ENERGY EFFICIENCY PROGRAMS AND ELECTRIC MOBILITY IN MEDITERRANEAN COUNTRIES

Empowering Mediterranean regulators for a common energy future

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Renewables Working Group (RES WG)

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ABSTRACT

This document aims to provide an overview on the current situation of the implementation of Energy Efficient (EE) programmes and electric mobility (e-mobility) in the Mediterranean region.

Furthermore, to achieve the climate change targets and reach the energy transition, the regulators should consider additional mechanisms besides to the development of the renewables (RES). In this report, two main sections can be identified, a first dedicated to the development and implementation of energy efficiency measures by the MEDREG members in their countries, with a focus on regulatory framework and incentives to facilitate the achievement of the EE objectives.

In the second section, case studies on the deployment of e-mobility are presented to explain the mechanisms in place to replace fossil fuel-based vehicle by electric ones. Furthermore, it provides the recent data on the operating electric vehicle and charging station by country.

Finally, the report provides some conclusions summarizing the main finding in the Mediterranean region and a set of recommendations for regulators and policymakers to facilitate the implementation of the energy efficiency and e-mobility in their respective countries.

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ABOUT MEDREG

MEDREG is the association of Mediterranean energy regulators, bringing together 27 regulators from 22 countries that span the European Union (EU), the Balkans, and North Africa.

MEDREG acts as a platform for facilitating information exchange and providing assistance to its members in addition to fostering capacity development activities through webinars, training sessions, and workshops. Mediterranean regulators work together to improve the harmonization of regional energy markets and legislations, seeking a progressive market integration in the Euro-Mediterranean Basin.

Through constant cooperation and information exchange among members, MEDREG aims at fostering consumer rights, energy efficiency, infrastructure investment, and development by employing safe, secure, cost-effective, and environmentally sustainable energy systems.

The MEDREG Secretariat is located in Milan, Italy.

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INTRODUCTION

In generic terms, energy efficiency refers to the amount of output that can be produced with a given input of energy (for example, the amount of mechanical energy that an electric motor can produce for a given input of electricity energy). In the past, energy efficiency was mostly associated with individual users (households and building heating). However, in 2012, the Directive 2012/27/EU on Energy Efficiency established a broader definition for this concept: "'energy efficiency' means the ratio of output of performance, **service**, **goods**, or **energy**, to input of energy." This implies that energy efficiency concerns not only mechanical processes but also the final services, goods, or performance resulting from the use of energy. For example, we can consider energy efficiency in several ways: energy consumed in one's home, energy used for generating power, the energy required for a household appliance to operate, and so on.

In other words, energy efficiency is multi-dimensional and occurs in all economic sectors, in one form or another. The efficient use of energy, optimizing the amount of energy needed to achieve a given output, is important for consumers as well as for efforts to decarbonize our economies and society.

In the energy sector, efficiency can be promoted across the entire value chain, from generation to transmission, distribution, and end-consumption. In 2019, MEDREG published a report on "Regulatory practices on handling technical and non-technical losses for electricity," analyzing the factors affecting power loss. These include features of power systems, understanding and definition of loss, transmission, distribution, and non-technical loss, calculation of loss, coverage of loss, applied measures in mitigating power loss, as well as the applied regulatory incentives and the role of regulators. The report provides recommendations for reducing power loss from the perspective of not only energy efficiency but also consumer protection, aiming to guide MEDREG members on implementing concrete measures, considering the economic and social situation of their country.

The long-term objective of achieving a competitive low-carbon economy is mainly based on enabling environmentally sustainable investments, particularly in terms of decreasing energy consumption in buildings, transitioning to electric vehicles, and developing smart electricity networks, while promoting renewable energy use to reduce greenhouse gas (GHG) emissions. Since transport is one of the main sectors responsible for EU's emissions, the development of electric mobility policies can facilitate immense reduction.

In the present report, we explore energy efficiency from the perspective of optimization of electricity consumption. We also examine the development of electric mobility policies in the Mediterranean region, as they can help increase the efficient use of resources in the transport sector, in the context of energy system integration, thereby contributing to the decarbonization of the overall economy.

The Environment, Renewable Energy Sources and Energy Efficiency working group (RES WG) has authored this report, which constitutes the first presented by the Portuguese (ERSE), Lebanese (LCEC), and Algerian (CREG) energy regulators as chairs of the working group for a two-year-mandate (2020–2022).

The report is organized into seven chapters, where the first part (Chapters 2 to 4) focuses on energy efficiency and e-mobility in the Mediterranean region with some insights on the member countries' particularities. The second part (Chapters 5 and 6) provides an analysis of the questionnaire and case studies provided by MEDREG members. Based on the previous chapters, the report presents in Chapter 7 a summary of conclusions and provides some recommendations for policymakers with respect to energy efficiency and electric mobility.

2

OVERVIEW ON ENERGY EFFICIENCY IN THE MEDREG REGION

The MEDREG region includes European countries, which are members of the European Union (EU) and follow EU legislation (notably regulations and directives), and non-European countries that usually have their own national plans.

For the EU member states, the target is to reach at least **32.5%** energy efficiency by **2030**, with a clause for a possible upwards revision by 2023. The 32.5 % target for 2030 translates into a final energy consumption of 956Mtoe and/or primary energy consumption of 1,273Mtoe in the EU-28 in 2030.

Each EU country is required to establish a 10-year integrated national energy and climate plan (NECP) for 2021–2030, outlining how it intends to contribute to the 2030 targets for energy efficiency, for renewable energy, and for GHG emissions.[1]

In order to attain the 2030 target, each country is required to achieve an annual saving of at least 0.8% in terms of final energy consumption in the period 2021–2030. For this purpose, each country can either use the energy efficiency obligation scheme (EEOS), alternative policy measures, or both.

By alternative policy measures, the European directive refers to policy measures other than those related to taxation. Besides these measures, EU countries should put in place measurement, control, and verification systems that provide at least statistical monitoring to track the energy efficiency improvement shown by the participating or entrusted parties.

The measurement, control, and verification shall be carried out independently of the participating or entrusted parties.

However, for Cyprus and Malta, the requirement is lower due to the size of the electricity market in the two countries. Cyprus and Malta are required to achieve cumulative end-use energy savings equivalent to new savings of 0.24% of the final energy consumption for the period 2021–2030.

Furthermore, energy efficiency improvement measures in transport are eligible to be considered for achieving their end-use energy savings obligation. Such measures include policies that are, inter alia, dedicated to promoting more efficient vehicles, a modal shift to cycling, walking and collective transport, or mobility and urban planning that reduces demand for transport.

The detailed requirements are explained in Directive 2018/2002/EU of the European Parliament and of the Council, of 11 December 2018, amending Directive 2012/27/EU on energy efficiency.

The next figure provides an overview on the implementation of energy efficiency policies in the Mediterranean region.

[1] Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0001.01.ENG&toc=OJ:L:2018:328:TOC

Figure 1. Energy efficiency implementation in the Mediterranean region

On the other side of the Mediterranean region, due to the absence of a unique economic and political union such as the EU, each country has its own national plans/policy or measures to achieve the targets set by their own government. Usually, the energy efficiency targets take into consideration the characteristics of the energy systems and the available financing capacities.

The following table provides some general information on the energy efficiency programs in the non-European countries of the Mediterranean region. For each country, the type and period of the measures, the targeted sectors, the objectives/measures, and the data references are mentioned.

Table 1. Energy efficiency programs in non-EU MEDREG countries

Country	National plans/policy or measures	Targeted sectors	Objective/measures	Reference
Algeria	National programme on energy efficiency (EE) 2015 to 2030	- Building Sector - Transport - Industry	- Providing thermal insulation to 100 000 homes per year - Distributing 10 million energy efficient lamps and switching 1.3 million vehicles to liquid petrol gas - Creating 180 000 jobs	World Energy Council. World Energy Issues Monitors; World Energy Council: London, UK, 2019
Egypt	National Energy Efficiency Action Plan (NEEAP) 2018–2021	- Macro - Residential - Tertiary	- Replacing traditional lighting systems with LED - Linking cogeneration units and units producing electricity from power recovered - Replacing low-efficiency appliances and improving electric power usage efficiency in industrial and commercial systems - Using energy efficiency cards in electric devices - Rationalizing energy by increasing the efficiency of home appliances - Using solar energy for heating in the industry	MeetMED report "Energy efficiency and renewable energy strategies and policies" RCREEE – Key energy efficiency actions and Initiatives in Egypt eidt
Jordan	National Energy Efficiency Action Plan (NEEAP) 2017–2020	- Macro - Residential - Industrial - Water Pumping - Street Lighting - Commercial and Services	- Replacing 1.5 million incandescent lamps with energy-efficient lamps - Adopting the Energy Label Program for four home appliances - Installing 30 000 solar water heaters	MeetMED report "Energy efficiency and renewable energy strategies and policies" RCREEE – Plans Jordanian NEAP summary

Country	National plans/policy or measures	Targeted sectors	Objective/measures	Reference
Israel	National plan for energy efficiency and dealing with the climate crisis 2020–2030	- Commercial, - Residential - Public Buildings - Industry	- Making a 17% reduction in electricity consumption relative to the business-as-usual (BAU) scenario in 2030 - Creating a 7.5% (6 million tons) decrease in GHG emission per year - Reducing municipal electricity consumption - Banning sales of polluting vehicles starting from 2030 - offsetting up an electric charging infrastructure, R&D, incentives, and more	Ministry of Environmental Protection website[2]
Palestine	National Energy Efficiency Action Plan (NEEAP) 2020–2030	- Residential - Commercial - Distribution Network Losses	- Reducing total electricity consumption by 500 MWh per year - Using efficient appliances and industrial equipment - Facilitating the general deployment of smart meters - Switching to gas for heating water - Introducing demand-side management - Creating smart homes, smart buildings, and smart grids	World Bank document – West bank & Gaza energy efficiency action plan 2020–2030
Morocco	National Energy Efficiency Strategy 2030	- Transport - Industry - Construction	- Reducing 12% energy consumption by 2020 and 15% by 2030 - Increasing demand-side energy efficiency to reduce domestic demand by 15 % by 2030 - Switching out incandescent or CFL light bulbs for LEDs	Ministry of Industry, Trade and Green and Digital Economy website[3] World Bank document – Morocco energy policy mrv

[2] https://www.gov.il/en/departments/guides/reducing_greenhouse_gases_increasing_energy_efficiency?chapterIndex=1
[3] https://www.mcinet.gov.ma/en/content/renewable-energy#:~:text=Energy%20efficiency%20along%20with%20the,2020%20and%2015%25%20by%202030.

Country	National plans/policy or measures	Targeted sectors	Objective/measures	Reference
			- Upgrading to more efficient appliances	
Lebanon	National Energy Efficiency Action Plan (NEEAP) 2016–2020	- Demand-Side Management - Specification on Energy Conservation Measures - Strategies in Different Economic Sectors (Buildings, industry and agriculture, public, equipment, power)	- Targeting a reduction in the actual electric power growth rate of 17% to achieve a total saving of 4.83% of the total electric power demand of 2020 - Creating a specific target per measure for each sector (NEEAP 2021–2025 is under preparation.)	NEEAP 2016–2020 (https://lcec.org.lb/our-work/LCEC/NEEAP)
Tunisia	Energy transition strategy towards 2030	- Residential, - Tertiary - Industry - Transports - Agriculture	- Reducing energetic demand by 30% compared to a reference scenario (base year 2013) - Banning incandescent lamps since 2018 - Replacing 50% of the lamps with LED in the building sector (residential and tertiary) - Providing thermal insulation to 185,000 homes (including 65,000 between 2016 and 2020)	MeetMED country report "fiche pays: Tunisie"

Country	National plans/policy or measures	Targeted sectors	Objective/measures	Reference
			- Installing 100,000 smart meters or replacing 450,000 public lighting points with LEDs	
Turkey	National Energy Efficiency Action Plan (NEEAP) 2017–2023	- Buildings and Services - Power and Heat - Transport - Industry and Technology - Agriculture - Cross-Cutting Areas	- Reducing primary energy consumption by 14% from BAU levels - Upgrading at least 25 % of the building stock to sustainable buildings by 2023 - Decreasing annual energy consumption by 20% for public buildings and facilities	GIZ – Energy Efficiency in Public Buildings in Turkey IEA report – Turkey 2021 Energy Policy Review

3

ENERGY EFFICIENCY IN THE CONTEXT OF ENERGY SYSTEM INTEGRATION

In this chapter, it is important to address the promotion of efficiency for energy systems, discuss the actual capacity of the Mediterranean area when it comes to implementing it, and evaluate its potential in terms of supporting the energy transition.

The promotion of energy efficiency for electricity systems occurs when the design and installation of equipment and technologies, the use of these equipment and technologies, as well as the energy generation and network functioning are motivated by the minimum possible use of primary and/or end-use energy consumption. The promotion of energy efficiency in electrical systems can take place with different degrees of complexity and interaction with electrical systems.

The "first stage" of energy efficiency integration with electricity systems relates to technologies and policies that basically aim to reduce end-use electricity consumption. Better insulation of buildings, replacement of lamps and appliances with more efficient ones, and replacement of obsolete machinery in the industry with lower specific electricity consumption appliances are examples of these policies and technologies. The first stage is about the "basics" of any energy efficiency integration policy and objective and can be found, to various degrees, in all countries that are implementing energy efficiency policy through direct (subsidies) and indirect (incentives) support. This category includes measures designed to reduce electricity consumption by means of direct intervention in electricity systems themselves (reduction of network loss, reduction of power plant self-consumption, more efficient use of fuels used for generation), although most of the interventions covered by public policy programs focus on the general public and the industrial sector.

