the region to move beyond simple mandatory targets towards a market-driven policy framework. The ultimate aim is to make low-emission practices financially attractive for investors, shifting the burden from pure compliance to economic opportunity.

The future strategy is built on three interconnected pillars.

**1. International Standards** for Transparency and Credibility: Regulators plan to mandate or encourage the adoption of rigorous, globally recognised standards like OGMP 2.0 for measurement-based methane reporting and ISO 14064 for organisational-level GHG accounting. Alignment with the upcoming EU Methane Regulation is also a key focus. This is crucial for ensuring the credibility of reported data, which is a non-negotiable prerequisite for credible reduction efforts and carbon market participation.

**2. Financial and Fiscal** Incentives to Overcome Investment Barriers: The policy toolkit includes a broad range of measures such as grants, soft loans, rebates, and subsidies for purchasing green technologies and vehicles, coupled with tax exemptions (e.g. VAT, registration fees). A prominent, innovative example is the proposed feebate system for transport, which is a self-financing model

that levies a fee on high-emission vehicles and uses the revenue to rebate low-emission ones. Performance-based grants for projects that exceed mandatory targets are also highlighted.

**3. Market-Based Mechanisms and Carbon Pricing:** Regulators intend to leverage economic principles to reduce emissions. There is a strong interest in developing and facilitating access to voluntary carbon markets and national Emissions Trading Systems (ETS). This provides a financial incentive for companies to go beyond mandatory targets by allowing them to generate and trade in carbon credits. Further, the EU Taxonomy Regulation is highlighted as an influential market tool for channelling private capital towards genuinely sustainable investments.

**Other** complementary **supportive measures** include using Green Public Procurement to leverage government purchasing power and establishing Recognition/Certification Programmes to offer non-financial competitive advantages to top-performing companies.

**Challenges:**

- **Institutional and Legal Gaps:** The fragmented regulatory landscape is a primary hurdle, with many energy regulators lacking a direct mandate over emissions reduction, and responsibility falling on other government bodies.
- **Technical and Financial Barriers:** These include the high cost of advanced abatement technologies and a critical warning about the risk of carbon leakage—industries relocating—if strict, unsupported regulations are imposed.
- **Data and Policy Implementation:** A weakness in data availability and quality makes it difficult to design effective policies, set accurate targets, and verify compliance.

**Opportunities:**

- **Leveraging Technology and Digitalisation:** The answer to the data challenge is adopting advanced, real-time digital MMRV systems. This involves using innovative tools like satellite monitoring, drone-based sensors, and IoT sensors to ensure data credibility and attract international climate finance.
- **Mobilising Capital through Innovative Mechanisms:** Regulators can de-risk and fund high-cost investments by leveraging Public-Private Partnerships (PPPs) and facilitating participation in Article 6 carbon markets, which provide a clear financial pathway for emission reduction projects.
- **Fostering Regional Cooperation:** Aligning with international frameworks (e.g. the Energy Community Treaty) provides access to vital technical expertise and funding from international partners, helping to modernise infrastructure and enhance regional competitiveness.

# 5. Conclusion and The Way Forward

The comprehensive analysis of regulatory and technical efforts across 13 MEDREG member countries underscores the critical importance of developing cohesive, effective, and regionally consistent strategies to address CO2 and methane emissions from the natural gas value chain. As the Mediterranean region faces disproportionately severe climate impacts, managing the energy transition requires balancing the urgency of decarbonisation with the necessity of safeguarding energy security and economic stability.

The core findings reveal a dynamic landscape characterised by both significant progress and systemic challenges. On the progress front, the deployment of advanced monitoring and technological mitigation is widespread. Countries are actively investing in CCUS projects (as in **Greece** and **Algeria**), implementing systematic LDAR campaigns, and leveraging highly efficient technologies like CCGT. This demonstrates a strong operational commitment to reducing both long-lived CO2 and high-potency methane.