One step up in the hierarchy of integration complexity are the technologies and policies that, by modifying the mix of final consumption of households and businesses, require structural interventions on electricity systems. The spread of heat pumps, for example, which intended to reduce total final energy consumption, requires an increase in the production of electricity in order to replace the traditional fuels used in heating. Another example of a "policy that favours electrification" is the spreading of electric vehicles (EV), which is expected to reduce overall emissions in combination with a low-emissions primary energy mix. EV supporting policies are indeed generally, although not necessarily, linked with a substantial rise in the contribution of RES. However, these policies share the common feature of requiring more generation capacity, system optimization, investments in additional network capacity, and ancillary services to support the functioning of EV charging stations. The choice to favour technologies that reduce emissions while increasing electricity consumption requires a deep reform of energy systems. Not surprisingly, the EU proposes a progressive electrification of the energy system in the "Fit for 55" package: a set of measures through which the EU intends to achieve the intermediate 2030 decarbonization objectives with a view to achieving climate neutrality by 2050. This path involves reaching a 36% and 29% share of renewable sources, respectively, in the total energy final consumption and primary energy demand. The RES contribution to electricity generation will have to increase by up to 80%, which makes for very ambitious private and public spending programs. The EU's message here is that the desired progressive electrification of energy systems, which is supposed to lead to consistent greenhouse gas (GHG) reduction over time, can only happen in combination with sustainable electricity generation. It is not clear enough, however, whether this policy path

can be commonly adopted throughout the Mediterranean region. However, considering electrification of energy systems in the Mediterranean region will require a careful assessment of the net contribution of policies to overall emissions. In this light, it seems important to promote energy efficiency across the entire electricity supply chain; the lower the consumption per unit of gross domestic product (GDP), the more easily can decisions be taken in favour of the progressive electrification of energy consumption patterns.

The third stage of promotion of energy efficiency in electricity systems is linked with the availability of a "smart" network system that is capable of making it possible to accommodate increasing shares of generation from intermittent sources, adapt electricity systems to changing consumption habits, and promptly react to market signals and price dynamics. Although it is usually associated with the growth of renewables, "going smart" does not necessarily depend on the RES revolution. Making the electricity grids and consumers "smart and interactive" should be a valuable goal regardless of the developments in the generation mix. Smart meters increase consumer awareness of their choices and induce energy-saving behaviours; interactive networks that are ready to capture instantaneous changes in loads and delocalized production are a fundamental contribution to the reduction of final energy consumption for each given use, via the optimization of network assets (and, therefore, the reduction of network losses) and the rationalization of consumption behaviour. The digitalization of the electricity system is a "high on the agenda" issue in all regulatory contexts of the Mediterranean region, and there is an agreement on the importance of developing smart networks and an interactive system to seize opportunities for digital transition in terms of energy saving. As a matter of fact, the dissemination of smart meters—one of the basic building blocks of electricity system digitalization—is somewhat satisfactory in the Northern Mediterranean area and slower in the South shore of the region. Although there is no doubt that the energy transition in the whole Mediterranean region is deemed to accelerate the digital and smart orientation of networks and final consumption, making electrical systems smart is clearly complex and expensive.

The following chapters of this report will elaborate on the available tools and policies adopted to implement energy efficiency integration.
Before going into these details, it is worth noting that the complexity and multidimensionality of the energy transition stress on the fact that the policy mix behind promoting, organizing, planning, and actively supporting the transition towards more energy sustainability and less emissions can build on different degrees of complexity and depends on local factors, including economic perspectives, energy market development, and availability of resources for investment.

In this context, it is of utmost importance to support energy-saving actions and reforms not only as a complement to RES contribution growth but also as a key driver of decarbonization. The promotion of energy efficiency in electric systems can, and indeed should, be viewed as a technology-neutral, cost-effective, and flexible policy choice when considering the available options to reduce global GHG emissions. In fact, the Mediterranean region is likely to be in the best-suited historical moment to give a global boost to policies that promote energy efficiency in the framework of overall energy transition in the Mediterranean area.

There are two reasons for this. First, in the Mediterranean area, there is a great potential for energy saving that can provide a decisive contribution to the modernization of the energy and economic system of the area. Second, despite the ambition of the programs, the spread of renewable sources, at least in the countries of Middle East and North Africa (MENA), is slowing down, and the push from the new EU renewable sources directive in the framework of the Green Deal will probably only impact the northern shore of the area. According to the data collected by RES4Africa, in fact, despite the dynamics being positive over time (installed capacity rose from 19 GW in 2000 to 33 GW in 2019, and there was a six-fold increase in installed wind and solar capacity), the potential of the region remains untapped: in the last decade, in the MENA region, only 1% of the global additional capacity for generation from renewable sources has been installed. As a result, in 2019, the share of electricity produced from renewable sources stood at 4%4.
This hopefully temporary phenomenon seems to be essentially due to authorization and permitting issues, financing problems, and uncertainty related to general economic development. What is worth pointing out in this report is that more energy efficiency means supporting the transition even in periods when it is not possible to ensure the ambitious growth rates of the contribution of renewables to the Mediterranean energy system. As RES ambitions face actual low growth rates, the "wait and see" option would be the worst of choices.

As it is not clear until now how much renewables will contribute to decarbonization in the Mediterranean region in the short to medium term, promoting and integrating efficiency into energy systems means making the Mediterranean area's path towards the energy transition robust and credible; in turn, this requires making decisions and implementing policies that promote energy efficiency as a permanent complement to RES-oriented policies. It means, in sum, acting rationally and making the most cost-effective choice, whereas promoting energy efficiency integration often represents the least expensive option for any given level of emission-reduction targets.

The figure below illustrates a possible GHG abatement cost curve beyond the BAU scenario, based on the comparison between different outcomes in terms of costs per avoided GHG ton of different technologies and generation sources. The simulation shows that, in most cases, demand-side energy efficiency measures provide the most cost-effective means of contributing to an abatement of CO2 emissions.

[4] Source: RES4Africa Foundation's "Connecting the Dots" Report, October 2021

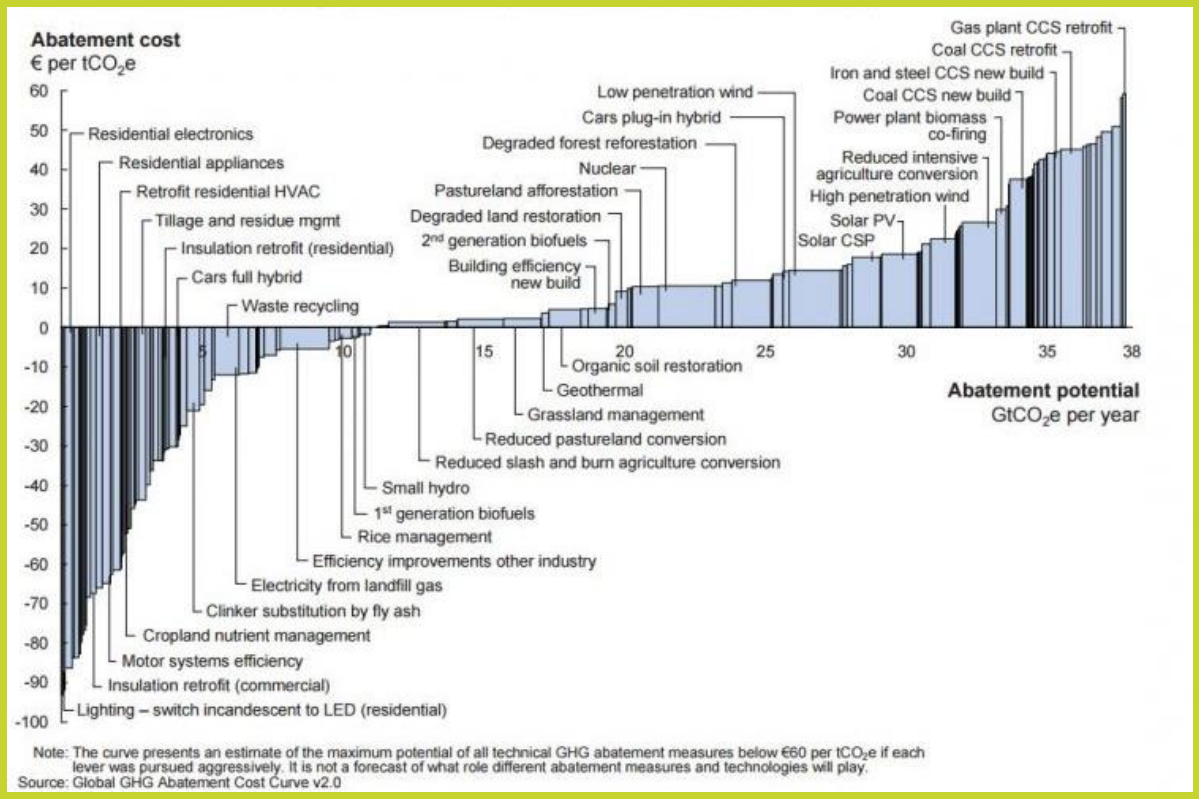


Figure 2. Global GHG abatement cost curve beyond business-as-usual 2030

Source: McKinsey & Company

Cost efficiency does not necessarily drive the choices of households and the industry. Even if investments in energy-saving appliances can be recovered in a reasonable time period as energy bills are consistently reduced, these investments may be hampered by liquidity constraints and limited access to lending and financial markets. Here, it is the public sector's role, given the efficiency-driven policies' cost effectiveness, providing for credit guarantees, and direct subsidies for capital expenses devoted to promoting energy efficiency would result in a favourable cost-benefit outcome in terms of public spending, especially in the context of regulatory uncertainty and permitting complexity when it comes to supporting investments in RES.

Such an approach requires, of course, that an energy savings potential that is effective and worth exploiting exists. As far as the Mediterranean area is concerned, the literature and the available studies agree that there is substantial room for action to improve energy efficiency. And here comes the second reason for which adopting energy efficiency integration as a horizontal policy, promoting the modernization of the electricity industry, seems to be timely.

The following graph contains figures shared by the International Energy Agency (IEA) in 2017 on measured energy intensity for a panel of Mediterranean countries as well as for notable regions (Europe as a whole and MENA). Further details and more specification on energy intensity measures and dynamics can be found in the next chapter. What is interesting for this chapter's purposes is the different degree of actual and potential energy efficiency integration in relation with Mediterranean economies.

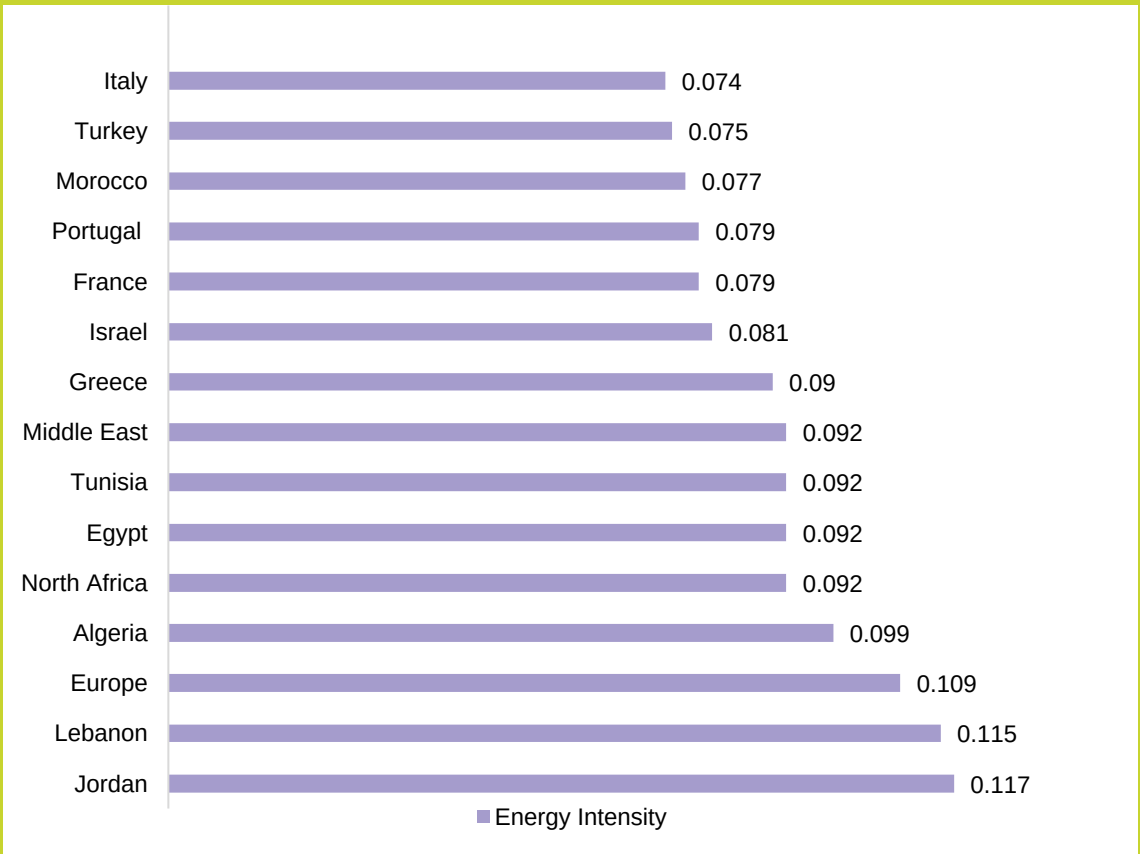


Figure 3 Energy intensity in terms of primary energy and GDP (toe per 1000 USD/PPP, 2017) – Source: IEA

As expected, the figures on the energy intensity across the Mediterranean region are diverse, although ranging in the same order of magnitude (the only significant outlier being Syria, which is not reported in the graph, displaying a 0.305 value). However, there is clearly room for improvement in terms of getting different performers closer as well as bringing overall better results for the whole area. For the IEA, approaching the Paris Agreement on Climate objectives involves a considerable effort for all areas and all countries considered: by 2030, energy intensity should be reduced globally by at least 30%, which is the same result achieved by the EU in the period 2000–2020.