However, two critical barriers threaten the pace of this transition. Firstly, the regulatory landscape remains sharply bifurcated. While EU Member States operate under the legally binding, harmonised framework of the European Green Deal and EU ETS, non-EU members rely on diverse, often conditional, national targets. This divergence creates complexity in regional energy integration. Secondly, regulators consistently highlighted institutional and financial gaps, including a limited scope of authority for energy regulators on environmental policy, the high upfront cost of advanced abatement technology, and the associated risk of carbon leakage for energy-intensive industries.

Importantly, in the discussions leading to the drafting of this report, it became apparent that for some countries in the region, the immediate push for emissions reduction is primarily driven by financial imperatives—specifically, securing access to global green finance, maximising export competitiveness in a carbon-conscious market, and establishing a position in the emerging voluntary carbon markets (as seen in **Egypt** and **Türkiye**)—rather than solely fulfilling domestic climate mandates.

Ultimately, these efforts are not just about meeting climate goals; they are essential for securing the region's long-term energy competitiveness by ensuring gas production and transport adhere to increasingly stringent global supply chain standards, such as the recent EU Methane Regulation.

**Recommendations and The Path Forward**

In conclusion, the empirical evidence strongly suggests that the transition must be driven by a dual strategy of regulatory enhancement and aggressive market mobilisation. Regulations provide the floor, but future success relies on actively making low-emission practices commercially and financially attractive for market players.

## CONCLUSION AND WAY FORWARD

Based on this evidence, it is strongly recommended that MEDREG members and associated organisations prioritise the following actions:

- Mandate Credible MMRV Systems and Technological Convergence: Prioritise the immediate establishment of measurable, verifiable MMRV systems across the region, potentially aligning with leading international frameworks such as OGMP 2.0. This will ensure data credibility, which is the prerequisite for all future financial mechanisms. Regulators should also support the deployment of continuous monitoring technologies (like IoT sensors and satellite imagery) for effective LDAR.
- Harness Financial and Market-Based Incentives: Overcome financial barriers by implementing green financing mechanisms and market incentives. This includes exploring the introduction of voluntary carbon markets (as pioneered by **Egypt**) or ETS (as planned by **Türkiye**), alongside targeted tax breaks and grants for companies that invest in methane abatement and CCUS infrastructure. Financial tools like feebates and scrappage schemes, as suggested by **Albania**, should be studied for wider applicability across different sectors.
- Strengthen Institutional and Legal Frameworks: Regulatory bodies must work with governments to strengthen institutional and legal frameworks to optimise the collective decarbonisation effort. This means ensuring NRAs have clear authority over technical compliance in the gas value chain and fostering deeper regional cooperation, leading to the integration of common green gas and emissions standards.

# ANNEXE (Case Studies)

## GHG Inventory System in the Republic of Cyprus

### Introduction

The **Republic of Cyprus** ratified the UNFCCC in 1997 through Law No. 19(III)/1997 as a non-Annex I party. The Kyoto Protocol was ratified by **Cyprus** in 2003 through Law No. 29(III)/2003. According to Decision 10/CP.17 of COP17, as of 9 January 2013, the status of **Cyprus** changed from a non-Annex I to an Annex I party to the UNFCCC. As part of the EU, **Cyprus** has accepted commitments for the CP2 of the KP through the Doha amendment. **The Republic of Cyprus** ratified the Paris Agreement on 4 January 2017 through Law No. 30(III)/2016[5].

The Department of Environment of the Ministry of Agriculture, Rural Development and Environment (DoE) is designated as the national entity responsible for the national GHG inventory, holding overall responsibility and maintaining an active role in the management of the national GHG inventory, including technical and scientific responsibility for compiling the annual inventory. Other governmental ministries and agencies contribute through the provision of relevant data or advice through their appointed focal persons.[6]

### Emissions Trajectory

**The Republic of Cyprus** follows a low-GHG-emission development strategy aiming to align with the EU's climate neutrality target of 2050. The **Cyprus** National Energy and Climate Plan (NECP) for 2021–2030 was revised in 2024, raising the national emission reduction target to 32%, up from the previous target of 24%.