How realistic is this goal? In its analysis of the scenarios for 2050, the Mediterranean Energy Organization (OME) foresees an increase in energy demand in the Southern Mediterranean area and a reduction in the Northern sub-region, which seems to be consistent with EU's declared objectives to progressively reduce the global energy demand even in absolute terms. The growth of the economy and population in the Southern Mediterranean area will, in fact, lead to a reversal of the current proportions of energy demand: by 2050, the total energy demand of the Southern area will be equal to 60% of the total in the Mediterranean region, while it is currently equal to 40%. OME estimates a potential primary energy saving of 25% of the total (about 1400 Mtoe) by 2050, which can go even further in a scenario that OME defines as "proactive".

The interesting feature here concerns the role of electricity systems in the energy transition of the Mediterranean area. Most observers, including the OME, estimate that the growth rate of electricity

demand in the Mediterranean area will be greater than the growth rate of total energy demand for end-uses.

Consistent with the demand forecasts, OME estimates, by 2040, an electricity generation figure for the Mediterranean area of 3,200TWh, showing an increase of 60% compared to 2015. Once again, a reversal of the proportions between the Southern and Northern areas is foreseen: the South shore will produce over 50% of the total electricity generated in the Mediterranean (1,700 out of 3200TWh), which means more than doubling Southern Mediterranean's generation share.

The importance of promoting energy efficiency in electricity systems in such a context is now clear. The combination of the efforts to save primary energy in the building and transport sectors and the electrification process should lead to the key result we are interested in, i.e., the progressive reduction of energy intensity.

According to OME assessments, the Northern area will contribute to the reduction of energy intensity to a greater extent, essentially because of EU policies that will determine mandatory energy efficiency actions, as the graph below shows.

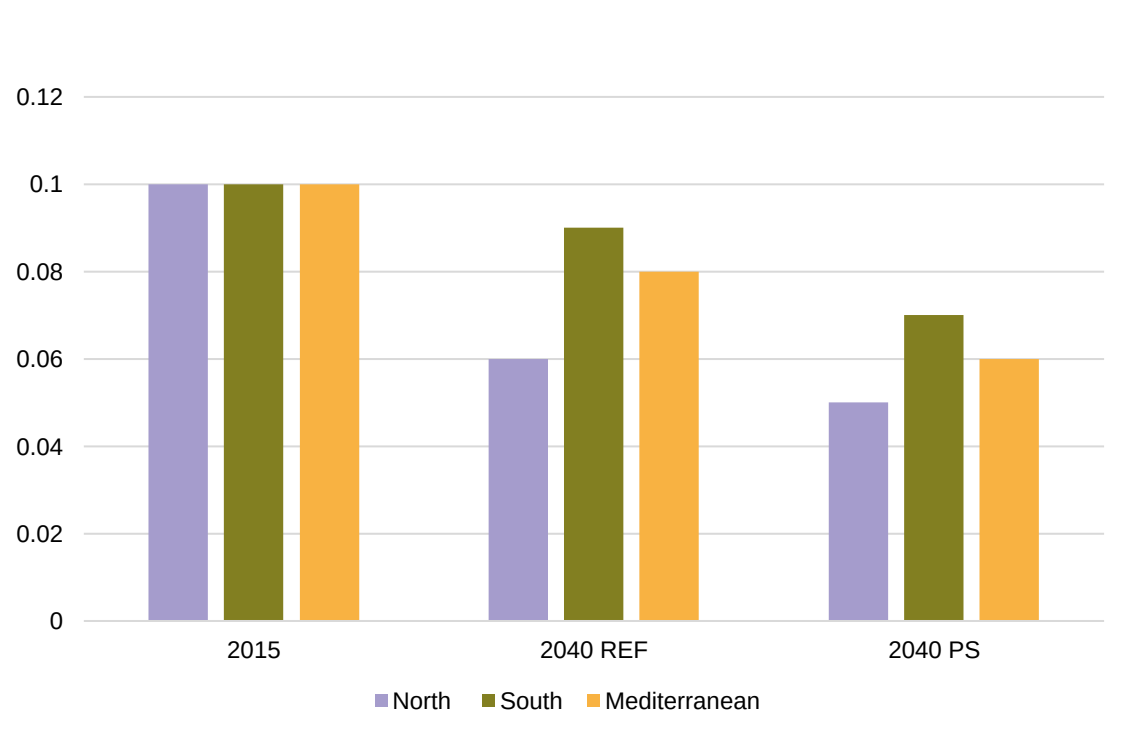


Figure 4 Energy intensity in terms of primary energy demand and GDP, toe per 1000USD (at 2000 PPP); reference scenario and proactive scenario at 2040, OME

A stronger role for the Northern Mediterranean region is indeed reasonably foreseeable. Energy efficiency has always been a fundamental pillar of the EU's overall policy of diversifying sources, securing supply, and reducing GHG emissions. Since the first ever Energy Policy Package proposed by the European Commission in 2007, sustainable development has been placed by the EU Institution at the centre of the energy policy stage. Stringent energy efficiency objectives were then established by the Clean Energy Package, the implementing arm of the 2014 EU's Energy Strategy.

More recently, "energy circularity" and end-use efficiency have been indicated as key elements of the "strategy for the integration of the energy system" that follows the announcement of the Green Deal—the plan intended to bring EU's economy towards climate neutrality by 2050. Renovation of buildings, sustained increase in the contribution of renewable sources, electrification of heating and transport, use of fuels with low environmental impact such as hydrogen in the "hard to abate" sectors of the industry are tools of this strategy, which have as their ultimate goal the reduction of total primary energy demand (from 1,600 to 1,200 Mtoe by 2050). It is not easy to imagine that such ambitious programs, which must consider substantial public funding, being embraced by all Mediterranean countries. National decarbonization programs of non-EU Mediterranean countries are not bound by common legislation. It is also worth noting that in the Southern shore of the Mediterranean region, energy efficiency-supporting actions will be partly countered by the absolute growth in total energy demand.

However, forecasts and simulations show that the net effect of combined energy efficiency actions in the Mediterranean region is positive in any scenario. Even in its "reference scenario," OME estimates that a reduction in energy intensity of 20% on average in the Mediterranean is achievable by 2040; further effort and stronger policy actions might result in a 40% long-term reduction in energy intensity.

In order to achieve this, energy efficiency must be vigorously pursued. The absence of sectoral constraints stemming from EU legislation can even act as a stimulus for the countries of the Southern Mediterranean, which will be able to adapt their energy transition strategy and choose to strongly push energy savings to complement the growth of renewables. In doing so, countries will be able to manage with flexibility their efforts to make their energy system more and more sustainable.

Regardless of the transition model adopted, each country in the Mediterranean area can contribute to the Paris goals by optimizing its energy policy mix if it promotes clear and credible objectives of integrating energy efficiency.

One final aspect that must be addressed is the importance of aligning the promotion of energy efficiency measures with the concepts of energy poverty and vulnerable consumers.

Energy poverty can be caused by several factors, such as difficulty in accessing quality energy services and low energy efficiency of housing that negatively impacts households, namely in terms of social well-being and quality of life, which also translates into impacts on other dimensions, such as health and labor productivity.

In order to fulfil the goals of decarbonization and energy transition, both social and economic, it is unequivocally assumed that this paradigm shift cannot accentuate energy poverty and that these situations must be identified and avoided through concrete measures aimed at vulnerable consumers, especially related to the rehabilitation of buildings, to promote energy efficiency in buildings, focused mainly on insulation measures, and the reduction of dependence on fossil fuels, where the focus on decentralized electricity production based on renewable energy communities and enhancement of collective systems can play a very important role in mitigating energy costs.

The promotion of energy efficiency among vulnerable consumers, in addition to being justified by the societal aspects of facilitating their access to a service essential to human life, is also justified by economic reasons, as this group of consumers registers the greater market failures and significant market barriers

such as financing difficulties or information and info-exclusion failures, which justify, from an economic point of view, a greater return for the implementation of energy efficiency measures compared to other groups of consumers where these market failures have less relevance.

4

ENERGY EFFICIENCY IN THE ELECTRICITY SYSTEM

A key indicator of the use of energy in the economy is primary energy intensity. It is defined as the ratio of primary energy supply to gross domestic product (GDP). This indicator is used to track progress on global energy efficiency, and during recent years, this indicator has declined for the third year in a row (2016: 2.15%; 2017: 1.70%; 2018: 1.20%) as shown in the following graph.

The initial Sustainable Development Goal (SDG) 7.3[5] target to achieve average annual energy intensity improvements of 2.6% has not been met. This might be due to weaker energy efficiency policy implementation in many countries, which is correlated with a demand growth in more energy-intensive economies.

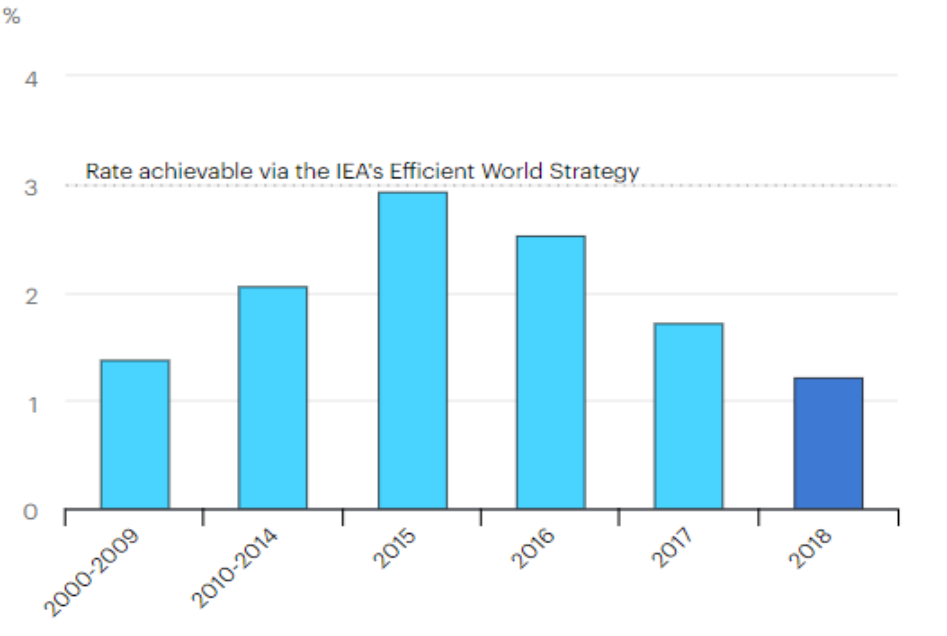


Figure 5 Global improvements in primary energy intensity, 2000–2018

Source: Energy Efficiency 2019 – Analysis – IEA

According to an IEA analysis, the slowdown in 2018, with an improvement in energy intensity of only 1.2%, means that from 2019 to 2030 the global energy intensity must improve by 2.9% annually to fulfil SDG (Sustainable Development Goal) 7.3. In fact, to meet this objective, energy efficiency policies must be expanded and enforced with higher local, regional, and global targets.

The COVID-19 pandemic in 2020 had a crucial impact on energy-efficiency investments that declined by 20%—or almost US$400 billion—in capital spending compared with 2019[6]. The pandemic has created a large gap between the targets and the achievements. This could widen in the upcoming years or could be used to accelerate the path towards achieving the targets. Recovery policies shall be implemented.

[5] SDGs: Sustainable Development Knowledge Platform (un.org)
[6] 26235UNFINALFINAL.pdf page 34.

Mandatory policies, such as codes and standards, including minimum energy performance standards, fuel-economy standards, building energy codes, and industry targets, continue to form the basis of energy efficiency policies. However, these measures are being complemented by fiscal and financial incentives, such as tax exemptions/reductions on building renovations and electric vehicle purchases, public financing, and the use of market-based instruments. Technological change and advances in energy management in the industrial and building sectors are also delivering efficiency improvements.