In 2023, **Cyprus** accounted for around 0.3% of the EU's net GHG emissions and achieved a net emissions reduction of 5.6% compared to 2005. The country's total emissions decreased by 4.7% between 2005 and 2023, while its net carbon removals in the land use, land-use change, and forestry (LULUCF) sector increased by 36%. Emissions from sectors covered by the effort-sharing legislation have increased by 7.9% since 2005, and were slightly higher in 2023 than those from sectors under the EU ETS, which were down by 14.9% over the same period[7].

The most significant source of GHG emissions in **Cyprus** is the electricity production sector, followed by the transport sector. Emissions from cement production are also noteworthy. However,

[5] https://unfccc.int/sites/default/files/resource/CyprusNIR2024_vUNFCCC_v1.2.pdf

[6] https://unfccc.int/sites/default/files/resource/CyprusNIR2024_vUNFCCC_v1.2.pdf

[7] https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI%282025%29769495

these two sectors are covered by the EU ETS, and thus any emission-reduction measures in these areas do not count towards **Cyprus's** national target under Regulation (EU) 2018/842.

The largest contributor to GHG emissions covered by the national target (under Regulation 2018/842) is the transport sector (46%), particularly road transport. This is followed by solid waste (13%), energy use in households, services, and agriculture (12%), fluorinated gases (9%), enteric fermentation (7%), and livestock manure management (6%).

**Policies and Measures Defined in NECP**[8]

- Increase the share of renewable energy sources (RES):
  - Net metering, net billing, virtual net metering/billing schemes for RES self-consumption.
  - Financial support for installing photovoltaics and solar systems in homes.
  - RES installations in public, commercial, and industrial buildings combined with energy upgrades.
  - Promotion of high-efficiency heat pumps.
  - Grant schemes for electricity storage.
  - Support for RES energy communities.
  - Simplification and acceleration of licensing procedures for RES projects through a One-Stop-Shop service.
  - Transport fuel suppliers' obligation to use biofuels.
  - Production of biofuels from waste.
  - Exploration of offshore RES and green hydrogen production.
- Achieving Energy Efficiency Targets
  - Energy efficiency obligation scheme for energy distributors.
  - Energy upgrades in public buildings.
  - Grant schemes for comprehensive energy renovations in homes and businesses.
  - Individual energy-efficiency measures in households.
  - Energy-efficient street lighting.
  - Energy-saving measures in road transport.
  - Water-sector energy efficiency.
  - Smart metering infrastructure.
  - Digital one-stop-shop platform for building renovation.
  - Creation of a National Development Organisation to facilitate energy-efficiency investments in businesses.
  - Increased capital deductions for business energy upgrades.

[8] Policies and Measures defined in NECP

- Emission Trading System for fuels in buildings, road transport, and light industry.
- Promotion of energy efficiency and innovative approaches in schools.

- Transport Measures
  - Sustainable Urban Mobility Plans (studies and implementation).
  - Telematics Transport System.
  - New contracts for low-/zero-emission buses.
  - Bus stop and shelter infrastructure.
  - Pricing policy for public transport.
  - Construction of bus and Park & Ride stations in all cities.
  - Amendment of the Motor Vehicles and Road Traffic Law.
  - Implementation of the 2023 Law on Specific Measures for Reducing Air Pollution and GHGs from Road Transport.
  - Incentive scheme for purchase/use of low-/zero-emission vehicles and retirement of polluting vehicles.
  - Expansion of EV charging infrastructure.
  - Intelligent Transport Systems (ITS).
  - Seventeen actions to promote cycling and micro mobility.
  - Central parking management pricing policy.
  - Awareness campaigns and public education for behaviour change.
  - Promotion of alternative fuels (e.g. biomethane, hydrogen).
  - Planning obligations for sustainable development in urban permits.
  - Upgrading of urban design and transport standards.
- F-Gases (Fluorinated Gases)
  - 5% recovery by 2030 (starting in 2024).
  - 10% recovery by 2030 (another pathway).
  - Emissions inventory improvement.
- Anaerobic Digestion for Livestock Waste Treatment.
  - Dairy cows: 10% AD by 2030.
  - Pigs: 65% AD by 2030.
  - Poultry: 25% AD by 2030.
  - 80% state aid for new units (up to €1.6 million).
  - Support for existing units to comply within 3 years.
  - Cooperation among farmers for shared facilities.
  - CAP Strategic Plan grants: max €800,000 per action, total €5 million.
  - Construction of central AD stations.
  - No further increase in cow milk production.

  - 10% reduction in dairy cow population by 2030.
  - Maintain milk production and improve animal welfare.
  - Budget: €15 million (2025–2030).
  - Emissions reduction: 100,000 t $CO_2$ eq.
- Waste Sector
  - 60% source separation by 2030.
  - Only 24% of organics to be landfilled by 2030.
  - 20–30% biogas recovery from decommissioned dumpsites.
  - Biogas recovery equivalent to 150 Gg $CO_2$ eq/year from restored landfills by 2025.
  - 1% annual increase in anaerobic digestion use.
- Wastewater Sector
  - 100% population connection to centralised sewerage systems.
  - Increased anaerobic digestion for industrial (food sector) wastewater.
- Land Use, Forestry, and Carbon Sinks
  - "Plant for Climate": 300,000 trees by 2030.
  - Afforestation and creation of forest areas.
  - Forest area maintenance.
  - Development of green parks and space networks.
  - Tree planting on farmland.
  - Application of compost and nutrients.
  - Forest fire prevention and monitoring.
  - Proposal for voluntary carbon markets.
  - Cooperation for identifying state land for tree planting.
  - Tree species selection guidelines.
  - Emission reduction plan contribution assessment.
- Business Emissions Reduction Plan
  - Reduce business sector emissions by 355 kt $CO_2$ eq.
- Common Agricultural Policy (CAP) Strategic Plan
  - Crop actions for banana cultivation.
  - Use of certified seeds and slow-release fertilisers.
  - Crop rotation systems.
  - Infrastructure for recycled water and irrigation efficiency.
  - Promotion of the circular economy in agriculture.

**Projections to 2040 (including 2030) according to NECP**

Based on the current policies and measures, it is estimated that national GHG emissions outside the EU ETS will decrease to 4,105 Gg CO2 equivalent by 2030, representing a 4% reduction compared to 2005. As for the ETS sectors, emissions are expected to decrease to 2,883 Gg CO2 equivalent by 2030, corresponding to a 43% reduction over 2005 emissions, mainly due to the introduction and use of natural gas in electricity generation.

With the full implementation of the NECP, a 4% reduction in non-ETS GHG emissions can be achieved by 2030. If policies and measures remain limited to those currently in place, **Cyprus** will need to cover deficits of approximately 2.5 million and 5.0 million allowances for the periods 2021–2025 and 2026–2030, respectively.

## Egypt's Emission Reduction in the Petroleum Sector

The Ministry of Petroleum and Mineral Resources (MoPMR) in **Egypt** has taken significant steps to reduce greenhouse gas emissions by prioritising energy efficiency as a cost-effective climate mitigation strategy. This journey began in 2015 with the formation of a High Committee for Energy Efficiency, laying the groundwork for long-term institutional commitment to sustainability.

In 2017, as part of the Petroleum Sector Modernisation Project, Programme 4-B on "Improving Energy Efficiency" was launched to enhance energy performance across the entire oil and gas value chain. This was followed in 2018 by the establishment of the Energy Efficiency and Climate Department (EECD), tasked with overseeing and coordinating energy efficiency efforts across the sector. Parallelly, dedicated energy efficiency units were created in all affiliated companies to monitor energy use and drive improvements at the operational level.

A sector-wide Energy Efficiency Strategy, issued in 2018, set a target of reducing energy consumption by 18% by 2035. This strategy aligns with **Egypt's** Vision 2030 and broader national goals on sustainability, energy security, and emissions reduction.