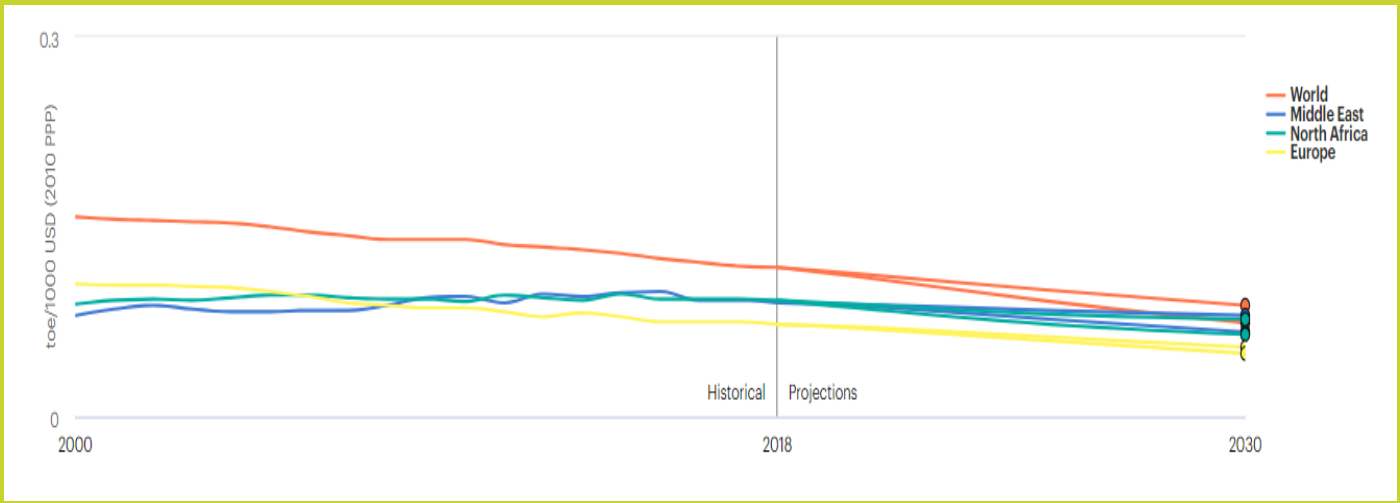


Figure 6 Energy intensity measured in terms of primary energy and GDP, 2000–2030

Source: Energy intensity – SDG7: Data and Projections – Analysis – IEA

Based on the IEA scenario for the next 20 years, energy efficiency contributes more than 40% to the reduction in energy related GHG emissions, and to achieve that, it is fundamental to develop and apply the needed policies and include energy efficiency in all sectors.

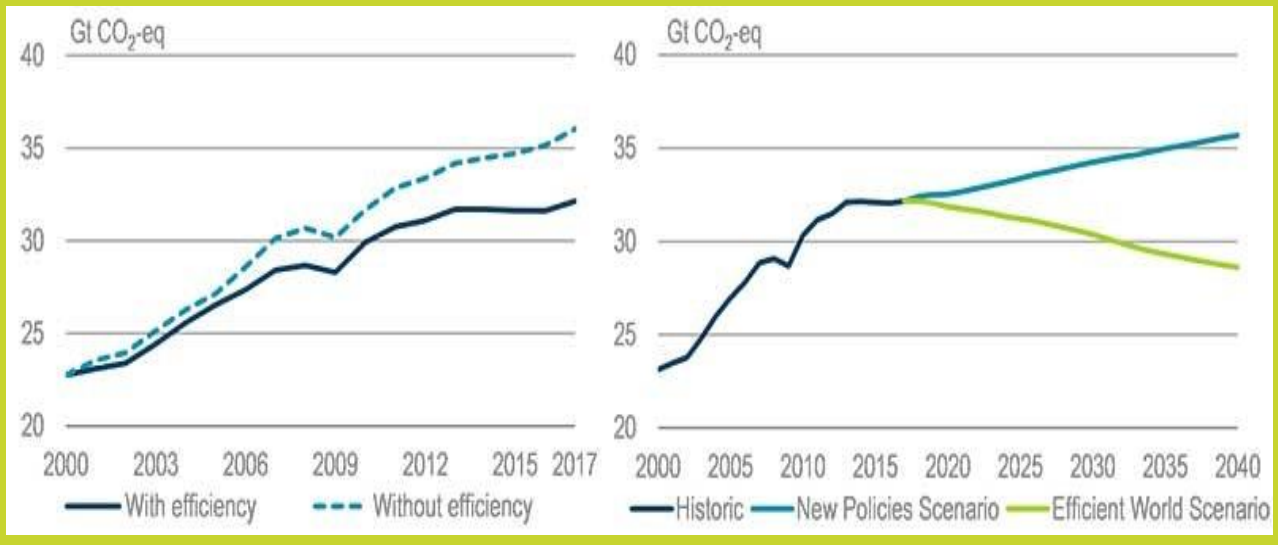


Figure 7 Energy-related GHG emissions, with and without efficiency, 2000–2017 (left), and in the NPS and EWS, 2000–2040 (right)

Source: IEA

4.1 Benefits of energy efficiency

Energy efficiency (EE) has multiple impacts on energy systems from the technical, economic, and environmental perspectives. Considering a multiple-benefits approach for energy efficiency policies allows for the widening of its impact and for the tackling of not only energy and GHG savings but also other aspects in many different spheres (health, public budgets, households). However, its impact may not be direct, and the estimation of the benefits is more complex than renewable energy integration or other technologies. Indeed, when using technology from the supply side, one may easily measure the energy added to the system using an energy meter. However, to measure the energy savings acquired with the implementation of energy efficiency demand-side programs, it is usually necessary to rely on engineering models to calculate the difference between the more efficient demand scenario obtained after the implementation of the programs and the demand scenario with the previous or standard technology. This additional difficulty to measure energy savings represents a barrier to the implementation of energy efficiency programs.
The use of energy efficiency improves the outcomes of each sector and is more economical in the long term. For the purposes of this report, we list the main benefits of using energy efficiency in the energy system:

- Increased cost savings in energy systems
- Empowerment of energy consumers
- Reduction of GHG emissions
- Improvement of energy system security (and self-sufficiency)
- Improvement of primary resource management

Energy efficiency benefits have direct and indirect impacts on several levels. Energy access and security is one of them. In fact, energy access is a necessity to enhance economic growth, human development and wellbeing, and environmental sustainability. As per the IEA, 674 million people remain without access to electricity[7]. Energy efficiency policies affect direct access to energy. Thus, it shall tackle the supply and demand sides. Energy efficiency combined with decentralized renewable energy solutions present the optimal solution for increasing energy access levels.
Remote areas that suffer from the lack of infrastructure and do not have access to the grid could benefit the most from these energy efficiency solutions. These solutions that became cheaper with time tackle basically more efficient lighting and appliances. These solutions, combined with off-grid systems, offer a good solution for remote areas.
Energy efficiency measures have a large impact on a macroeconomic scale, where the operating costs to deliver crucial services, such as cooling, heating, and mobility are reduced. It additionally enables jobs creation for the new and the existing workforce. Energy prices are also affected by energy efficiency policies. In fact, well-tailored energy efficiency policies can contribute to lowering energy prices by decreasing the need to add new power plants and update the grid. This is only possible if energy efficiency policies are largely enforced and implemented.
At the end-user level, energy efficiency measures increase comfort while reducing energy bills. Efficient lighting, cooling, heating, and ventilation are possible, and they contribute to wellbeing and comfort.

[7] Energy access – Multiple Benefits of Energy Efficiency – Analysis – IEA

Furthermore, in addition to all the direct and indirect benefits of energy efficiency, the deep decarbonization of all sectors, especially the energy sector, cannot be achieved without energy efficiency. Therefore, it is crucial that governments and all concerned institutions improve and promote energy efficiency.
In order to better understand the impact of energy efficiency on GHG emissions and particularly on electricity systems, it is worth understanding some key concepts of energy efficiency in the electricity sector.

4.2 Potential levels for improvement

As mentioned in the previous section, energy-efficiency programs and policies have many direct and indirect benefits. Tackling energy efficiency will be done on three levels.

Energy efficiency at the end-user side includes encouraging the implementation of efficient buildings, efficient appliances, and behavioural change towards more responsible populations. Financial incentives are the first step towards a successful implementation, specifically those designed for less-fortunate areas. The investment costs might be considered high for some efficiency measures; however, the programs tackle low-hanging energy efficiency measures with low payback periods. This is necessary to generate the necessary momentum in the absence of mandatory schemes. Taking on the operation and maintenance of electrical equipment, as well as proposing innovative designs, particularly in the industrial sector where waste heat recovery will be used, are two topics that must be addressed and could result in significant energy and GHG savings. In terms of the second level, some countries have very old grids, resulting in significant losses on transmission and distribution lines. As a result, energy efficiency measures are required. Innovative control systems, balancing, power factor correction, efficient transformers, smart meters, and other technologies could be used to achieve this. The third level is energy efficiency in energy production, which is achieved through well-maintained power plants, preferably using renewable energy on a large scale.

Several demand side management programs can improve the link between energy efficiency on the three levels previously mentioned. In fact, after taking into account transmission and distribution losses along lines, one unit of electricity saved at the consumer end is worth 10% more than one unit saved at the generator end.

It's worth noting that the evolution of electricity market regulation and liberalization has resulted in increased energy supply efficiency. However, there are still numerous barriers to increasing efficiency on the demand side, particularly with regard to energy companies' participation in energy efficiency activities.

The first step in improving electricity consumption efficiency is to create efficient tariffs that encourage the rational use of electricity and related resources. Two perspectives can be considered along the value chain of the electricity sector: market activities and natural monopoly activities.

The transmission and distribution infrastructure that is subject to economic regulation is referred to as natural monopoly activities. Regulated third-party access is implemented using standard tools and network codes for access tariffs, capacity allocation, congestion management, and balancing, among other things, all of which have been approved by national regulatory bodies. National regulatory authorities play a critical role in establishing appropriate methodologies on the referred third-party access topics, as well as in setting

efficient network access tariffs that ensure an appropriate reflection of costs to users and that recognize the benefits that may be recovered through appropriate infrastructure use.

In terms of market activities, specifically at the wholesale and retail levels, efficiency is boosted by appropriate and efficient market functioning, in which consumers have the power to choose their supplier and pay an integrated tariff that reflects the overall cost of the sector's value chain, including the regulated part related to the use of infrastructures.

While acknowledging that the primary vector for promoting demand-side energy efficiency is through the application of efficient pricing by the market and the regulated component of the electricity value chain, recognizing the existence of a number of barriers or market failures that obstruct or prevent efficient decision-making by economic agents may justify the implementation of measures to promote consumption efficiency.

Among the various market barriers to consumption efficiency, extended investment return periods and very high individual discount rates; the difference between supply prices and short-term marginal costs; environmental externalities not reflected in prices; a lack of information and associated high transaction costs; misalignment of interests between agents; or consumers' financial constraints are just a few examples. Programs or instruments that promote energy efficiency can be used to overcome these market barriers.

Beyond the regulation of natural monopolies, the role of national regulatory authorities is justified by the need to remove market barriers. To overcome market barriers that reduce social welfare, national regulatory authorities should also play a role in the definition and management of energy efficiency programs.

4.3 Demand-side management (DSM)

Demand-side management (DSM) is a concept that aims to reduce electricity consumption by maximizing energy efficiency (at end-user level). More efficient traffic and street lighting technology, energy efficiency in buildings, improved performance, and efficiency of household, service, or industrial appliances are all examples of this. Many mechanisms are in place to implement DSM, ranging from financial to fiscal measures, voluntary or mandatory actions.

Demand response programs, which include activities and actions that provide flexibility in terms of load management, such as peak load clipping or load shifting, may also be used in DSM. Market-based and reliability-based tools are the most well-known programs.

Market-based programs are closely associated with effective market management. Auctions (demand bidding) are the most common approach, which allow large consumers to participate in load management by making a specific amount of load available to be curtailed when needed. Furthermore, real-time pricing allows consumers, particularly industrial customers, to choose their pricing based on the price of electricity at any given time of day. There are several options available, ranging from the simplest, where there is a day and night price, to the more complicated, where consumers pay based on actual market rates.

The second type of demand response program involves contracts between the System Operator and large consumers that allow the latter to reduce their load when the electricity systems' operational security is

threatened. This mechanism can be mandatory for a specific consumer, such as industrial consumers who have a significant impact on the electricity system (such as cement plants or steel plants) due to their high electricity consumption, and who can dedicate a certain amount of load to be curtailed without affecting their work process, such as lighting or other non-essential utilities. The demand response programs used by System Operators for DSM are shown in Figure 8.

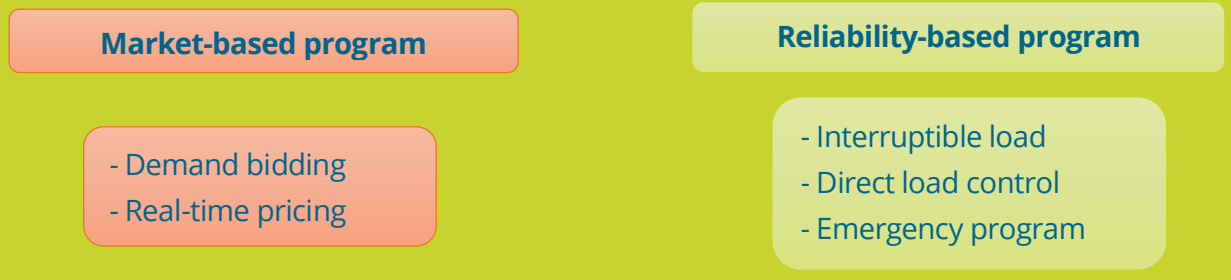


Figure 8 Demand response programs

DSM's impact on power systems can be measured at several levels, including the impact on the electricity market, system operation, end-user level, and utility level.

The effects of the DSM programs on the electricity market can be measured on two levels. First, at the level of the consumers who are directly affected and who may be eligible for incentives as a result of their participation in a DSM program. Second, at the demand management level, this would allow utilities to reduce load losses and operating costs.

The demand response (DR) program, for example, can reduce network load when electricity generation is insufficient to meet demand or when network congestion is detected in the transmission system. Furthermore, it reduces the market risk that consumers and suppliers are exposed to, as well as price uncertainty and fluctuation.