To support these efforts, a centralised electronic database was developed to track energy consumption and energy-saving projects across approximately 100 companies, permitting continuous monitoring and better-informed decision-making. An in-depth assessment identified 30 energy-intensive companies responsible for 97% of the sector's total energy use, enabling targeted interventions and focused actions on key areas of improvement.

To build the necessary human capacity, over 1,350 personnel have been trained in energy efficiency and audit practices. Additionally, energy audits were conducted across energy consumption-intensive companies to identify savings opportunities, and Key Performance Indicators and benchmarks established to measure progress.

Consequent to these efforts, the sector successfully implemented 340 no/low-cost energy efficiency measures and projects, resulting in an annual emissions reduction of 1.1 million tonnes of CO2 equivalent and a 6.8% reduction in energy consumption.

**Several major projects, including the following, are currently in progress:**

### Dahshour Compression Station (GASCO)

- 28 MWe Electricity generation
- Nealry 2 million MMBtu Saving per year
- 23,000 tonnes of CO2 Reduction
- Waste Heat Recovery, 3 new gas compressors, 2 electric compressors

### Combined Heat and Power (CHP) System (SIDPEC)

- 7.5 MW Electricity Generation and 50 Tonnes Steam
- 85% Thermal Efficiency
- Approximately 45,000 tonnes of CO2 reduction

Additionally, in line with the MoPMR strategy for emission reduction and energy transition, the MoPMR inaugurated the petroleum sector's Centre of Excellence for Energy Transition in 2022 as the first strategic entity specialised in serving the petroleum sector and energy-intensive sectors in **Egypt** and the African continent in promoting the transition to sustainable, low-carbon energy systems. This Centre serves as one of the main elements of the Ministry's efforts to promote energy efficiency and support emission reduction across the energy sector.

Through strategic collaboration between the Centre of Excellence for Energy Transition and Carbon Limits to support the Centre's efforts and activities for emission reduction, including through methane abatement, the Centre conducted a methane measurement campaign in December 2024 at several sites, which was useful for identifying opportunities for abatement.

These examples demonstrate how MoPMR has leveraged strong governance, data-driven planning, and human capacity development to achieve measurable emission reductions cost-effectively and sustainably.

# France's Biomethane Grid Integration Model

**France's** strategy for achieving carbon neutrality relies significantly on decarbonising its natural gas sector by replacing fossil fuel gas with renewable and low-carbon alternatives, primarily biomethane (purified biogas). This transition requires substantial, calculated investment to upgrade the existing gas transmission and distribution networks (TSOs and DSOs), which were historically designed for unidirectional flow.

Rather than leaving this adaptation to individual producers, **France** implemented a sophisticated, centrally regulated framework. This case study analyses the key legislative and economic mechanisms designed to ensure the effective, yet economically rational, integration of renewable gases into the national grid.

**Legislative Foundation: The "Right to Injection"**

The cornerstone of this model is the "Right to Injection" principle, established by two major laws:

**Loi EGalim (2018): Article 94** of the *Loi EGalim* (Law for the balance of commercial relations in the agricultural and food sector) formally introduced the right of biogas producers to inject their purified gas (biomethane) into the national grid.

**Law of March 2023 (Acceleration of Renewable Energy Production):** This law significantly expanded the scope of the right to injection to cover all renewable and low-carbon gases (including hydrogen and syngas).

This right, now codified in **Article L. 453-9 of the Energy Code**, imposes a clear mandate: network operators are legally obliged to perform the necessary reinforcements to permit the injection of these gases, provided the investments meet specific "technico-economic relevance" criteria. This commitment transfers the network development risk from local producers to the regulated utility sector, funded through network tariffs (transport and distribution).

**Core Regulatory Mechanisms for Infrastructure Planning**

The regulatory authority, the **Commission de Régulation de l'Énergie (CRE)**, oversees the operational implementation through three interconnected mechanisms to manage investment risk and promote efficiency:

**A. Connection Zoning (*Zonage de Raccordement*)**

- **Function:** Network operators (GRDF, GRTgaz) proactively define geographical zones where new gas production sites are most economically viable to connect. This is based on local biomethane potential and existing network capacity.