Energy security, accessibility, reliability, and flexibility are the main concerns in power system operation. Power source management is considered by adjusting electricity demand through DSM programs. As a result, the system becomes more flexible, allowing for better delivery of the required services. When power generation from renewable energy sources is at its lowest, combining DSM with them is especially beneficial.

When it comes to reliability-based DSM programs, it's important to remember that power system reliability is a top priority during the design, planning, and operation stages. It is critical to ensure the system's ability to respond to disturbances and the presence of sufficient equipment and facilities in the system to meet the consumer's demand.

This type of DSM program is primarily comprised of the following programs, as shown in Figure 8.

Large customers with the highest loads and capabilities to participate in such programs are most likely to use interruptible load programs. For specified periods of time, these customers agree to disconnect some or all of the loads in their facilities. Customers' most common strategy for ensuring the energy security of

their facilities is to provide backup electricity sources, such as diesel generators. These sources can also be used to provide power to critical loads in the event that the grid's power supply is disrupted. In this case, some utilities anticipate gird interruptions by using backup generators to provide interruptible load response. It also enables them to comply with air emission regulations or obtain exemptions to allow backup generators to operate for longer periods of time throughout the year.

Customers in some cases have lower electricity bills during normal operation to encourage commitment to interrupt load. Additional incentives for each interruptible event can be implemented depending on the country, with the understanding that the program is carried out through bilateral agreements between the utility and the customer. Non-performance penalties may be imposed under these agreements.

DLC programs are typically mass-market programs aimed at small commercial and residential customers. They sign up for the program in this case so that the utility can control specific end uses at the customer's location. Air conditioning (AC) load is the most commonly controlled end use. However, lighting is a potential candidate for commercial DLC programs, whereas residential DLC programs can target water heating and pool pumps. Fixed monthly payments included in the customer's utility bill, as well as a one-time participation payment, are used as incentives for DLC programs. Some utilities offer tiers of payment based on the size of the air conditioner's capacity or the way it cycles.

Because the utility controls the customer loads directly, the utility establishes agreements with customers that specify the maximum number of events per year and the maximum duration of any given event. Customers are usually given a short notice of a few minutes before an event is initiated. If a customer is uncomfortable, most DLC programs allow them to override an event. Overrides, on the other hand, can result in penalties. Loads can be curtailed or called upon when needed with DLC programs, which is important to utilities. In general, these programs use utility-connected load control switches or "smart" thermostats, and some utilities prefer to pay for these low-cost technologies up front and give them to customers for free because they are reliable and capable of achieving up to a 60% load reduction per site for small customers.

The Emergency Program is the third type of reliability-based DSM program. It is a plan that specifies a predetermined procedure to be followed during specific periods, such as periods of increased demand or when the grid is impacted by unplanned events. The strategy aims to make the most of available resources. It allows for demand reduction during electric system outages while ensuring maximum service continuity and maintaining the utility's integrity when necessary. Demand curtailment is usually accompanied by incentives for customers to reduce loads during reliability events, though the curtailment is voluntary, and no penalty is assessed if customers do not respond positively, and the rates are pre-specified, though no capacity payments are received.

Another aspect of energy efficiency is changing energy consumption habits in order to reduce waste. It can be summarized as daily actions that contribute to reducing energy consumption, such as maximizing daylight and always turning off lights in empty rooms, or using rechargeable batteries, or avoiding using air conditioning or heating when the windows are open.

In fact, energy infrastructure is a critical factor in determining end-user energy consumption behavior. Several factors could come into play here, including unexpected capital costs and the consumer's ability to deal with new technology. The latter is determined by socioeconomic factors, with the social factor dominating in some instances. End-user behavior is influenced by their level of education, awareness, and cultural traits. The success of measures aimed at changing consumer behavior and practices hinges on persuading the consumer of the benefits of his conscious behavior, which range from personal to global. The installation of references and baselines will allow the consumer to estimate his excessive consumption. Consumption readers (meters) that are easily accessible are the first step in raising consumer awareness. The second step is communication, in which low-hanging-fruit measures with no cost are disseminated to the consumer to demonstrate the impact of minor behavioral changes on his consumption. Other measures can then be disseminated and implemented on a larger scale, such as a building scale. Although installing automation systems such as light sensors in common areas necessitates a financial decision, showing end-users the benefits and payback period on their bill can have a significant impact on this decision. To encourage a change in consumer behavior, all countries' plans must include awareness campaigns, capacity-building programs, and incentives.

5

POLICIES FOR EFFICIENCY IN ELECTRIC CONSUMPTION IN THE MEDITERRANEAN REGION

The RES WG chairs created and distributed a questionnaire to collect data for the report's drafting as well as two case study templates to share the members' knowledge.
Only 11 of the 27 members responded to the questionnaire and/or provided case studies; 7 members only regulate the gas market or do not yet have a regulator, so this analysis does not apply to them. This report's analysis will be based on the 11 positive responses.
The following graph depicts the current status of responses to the RES WG documents. Many regulators have no responsibilities in the area of energy efficiency (EE), but they contacted the appropriate authorities and provided an overview of their policies/strategies.

Figure 9 Overview of the replies to the RES WG questionnaire and case studies

The members' responses will allow for the dissemination of key findings on energy efficiency (EE) and E-mobility (EM) in the Mediterranean region, from European countries to countries on the southern coast (North Africa to the East Mediterranean).

The energy efficiency case studies will provide a more in-depth analysis and understanding of each country's mechanisms and regulations.

To promote and encourage the implementation of energy efficiency actions, the majority of countries have either an energy efficiency program, strategy, or national plan.

According to the results of the analysis, all of the countries either have an energy efficiency goal or meet the EU's targets, as shown in the table below.

Table 2. MEDREG members' energy efficiency programs

Country	Name of the plan	Description
Albania	National Target Contribution (NDC)	• In alignment with the EU target 20-20-20, Energy Community Treaty, and EU integration process • Objectives compared to the baseline scenario • Potential of final energy consumption reduction of 28% by 2030 • Potential of GHG reduction of 27% by 2030
Algeria	Energy Efficiency Program	• Global program objective is to realize 10% energy saving in 2030 • Planned measures concerns various sectors: - Thermal insulation of buildings: 30 thousand tons of oil equivalent (TEP) in 2030 - The solar water heater: 7 thousand tons of oil equivalent (TEP) - The widespread use of low consumption lamps: 800 thousands of toe - The introduction of energy performance in public lighting: 100 thousands of toe - The use of high-performance equipment to achieve about 1.2 million of TEP gains - The promotion of energy efficiency in the industrial sector: 210 thousands of toe - The promotion of liquefied petroleum gas fuel (LPG / c) and natural gas fuel (CNG), for the expected gain of 1.9 million of TEP.
Cyprus	National Energy and Climate Plan for 2030	• Complying with the European Directive for Energy Efficiency • Objectives compared to the 2007 scenario. • Final energy consumption reduction of 2 Mtoe by 2030 (13.0%). • Primary energy consumption reduction of 2.4 Mtoe by 2030 (17.0%) • Cumulative energy saving in end-use of 243.04ktoe for 2021-2030. • In buildings, measures will bring an annual saving of 1.31 GWh until 2030
France	Multiannual Energy Programme (PPE)	• Objectives compared to the 2012 scenario. • Final energy consumption reduction: 7.6% by 2023 and 16.5% by 2028. • Primary energy consumption reduction: 20.0% by 2023 and 35.0% by 2028.
Greece	National Energy and Climate Plan (NECP)[8]	Taking into account European Commission's recommendations and the UN sustainable development goals, the Greek NECP set policy priorities to promote energy efficiency over the period 2021-2030: • EE in public buildings • Renovation of building stock in the residential and tertiary sector • EE improvement of road, rail, electricity and gas infrastructures • Promoting energy efficiency contracts by energy service companies • Attaining cumulative energy savings of 7.3 Mtoe in the period 2021-2030

[8] (Helenic Republic - Ministry of the Environment and Energy, 2019)

Country	Name of the plan	Description
		• Improving energy efficiency in final energy consumption by at least 38% in relation to the foreseen evolution of final energy consumption by 2030
Italy	Gestore del sistema energetico (GSE)	• The EE strategy concerns mostly EE in buildings • EE program in place since 2005; EE certificates mechanism established. • 20Mtoes saved so far in buildings • ARERA set the subsidy that distributors receive to cover their EE activities costs. • Electricity and gas distributors are obliged to reach minimum savings of final energy consumption
Lebanon	National Energy Efficiency Action Plan (NEEAP)	• 1st NEEAP to support national stakeholders to set the roadmap. • 2nd NEEAP targets energy saving in the power sector, building, industrial, agricultural, and public sectors • Third NEEAP is under development. • Commitment to a saving of a minimum of 4.83% of total demand
Malta	Recovery and Resilience Facility Plan (RRF)	The country will develop a thorough long-term renovation strategy by 2023 that will aim to promote energy efficiency in its buildings with a view to increase their energy performance and achieve decarbonization of the building stock by 2050. In this scope, Malta plans to invest in the renovation, including deep retrofitting, of at least 9,232 m^2 of public buildings and at least 40,605 m^2 of private sector buildings, including commercial and non-residential buildings. This investment will aim to achieve a reduction of primary energy demand of those buildings by at least 30% by 2025.
Montenegro	Energy Efficiency Action Plan for 2019- 2021 (EEAP)	• Based on the EU Directive 2012/27/EU (Energy-saving at the level of 1% annually) • 4.16ktoe of the final energy • 6.54ktoe expressed in primary energy equivalent.
Palestinian Authority	Green Building Council	The EE in Palestine concerns only EE in building and aims to develop and implement green building innovative projects.
Portugal	National Energy and Climate Plan 2021-2030 (PNEC 2030) Long-Term Strategy for Building Renovation (ELPRE) PPEC (Electricity Consumption Efficiency Promotion Plan)	• PNEC 2030 is framed under the regulation of the EU 2018/1999 of the European Parliament and the Council of 11 December 2018 on the Governance of the Energy Climate Action Union • PNEC 2030 covers five dimensions: decarbonization, energy efficiency, security of supply, internal energy market and research, innovation and competitiveness • PNEC 2030 set the goal of reducing 35% of energy consumption by 2030 (reference scenario 2007) • ELPRE aims to transform existing buildings into nearly zero-energy buildings (NZEB) • ERSE has responsibilities in energy efficiency promotion • ERSE developed PPEC in 2006; six editions being implemented till now; energy savings achieved are accounted to PNEC targets

In any case, the implementation of the targets includes several sectors such as energy efficiency in buildings, energy networks, generation, electricity consumption, and demand response programs.

The next figure provides the targeted sectors by country.

In buildings	In energy networks	In generation
• Albania • Algeria • Bosnia-Herzegovina • Cyprus • Egypt • France • Greece • Italy • Lebanon • Malta • Montenegro • Palestine • Portugal	• Albania • Bosnia-Herzegovina • Cyprus • France • Greece • Italy • Lebanon • Montenegro • Portugal	• Algeria • Bosnia-Herzegovina • Greece • Lebanon • Montenegro

In electricity consumption	Demand response programs	Other
• Albania • Algeria • Bosnia-Herzegovina • Cyprus • Egypt • France • Greece • Italy • Lebanon • Montenegro • Portugal	• Albania • Cyprus • France • Greece • Lebanon • Portugal	• Lebanon • Montenegro

Figure 10 Targeted sectors in the Energy Efficiency programs by country

Each country's energy efficiency programs have specific measures based on energy-consuming sectors and potential savings.

Aside from the objectives listed in table 1, the Albanian public sector must renovate a minimum of 3% of the total stock of public buildings every year beginning September 1, 2021. Furthermore, after receiving an energy audit, large energy consumers must develop an action plan to save at least 4% of the electricity consumed. For the first time in Albania, municipalities must develop energy efficiency action plans based on their consumption.

In Algeria, the focus is on three main axes, transportation, the use of high-performance equipment, and the promotion of energy efficiency in the industrial sector, which account for 57%, 36%, and 6% of the global target, respectively.

ERSE established the PPEC in Portugal in 2006 to promote more efficient electricity consumption and the adoption of more efficient equipment by electricity consumers. PPEC is a tender mechanism in which eligible promoters submit measures to improve electricity consumption efficiency. Ex-ante, these measures are chosen based on technical and economic criteria that are publicly discussed and approved. There are two types of measures supported by PPEC: tangible and intangible. The first is the installation of equipment with a higher level of energy efficiency than standard equipment on the market, which is aimed at the industrial, service, or residential sectors. The second type of measure, on the other hand, is concerned with encouraging people to change their habits by disseminating information about energy efficiency practices such as energy audits and information campaigns.

The implementation of energy efficiency in Cyprus is based on three methods: mandatory regulation, information on the benefits of energy efficiency, and the use of support schemes. Energy distributors are required to follow an energy efficiency obligation scheme, and energy efficiency is promoted through support schemes for businesses. Aside from these two measures, there is a lot of information dissemination and incentives to promote energy efficiency in households, businesses, and government.

In France, the PPE provides incentives and methods to encourage the implementation of energy efficiency measures in a variety of settings, including buildings, energy networks, electricity consumption, and Demand-Side Response.

The main measures in the construction sector apply to all types of buildings, from new construction to existing structures, with the goal of reducing carbon emissions for new construction and renovating existing structures with a target of 500 000 homes per year.