- **Purpose:** Zoning directs capital towards the most promising areas, providing developers with clear *prescriptive* guidance on where to site projects and which network (distribution or transmission) they should connect to. This minimises planning uncertainty and delays.
- **CRE Role:** CRE validates the zoning submissions by operators, transforming them into binding development plans. To follow the degree of progress of each project, a national register for injection capacity development and booking is managed by French TSOs (NaTran and Terega).

**B. The Investment/Volume (I/V) Ratio**

- **Function:** This is the primary financial criterion for validating investments in network reinforcement (e.g. pipeline extensions, backhaul compressors).
- **Formula:**

$$I/V\ Ratio = \frac{Investment\ Costs\ (I) of\ Reinforcement}{Total\ Biomethane\ Volumes\ (V)\ in\ the\ Zone}$$

- **Economic Rationale:** CRE sets a maximum threshold (historically around €4,700/Nm³/h) for this ratio. If a project's required reinforcement cost per unit of gas volume exceeds this limit, the investment is deemed too expensive for the collective gas system, and third-party (producers, local authorities, private investors) financial participation is required to launch the investments.
- **Dynamic Update:** The I/V calculation is revised at least biennially to account for volumes already injected and investments already made.

**C. Third-Party Contributions and Shared Costs**

- **Connection costs concerning the technico-economic criteria: 40% are supported by the producer and 60% by the network tariff (up to a limit of €600,000 per site), per the Ministerial Decree of March 2, 2022.**
- **For reinforcement costs, I/V Over-Threshold Financing (2022 Deliberation):** If a reinforcement investment exceeds the I/V limit, the framework allows the producer or a third party to contribute the financial difference required to lower the calculated ratio to the acceptable threshold. This provides flexibility for strategic yet challenging projects.
- **Cost Sharing for Mutualised Infrastructure:** For shared assets (such as gas quality control stations) that benefit multiple producers in a zone but are not classified as major network reinforcements, a defined cost-sharing mechanism is applied as per the rules established by the CRE.

**Recent Implementation and Scale**

The latest official validation by the CRE, documented in **Deliberation N°2025-71 (March 6, 2025)**, demonstrates the sustained success and ongoing refinement of the system.

| ***Metric*** | **Detail from CRE N°2025-71** | **Interpretation** |
|---|---|---|
| ***Total Zonings Validated*** | 351 zonings have been previously validated. | This indicates the cumulative scale and maturity of the national planning effort since 2019. |
| ***New Validation Wave*** | Three new zonings have been validated, and 54 existing zonings have been revised. | This confirms the ongoing expansion of the network's capacity and the systematic biennial review of existing zones to optimise future investment. |
| ***Prescriptive Outcome*** | The validated zonings are "prescriptive", meaning all future connections in the area must adhere to the defined plan. | This reinforces strategic, centralised control over grid development, prioritising collective efficiency over fragmented, one-off projects. |

The French "Right to Injection" framework, implemented by the CRE, represents a globally significant policy approach to renewable gas integration. By shifting the responsibility for grid adaptation to regulated operators while strictly controlling investment through the I/V ratio and centralised zoning, the model minimises consumer costs and maximises the efficient deployment of clean energy infrastructure. The regular, documented updates and validations (such as the March 2025 deliberation) ensure that the framework remains agile and responsive to the rapid growth of the biomethane sector.

# Carbon Footprint Compensation and CO2 Absorption Projects in Spain

The Spanish Registry for Carbon Footprint, Compensation, and CO2 Absorption Projects is a voluntary initiative managed by the Ministry for the Ecological Transition and the Demographic Challenge (MITECO).

The registry consists of three sections:

a) Carbon footprint and GHG emission reduction commitments
b) CO2 absorption projects
c) Carbon footprint compensation

Organisations participating in the Registry may receive one of four seals, depending on their actions:

1. Footprint calculated.
2. Footprint calculated and reduced.
3. Footprint calculated and compensated.
4. Footprint calculated, reduced, and compensated.