In France, there are two types of demand side responses: "implicit" DSR (where the consumer's electricity consumption is reduced or postponed within the framework of the electricity supplier's contract) and "explicit" DSR (where the consumer's electricity consumption is reduced or postponed outside of the framework of the electricity supplier's contract) (where the consumer trades the change in their consumption pattern separately from their electricity supplier, for instance with an aggregator).

Energy efficiency in Palestine aims to build capacities, promote and support sustainable and environmentally friendly building design, construction, and operation. The details of the measure can be found in the green building council's "building code."

In Montenegro, the EEAP includes a variety of policy initiatives aimed at improving the legal and institutional framework, as well as concrete investment programs and energy efficiency subsidies, as well as public awareness initiatives.

On the 10th of November 2011, Lebanon's Council of Ministers approved the first NEEAP (2011-2015), which includes fourteen initiatives aimed at improving energy efficiency and renewable energy.

The second NEEAP's initiatives (2016-2020) are organized around two major axes: primary energy savings and end-use measures. The primary energy-saving measures in the Lebanese power network are in the generation, transmission, and distribution sectors (example, transformation of Open-Cycle Gas Turbine to Close-Cycle Gas Turbine). The section on end-use measures addresses energy-saving initiatives in the following major sectors: buildings (for example, the Double Wall Ordinance); industry, SMEs, and agriculture (for example, the installation of 100 VSD for irrigation pumps); mobility and transportation; and public services and facilities (example, management of public street lighting). Furthermore, the section on end-use measures contains an important section on horizontal measures that have a cross-sectoral impact on the economy (example, adoption of the energy conservation law).

There are two types of energy efficiency measures in place in Italy. The first is for electricity and gas distributors, who are given specific goals to meet in order to reduce final energy consumption and earn tradeable energy efficiency certificates (also known as white certificates) for each ton of equivalent oil. If the distributors do not meet the assigned goal by the end of the year, they must purchase the missing certificate from a GME-managed dedicated market (an entity overseeing the organization and outcome of wholesale energy markets). The second measure is a fiscal one that allows individuals and businesses to receive a "fiscal credit" (tax reductions) when they invest in energy efficiency equipment.

The measures in **Greece** included in the NECP are split into 7 main axes:[9]

- Climate change, emissions, and removal of GHG concerning the reduction of emissions
- Renewable energy sources
- Energy efficiency
- Security of supply
- Energy market
- Agriculture, shipping, and tourism
- Research, innovation, and competitiveness

On the subject of energy efficiency, the measures apply to the building sector, which includes public buildings, residential buildings, and tertiary institutions. A competitive framework with financial instruments is also in place to promote and improve energy efficiency in the industrial and transportation

[9] For the report purposes, only the energy efficiency measures will be explained while a more thorough analysis on the energy efficiency policy can be found at the Greek NECP available at https://ec.europa.eu/energy/sites/default/files/el_final_necp_main_en.pdf, pp. 152 – 174.

sectors. In addition, a new regulatory framework for the demand response mechanism will be developed, which will contribute significantly to the efficient use of energy by final consumers, initially by HV and MV consumers, with LV consumers joining after the smart meter rollout is completed. Finally, other mechanisms will be developed to raise professional and consumer awareness of energy conservation.

5.1 Energy efficiency programs/measures in the electricity consumption

Energy efficiency programs, as discussed in the previous chapter, can include a variety of measures in various sectors. This subchapter will detail the detailed measures used in the Mediterranean region by type of consumer; households and SMEs, business consumers, and industrials, as the report's goal is to provide an overview of the EE, primarily in the electricity sector.

Table 3. Energy efficiency in electricity consumption

Country	SMEs and/or households
Albania	N/A
Algeria	- The widespread use of low consumption lamps: 800 thousands of toe - The introduction of energy performance in public lighting: 100 thousands of toe - The use of high-performance equipment to achieve about 1.2 million of TEP gains
Cyprus[10]	- Fiscally neutral green tax reform by increasing environmental taxes while reducing labor taxation - Supporting scheme for energy efficiency investment using European Structural and Investment Funds 2021-2027 - Energy Fund of Funds providing soft loans for energy efficiency - Energy efficiency Obligation scheme - Supporting Schemes through the national Fund of Renewable Energy (RE) & Energy Conservation (EC) for promoting energy efficiency investments in the Residential and Public sectors and energy audits in SMEs - Additional floor space "allowance" for new buildings and buildings that are renovated - Removing barriers that impede the uptake of energy performance contracting and the implementation of energy efficiency investments in general - Minimum energy performance requirements for new and existing buildings, requirements for technical building systems installed in existing buildings, inspections for heating systems and a/c systems) - Minimum energy performance requirements for new buildings – revised - Implementation of soft measures (information campaigns, training, workshops, etc.) - RES and Energy Conservation fee (tax) applied on electricity - Measures promoting the installation of small-scale renewable energy technologies on or in buildings - Advanced Metering Infrastructure Plan
France	Demand-side response mechanism as explained in 2.1
Greece	New demand response mechanism, Energy Poverty Action Plan, improving building insulation, cooling and heating installations, window frames, smart home devices

[10] Business refers to service, transport, agriculture and/or energy supply

Italy	File for fiscal advantages when planning building renewals aimed at reducing energy consumption
Lebanon	- Double-wall ordinance: setting and implementing this ordinance in 100 buildings, which improves the building's envelope performance - Testing facility for building components; more precisely, the thermal properties of building components - Building code - Use of efficient equipment, using energy-efficient equipment in 200 buildings of 100m^2 each - Energy performance certificate for buildings - Energy audits for public buildings; performing energy audits for 200 public buildings of all types of usage - Implementing measures in selected public buildings; including renewable energy for hot water and electricity generation, use of energy-efficient equipment, high-performance double-flow ventilation with heat recovery, improvement of the building envelope, use of green lighting and lighting control equipment, and raising awareness for behavioral change - Pilot project; building the LCEC new premises as an exemplary green building - Capacity building for refurbishment; training and educating workers on the best ways of renovating a building going green - Minimum energy performance standards (MEPS); implementing MEPS and labelling program for at least 5 types of equipment (air conditioners, lamps, refrigerators, televisions, washing machines) - Financing mechanism: boosting and sustaining the operation of the National Energy efficiency renewable energy action (NEEREA) financing mechanism to promote and implement energy-efficient measures in different sectors - Awareness-raising campaigns and capacity building; raising awareness about energy efficiency among the public as well as building the capacities of professionals working in the sector - ESCO's business development; setting the legislative framework for the energy service companies (ESCOs) - Adoption of the energy conservation law; creating a political momentum towards the development of this law towards a more comprehensive framework law as per the recommendations of the League of Arab States (LAS) and towards having a smooth adoption by the Lebanese parliament
Montenegro	- Eco-design of energy-related products - Energy labelling of household appliances - Financial support for citizens for EE investments
Palestinian Authority	N/A
Portugal	- PPEC Tangible Measures: lighting, cooling, heating of sanitary water and demand-side management - PPEC Intangible Measures: tools (namely computer applications), audits, training and disclosure of information - The Efficiency Voucher program is an initiative of the Ministry of the Environment that aims to combat energy poverty and strengthen the renovation and efficiency of buildings. For this, 20 000 vouchers will be delivered for financing works that promote efficiency in the homes of families in situations of energy shortage, from August 31 until December 31, 2021

Country	Business consumers
Albania	N/A
Algeria	The EE program doesn't focus on specific category of consumer.
Cyprus[11]	- Fiscally neutral green tax reform by increasing environmental taxes while reducing labor taxation - Supporting scheme for energy efficiency investment using European Structural and Investment Funds 2021-2027 - Energy Fund of Funds providing soft loans for energy efficiency - Energy efficiency Obligation scheme - Promotion of Energy Efficiency in enterprises, through voluntary agreements under the "Business for climate" initiative - Additional floor space "allowance" for new buildings and buildings that are renovated - Removing barriers that impede the uptake of energy performance contracting and the implementation of energy efficiency investments in general - Net billing Scheme for high-efficiency cogeneration (HECHP) - Implementation of soft measures (information campaigns, training, workshops, etc.) - RES and Energy Conservation fee (tax)applied on electricity - Measures promoting the installation of small-scale renewable energy technologies on or in buildings - Advanced Metering Infrastructure Plan - Minimum energy performance requirements for new and existing buildings, requirements for technical building systems installed in existing buildings, inspections for heating systems and a/c systems)
France	- Demand-side response mechanism as explained in 2.1
Greece	- New demand response mechanism, building insulation, cooling and heating installations, window frames, ventilation, RES, and CHP unit installation, and lighting
Italy	- File for fiscal advantages when planning business building renewals aimed at reducing energy consumption
Lebanon	- The business consumers benefit from the cross-sectorial impact of the energy efficiency measures detailed in the previous section, as horizontal end-use measures
Montenegro	- Improvement of the energy performance of buildings in the public sector - Implementation of energy efficiency improvement measures in public utility companies of local self-governments and other public companies - Establishment and development of energy management in the public sector - Establishment of the mechanisms of financial support to EE investments in the commercial sector
Palestinian Authority	N/A

[11] Business refers to service, transport, agriculture and/or energy supply

Portugal	- PPEC Tangible Measures: lighting, driving force, cooling, capacitor batteries, compressed air systems, traffic lights and demand side management - PPEC Intangible Measures: tools (namely computer applications), audits, training, and disclosure of information - ECO. 2030 AP (Resource Efficiency Program in public administration for the period up to 2030) presents measures to reduce energy, water and material consumption and their GHG emissions, verified at installations affecting buildings, equipment, fleets and infrastructure, including electricity mobility infrastructure, and energy production capacity and energy storage solutions, under management or use by entities
Country	**Industrial consumers**
Albania	N/A
Algeria	- The promotion of energy efficiency in the industrial sector: 210 thousands of toe
Cyprus[12]	- Fiscally neutral green tax reform by increasing environmental taxes while reducing labor taxation - Supporting scheme for energy efficiency investment using European Structural and Investment Funds 2021-2027 - Energy Fund of Funds providing soft loans for energy efficiency - Energy efficiency Obligation scheme - Promotion of Energy Efficiency in enterprises, through voluntary agreements under the “Business for climate” initiative. - Additional floor space “allowance” for new buildings and buildings that are renovated - Removing barriers that impede the uptake of energy performance contracting and the implementation of energy efficiency investments in general - Net billing Scheme for high-efficiency cogeneration (HECHP) - Implementation of soft measures (information campaigns, training, workshops, etc.) - RES and Energy Conservation fee (tax) applied on electricity. - Measures promoting the installation of small-scale renewable energy technologies on or in buildings - Advanced Metering Infrastructure Plan
France	- Demand-side response mechanism as explained in 2.1
Greece	- New demand response mechanism - Public tender to be held within 2022 for the development of industrial parks for investments, among other categories, in infrastructure for the establishment of the new generation parks with specific energy efficiency criteria for the construction of new buildings and energy efficiency and demonstration projects in large enterprises and supporting measures
Italy	- Apart from requesting tax abatements provided for by fiscal laws, industrial consumers can benefit from the EECs schemes, which are not limited to energy efficiency in buildings since EECs can be issued for a broad range of electricity-saving installations and programs - Industry can both accede to the EECs market directly, by setting up Energy Saving Companies, and indirectly, for example by sharing with ESCOs the economic return of interventions made by these ESCOs in industry’s factories and processes

[12] Business refers to service, transport, agriculture and/or energy supply

Lebanon	- Mandatory energy audits for institutions consuming more than 400 toe (2,500KVA)
	- Implementing the following energy efficiency measures in 20% of the Lebanese industries:
	  - High-efficiency motors
	  - Motors-power factor improvement
	  - Boiler efficiency improvement
	  - Heat recovery systems
	  - Cogeneration-exhaust gas
	  - Preheating systems
	  - Improvement of cooling systems
	- Also, industrial consumers are affected by the cross-sectorial impact of the energy efficiency measures detailed in the SMEs & household section above

Montenegro	- Establishment of the mechanisms of financial support to EE investments in industry - Introduction of a regulatory framework for eco-design of energy-related products
Palestinian Authority	N/A
Portugal	- PPEC Tangible Measures: lighting, driving force, cooling, capacitor batteries, compressed air systems and demand-side management - PPEC Intangible Measures: audits and training.

5.2 NRAs roles and Energy efficiency regulation

Except for ERSE (Portugal), LCEC (Lebanon), and ARERA (Italy), most regulators have no direct involvement in the implementation of energy efficiency programs.

ERSE is a non-profit organization that oversees and manages the implementation of PPEC. From an economic regulation perspective, ERSE developed PPEC in 2006 and approves the measures that will be implemented in each edition.

Only ERSE monitors the implementation of the PPEC energy efficiency program, despite the fact that few regulators have a direct or indirect role in the process. The promoters are required to submit half-yearly reports outlining their progress in carrying out the actions. Once a project is up and running, the promoters must submit a measurement and verification plan to ERSE, which will be used to verify the project's savings. The incentives payment is jeopardized if the approved and expected savings in those reports are not met.

The LCEC's role is to lead Lebanon's efforts to develop energy efficiency and renewable energy in order to improve energy security and decarbonization levels. The main role of the LCEC in the energy efficiency program is to establish national action plans and strategies to develop Lebanon's sustainable energy sector, as well as to design the NEEAP, monitor its implementation, evaluate it every five years, and update it as needed.

For Italy, ARERA is in charge of defining and implementing the portion of the distribution tariff devoted to covering the costs of the distributor's obligations related to energy efficiency measures.