Organisations may calculate their carbon footprint.

Thereafter, they may register in the section on carbon footprint and GHG emission reduction commitments of the registry (section a). Once MITECO validates these calculations, the organisation may obtain the seal that reflects this effort. Subsequently, it will be assessed whether the reduction commitments have been fulfilled, in which case this will also be reflected in the seal.

Additionally, the organisation has the option to register in the "carbon footprint compensation" section (section c), through which it may compensate its emissions through CO2 absorption projects that have previously been registered in the "CO2 absorption projects" section of the same Registry (section b), or through other GHG emission reductions recognised by MITECO.

While the seal does not quantify the level of effort, detailed information is available in the public Registry.

Concrete examples are furnished below to facilitate understanding.

| | |
|---|---|
|  | Seal for carbon footprint calculation of 2019<br><br>The organisation holding this seal has registered in the "carbon footprint and greenhouse gas emission reduction commitments" section of the registry. It has calculated its carbon footprint for the year 2019 and has |

| | |
|---|---|
| | defined reduction commitments. The calculations have been validated by MITECO. |
|  | Seal for carbon footprint calculation and reduction of 2020<br>The organisation holding this seal has registered in the "carbon footprint and greenhouse gas emission reduction commitments" section of the registry. It has calculated its carbon footprint for the year 2020 and the three immediately preceding years, achieving a downward trend in its emissions in 2020. The calculations and emission reductions have been validated by MITECO. |
|  | Seal for carbon footprint calculation and compensation of 2021<br>The organisation holding this seal has registered in the "carbon footprint and greenhouse gas emission reduction commitments" and "carbon footprint compensation" sections of the registry. It has calculated its carbon footprint for the year 2021 and has compensated its emissions (totally or partially) through a project registered in the "CO2 absorption projects" section, or through other greenhouse gas emission reductions recognised by MITECO. The carbon footprint calculations and the emissions-absorption transaction have been validated by MITECO. |
|  | Seal for carbon footprint calculation, reduction, and compensation of 2022<br>The organisation holding this seal has registered in the "carbon footprint and greenhouse gas emission reduction commitments" and "carbon footprint compensation" sections of the registry. It has calculated its carbon footprint for the year 2022 and the three immediately preceding years, has achieved a downward trend in its emissions in 2022, and has compensated its emissions (totally or partially) through a project registered in the "CO2 absorption projects" section, or through other greenhouse gas emission reductions recognised by MITECO. The carbon footprint calculations, emission reduction, and the emissions-absorption transaction have been validated by MITECO. |

The projects listed in section b) of the Registry, through which organisations may compensate their emissions by acquiring CO2 absorption credits, typically involve forest-based carbon sinks such as reforestation or afforestation efforts.

To register a compensation, the organisation must present an agreement with a project promoter for a specific quantity of CO2 absorption. Thereafter, the Registry verifies the availability of absorptions and the validity of the agreement. Once validated, the absorptions are cancelled in section b) and recorded in section c) as compensated. The organisation receives the "compensa" seal, indicating successful compensation.

There is no deadline for submitting compensation requests.

Each absorption project must contribute 10% of its available absorptions to a guarantee pool, which serves as a buffer against potential losses due to unforeseen events (e.g. wildfires, pests, extreme weather). This pool may be used to maintain compensation validity in cases of *force majeure*.

Only projects officially registered in the Registry are eligible for compensation. However, the Registry also lists pre-registered projects expected to be implemented within two years. These facilitate early engagement between organisations and project promoters, although compensation can only occur once the project is formally registered.

Absorptions must be maintained for a minimum of 30 years. If the forest mass is lost, the compensation may be invalidated unless:

- The absorptions are replaced by another project.

- The guaranteed pool covers the loss (only in cases of *force majeure*).

- If the loss is not due to *force majeure* and cannot be replaced, the compensation is annulled.

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