Aside from these regulators, CRE (France) and ERE (Albania) play an indirect role in energy efficiency program; for example, CRE evaluates energy efficiency measures when setting tariffs or deciding on regulated operators' compensation. It also approves the contracts and tender terms and conditions through which regulated operators obtain demand-side response capacity.

The Albanian regulars play an important role in the development of the National Energy Strategy, but they have no authority over energy efficiency programs and measures, according to ERE.

CREG (Algeria) and RAE (Greece), for example, are directly involved in the monitoring of their DSOs' performance indicators in terms of (technical and non-technical) losses. Similarly, CREG issues power plant operation licenses based on efficiency criteria to encourage producers to improve equipment performance.

5.3 TSO/DSO's obligations towards the energy efficiency

Because the TSOs and DSOs are at the heart of the energy system, they are the first to comply with the law's requirements.

TSOs and DSOs have an obligation related to energy efficiency in all of the responses received; however, the obligation varies by country. Lebanon and Palestine are the only two countries where network operators are not obligated.

Targets for reducing technical losses are set during the tariff setting process in Albania, and the TSO and DSO must meet these targets.

In Algeria, the GRD sets goals to improve distribution grid performance, including loss reduction, which are then analyzed by CREG and approved by the ministry.

Similarly, under the tariff setting process, the DSO in Portugal has a regulatory incentive for the reduction of technical losses in MV/HV. In addition, the TSO and DSO may voluntarily participate in the PPEC as promoters.

On the other side of the Mediterranean, RAE in Greece held a public consultation on Key Performance Indicators (KPIs) for TSO operation monitoring that are linked to the Operator's Allowed Revenue (penalty/reward scheme). The DSO already has a similar incentive scheme in place to reduce technical network losses.

The TYNDP establishes the TSO/obligations DSOs in relation to energy efficiency in Cyprus.

Individual metering and billing should be provided by energy suppliers and distributors in Montenegro in accordance with the energy efficiency Directive (2012/27/EU).

In addition, a new requirement is being developed that requires energy suppliers and distributors to develop an energy efficiency improvement programs for end users and to put the measures in the program into effect.

Electricity and gas distributors in Italy have a specific goal of lowering final energy consumption and earning a tradeable energy efficiency certificate (as explained in paragraph 2.1). ARERA determines the amount of money this mechanism receives for each toe saved as a result of the DSO's energy efficiency efforts. The subsidy is then factored into the final price charged to customers via distribution tariffs. The energy efficiency obligations scheme has been in place since 2005 and has resulted in a saving of 42 Mtoe, resulting in a total subsidy of 6 B€.

Articles D233-10 to D233-16 of the French energy code contain special provisions for electricity and gas infrastructure operators. Specifically, network operators must assess the energy efficiency potential of the infrastructure they operate, with a focus on transmission, distribution, load management, and interoperability, as well as the connection of power generation facilities, including access opportunities for micro-generation. The infrastructure operator is required to define measures and investments to achieve cost-effective energy savings based on this evaluation or an external energy audit.

5.4 Consumer awareness and incentives

Aside from the potential for energy savings on the part of TSOs/DSOs, consumers also represent a significant potential for energy savings by raising awareness of the impact of changing final energy consumption behavior.

In addition to raising awareness, some countries offer financial incentives or programs to encourage energy efficiency implementation, ranging from tax breaks to loans.

There is no financing framework for energy efficiency in Albania; however, the amendment to the energy efficiency law envisions supporting the growth of the Energy Service Companies (ESCO) market. Furthermore, several international technical assistance and investment programs (EU, EBRD/GEFF, GGF, KfW) support energy efficiency improvements and consumer awareness, particularly in the building sector. After the €5 million loans from the EBRD's Green Economy Financing Facility (GEFF) in Albania, more money will be invested in energy efficiency measures in residential buildings. The program will encourage private owners of residential buildings to invest in high-performance energy efficiency technologies, materials, and other solutions.

Solar water heaters are the only direct incentive mechanism available to consumers in Algeria, with financial support up to 45 percent of the cost of supply and installation. Nonetheless, APRUE, the agency for the promotion and rationalization of energy use, is leading an information campaign to raise public awareness about:

- Reduce energy consumption;
- Promote the use of efficient equipment such as low consumption lamp.

Furthermore, the agency established a clear labelling system for household appliances to assist consumers in making energy-efficient purchasing decisions.

Furthermore, APRUE implemented a program to gradually integrate energy efficiency measures into the building sector.

Indeed, the goal of this program is to provide technical and financial assistance in order to reduce heating and cooling consumption. The goal is to incorporate energy efficiency into new constructions and to make existing buildings more energy efficient.

In Portugal, PPEC promotes the implementation of intangible measures such as computer applications, energy audits, training, and the disclosure of information on good practices in the efficient use of electricity to promote a change in behavior.

Financial incentives such as taxation on motor fuels, taxation of electricity due to the RES and Energy Conversation Fund fee, and new vehicle registration fees are based on the level of emissions, as well as financial incentives for energy upgrade measures in homes and businesses, are included in Cyprus' national energy efficiency measures.

The Energy Service's website and radio spots are used to carry out public information campaigns. In addition, the Energy Service has developed an Internet tool to assist citizens in determining the costs and benefits of various energy-saving measures and renewable energy sources.

There are also Support Schemes to encourage energy savings in homes and small and medium-sized businesses, such as thermal insulation, energy audits for SMEs, and house energy renovation. In addition, the Ministry of Energy announced that it intends to re-announce the Support Scheme for the Use of Renewable Energy Sources and Energy Saving in Households for 2022, and that it is working on a Support Scheme for the Replacement of Energy-Intensive Electrical Appliances in the Homes of Vulnerable Electricity Consumers.

Finally, the Ministry of Energy, Commerce, and Industry (MECI) is a Lead Partner in two projects aimed at promoting energy conservation in municipalities, communities, and public sector organizations, including the development of tools for use by these entities and the implementation of demonstrative energy-saving projects. Thermal insulation of external masonry, thermal insulation of roofs, replacement of windows, replacement of air conditioning systems, installation of LED lamps, and installation of Photovoltaic Systems are the most important measures that will be applied on a case-by-case basis for the energy upgrade of buildings in both projects in Cyprus. The projects are co-financed with 85% coming from the European Regional Development Fund and 15% coming from Greek and Cypriot national resources.

Investment programs for improving energy efficiency are available in Montenegro for public sector buildings, which are primarily financed through loans/grants from International Financial Institutions ("IFIs")

(over 50 million euros have been invested so far, with another 50 million euros to be invested in the next six years).

Furthermore, interest-free loans are available for citizens who invest in energy efficiency and renewable energy sources.

Similar financial mechanisms exist in Italy, where households and businesses are given "fiscal credit" (for example, tax abatements) when they invest in energy efficiency equipment.

Many support mechanisms exist in France to help with the implementation of energy efficiency measures, the most common of which are the following:

- The CEE heating incentive, which allows households and owners of tertiary (services sector) buildings to obtain subsidized CEE premiums for the replacement of an inefficient oil, coal, or gas heating system, will be extended until the end of 2025 under the 5th period of the CEE scheme.
- MaPrimeRénov (MyRenovationPremium), which helps households replace their inefficient, low-emission heating systems with renewable or very efficient heating systems since the beginning of 2021, has been open to all owner-occupiers and condominiums and will be open in July 2021 to landlords.[13]
- There is a reduced VAT at 5.5% on renovation works.
- The Zero rate eco-loan (eco-PTZ), which allows households to finance their remaining expenses through a zero-interest rate loan, the change of heating system being among the eligible actions.[14]

The National Housing Agency (Anah) offers several types of assistance for renovation works in homes. The financial aid can concern energy renovation works. Two types of assistance are the following:

- Habiter Mieux Sérénité (renovation project allowing to achieve energy performance of at least 35%);
- Ma Prime Rénov' (renovation project, one-off or not, such as insulation work or change of heating system)[15].

Furthermore, a public service (FAIRE) is in place to provide free guidance on energy renovation.[16]

Greece has also implemented financial programs related to building renovation, including electricity or natural gas installations and cooling or heating devices.

LCEC has run a number of public awareness campaigns in Lebanon to raise awareness about energy conservation, promote the use of renewable energy, and make individual project financing easier. Magazine articles, brochures, newsletters, TV spots, incentives, and events are all part of these campaigns. Furthermore, one of the NEEAP's (2016-2020) measures is known as aware awareness-raising signs and capacity building, which aims to raise public awareness about energy efficiency as well as build the capacities of professionals working in the sector, with a focus on schools/scouts, the general public, and installers. The campaigns are based on collaborations with a variety of national and regional entities, most notably the EU, which has invested heavily in raising awareness and strengthening the capacities of Lebanese professionals through the following projects and tools: TAIEX, MED-ENEC, CES-MED, SISSAF, MED-

[13] https://www.service-public.fr/particuliers/vosdroits/F35083
[14] https://www.service-public.fr/particuliers/vosdroits/F19905
[15] https://www.service-public.fr/particuliers/vosdroits/F1328
[16] https://www.faire.gouv.fr/

SOLAR, MED-DESIRE, SHAAMS, FOSTER-in-MED, GR.ENE.CO, SUDEP and several EU co-funded ENI CBC MED projects.

The National Energy Efficiency Renewable Energy Action (NEEREA), on the other hand, is a financing mechanism that provides green loans to the private sector in order to promote the implementation of various types of energy efficiency and renewable energy measures. It is a voluntary mechanism through which more than 1000 projects worth a total of 600 million dollars and 260 GWh of annual energy savings have been implemented until June 2020.

In Palestine, a program between the energy authority and the French Development Agency (AFD) aims to promote green investments in the private sector. The French Development Agency proposes its SUNREF program, which will help improve the economic context for green investment development. The project is being implemented in a time of economic uncertainty and energy scarcity, as the demand for energy continues to rise.

6

ELECTRIC MOBILITY POLICIES IN THE MEDITERRANEAN REGION

Electric mobility is another example of using a whole-system approach to improve electricity system efficiency. Converting the fleet of vehicles from fossil fuels to electricity can result in significant cost savings. That is to say, it reduces the amount of primary energy required for transportation, resulting in system and societal efficiency while also helping to reduce CO2 emissions.

When compared to fossil fuels, electric mobility offers significant benefits. Electric mobility contributes to an increase in renewables in the mix of energy sources in the transportation sector, in addition to local environmental benefits such as the absence of local air pollution and noise reduction. The environmental consequences of this situation are well-known, including those related to climate change.

Furthermore, new modes of mobility have emerged in conjunction with e-mobility: for example, soft mobility with electric assistance (e-bikes) and shared mobility (with e-bikes, e-scooters and car sharing). As a last-mile option, these new modes play an important role in conjunction with public transportation. This combination is critical for improving mobility, particularly in urban areas. They are, in fact, a new way of life in cities, with well-known environmental benefits.

In an electric system with a high percentage of renewables in its energy mix, electric mobility is especially important. The use of renewable energy for electricity generation and electric mobility, when combined, accelerates the transition to a low-carbon society and is an important complement to energy efficiency.

MEDREG received significant contributions from the questionnaire responses, as well as a significant added value from the case studies on electric mobility policies provided by the following regulators: Albania, Bosnia and Herzegovina, France, Greece, Italy, Lebanon, Palestine, Portugal, and Turkey are among the countries represented (nine members). Regulators were asked to provide a brief overview of an electric mobility program in place in their country, as well as some additional information related to technical information and requirements for participation in these activities, as well as cost, tariffs, and billing arrangements, in the case studies template.

According to the data gathered by the RES WG, MEDREG countries recognize the importance of adapting policies to promote the development of electric mobility. These policies apply to charging stations, electric vehicle tariffs and combined smart metering, PV generation, and charging point measures, promoting efficiency and the use of renewable energy sources.

6.1 Policies and strategies

Regarding the existence of a policy or strategy related to electric mobility, the Mediterranean region is divided into three categories of countries. Countries with an existing policy are in the first category, followed by countries with no official policy or strategy but some analyses and studies in place, and finally countries with no policy or strategy. The above-mentioned categories are represented in the diagram below.

Figure 11 Electric mobility strategies in the Mediterranean region

In Algeria, no specific strategy for electric mobility has yet been adopted. The government has addressed the issue of electric mobility and has chosen to incorporate it into its programs beginning in 2023, with an annual production of about 1000 electric vehicles until 2030.
In Egypt, a regulatory framework is being developed, which will focus on electric vehicle tariffs and regulations.

The implementation of the e-mobility strategy in Portugal began in 2010 with the launch of MOBI.E, a pilot project that aims to encourage the purchase and use of electric vehicles, ensure that electric vehicle batteries are charged through an integrated network, and provide universal and equitable access to electric mobility services. The project was completed in July 2020, with the commercial phase for all types of charges operational (slow and fast).

The law applies to both private and public charging stations for electric vehicles (EVs). People who have a charging station at home or in a shared garage are eligible for private charging (for example). On the other hand, private charging stations can be integrated into the public system, which is based on a fully interoperable platform managed by MOBI.E. (the public electric mobility network operator).

Consumers only need to identify themselves (via RFID card or App) and have a contract with a supplier for electric mobility (CEME) in order to charge their electric vehicle at any charging station, regardless of the supplier.

The National Integrated Plan for Energy and Climate in Italy includes an e-mobility strategy that aims to reach 4 million electric vehicles by 2030.

In France, on the other hand, the multiannual energy program (PPE) sets targets for electric mobility, including private individual use (electric vehicles for private individuals, plug-in hybrid vehicles) and business use (light business vehicles hybrid or not, heavy low-carbon business vehicles electric and natural gas ones). Furthermore, the PPE establishes targets for electric vehicle charging stations and hydrogen charging stations. The following graph depicts France's e-mobility targets for 2023 and 2028.

The targets for hydrogen charging points are 100 by 2023 and 400 to 1000 by 2028.

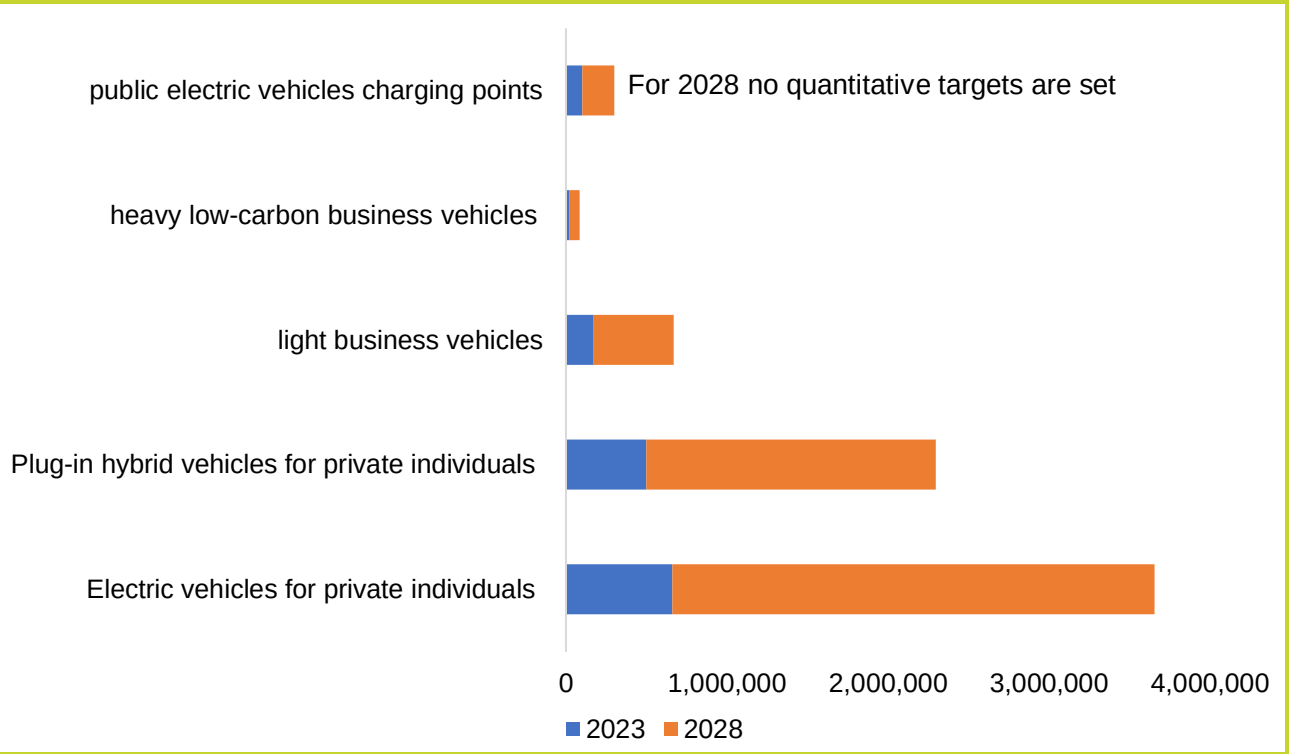


Figure 12 Electric mobility strategy target in France

It's worth noting that the e-mobility strategy calls for the sale of gasoline and diesel vehicles to be phased out by 2040.

Cyprus is the most recent country to implement a new electric vehicle promotion strategy. The Ministry of Energy, Commerce, and Industry (MECI) announced a support scheme in 2020 that will provide financial incentives for the installation/extension of a photovoltaic system (PV) and/or charging point, as well as a smart electricity meter, to charge an electric vehicle or plug-in hybrid vehicle in existing dwellings. Depending on the charging system installed in the house, the strategy divides the investment into three categories.

The following graphs show the consumer obligations as well as the subsidies available for each category.

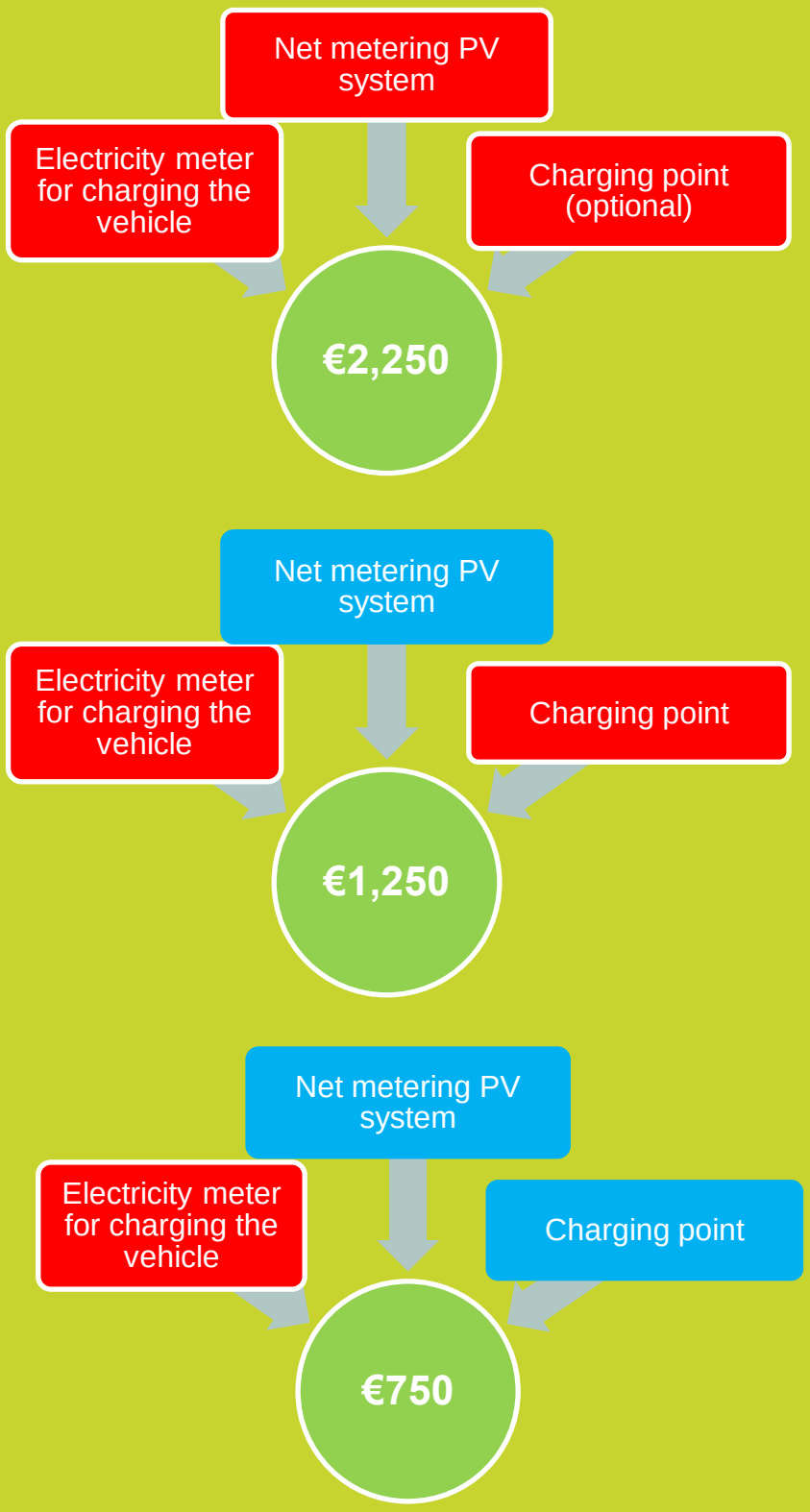


Figure 13 Electric mobility strategy in Cyprus

In the neighbouring country of **Greece**, the national policy for promoting e-mobility is based on 4 pillars that aim to increase the new registrations by 8.70% from 2020 to 2024 (starting from a share of 0.33%). The next figures regroup the 4 pillars of the strategy.

Greek Market	• Expanding the 'purchase bse' of the greek market by modifiying consumer identity (profile)
Old vehicles parks	• Replacing old vehicles with 'clean' BEV's and PHEVs
Infrastructure developement	• Developing a new user environment in terms of infrastructure and benefits (incentives).
Consumer's awarness	• Providing the general public with information by organizing communication programs.

Figure 14 Electric mobility strategy in Greece

Moreover, in 2020 the complete e-mobility support scheme was implemented, including both direct and indirect forms of support to promote the use of EVs.

Indirect forms	The development of free public parking spaces for EVs with zero emissions or emitting less than 50g CO2/km.
	Faster assessment and approval of licenses to the entities that manufacture EVs as well as any EV related good or item
	Tax exemptions for companies that use EVs that emit less than 50g CO2/km,
	Tax discounts for the purchase, installment and operation of the publicly accessible EV Charging Stations. The tax discounts are even higher if renewable energy sources are used.
	Tax exemptions for natural persons who buy EVs with zero-emissions are also foreseen in the legislation.
Direct forms (subsidy of total budget of € 45.8 million)	"ecological bonus" for citizens, Taxi drivers and legal entities the rates differs from a category to another with a bonus if the concerned dispose their old end-of-life vehicles. For Taxi drivers it's mandatory to dispose their old vehicles.
	The purchase of a "smart" home EV charging point can also subsidized with 500 €.

Figure 15 Electric mobility subsidies in Greece

The rates for each category, as well as how they are calculated, are detailed in Annex 2.

These policies and strategies in place in the Mediterranean region aid in the deployment of electric vehicles; the following graph shows the number of EVs and charging stations expected in the countries listed above by the end of 2020.

It's important to note that no comparison can be made because the maturity of e-mobility in some countries is high while in others, programs are just getting started. Furthermore, other factors such as population and land area should be considered.

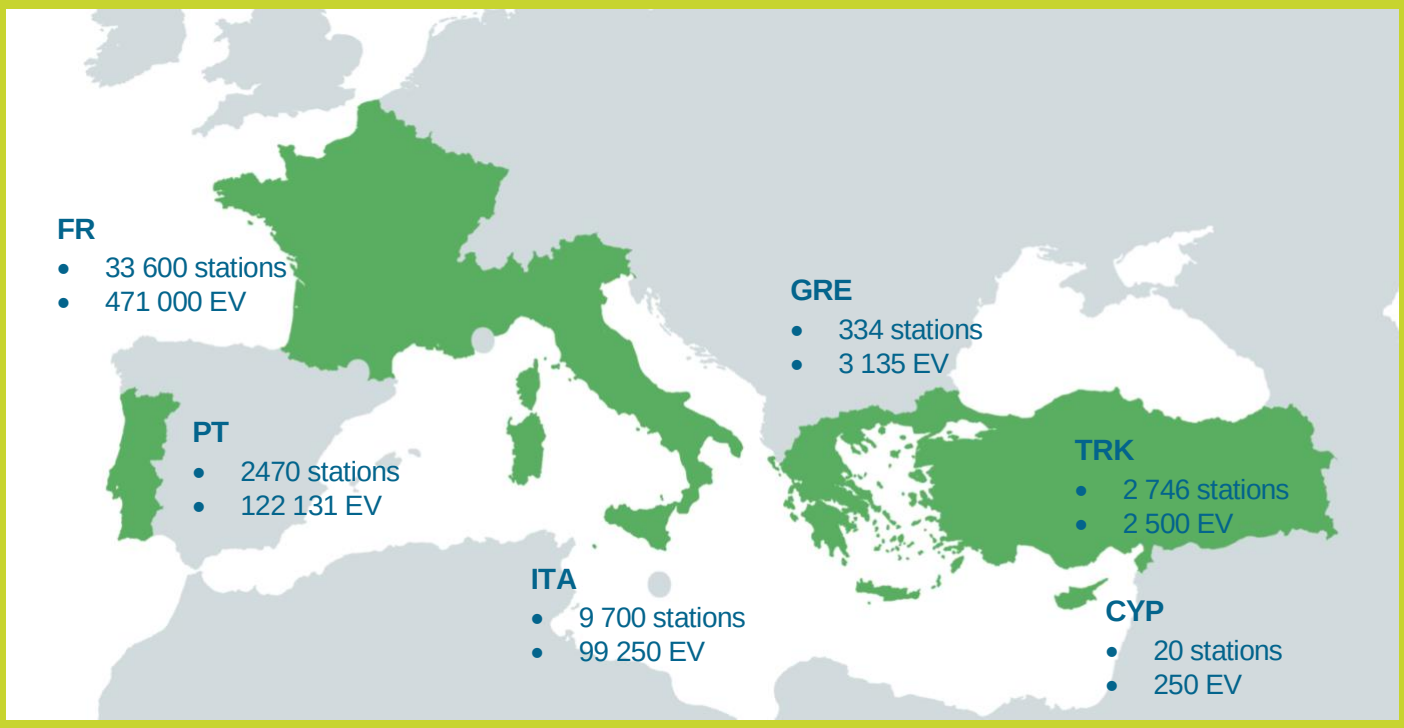


Figure 16 Electric mobility development by country

The number of electric vehicles in **Turkey** is approximately 2750. In 2020, 1020 new electric vehicles were registered to the traffic, and the number of electric vehicles per 1000 people is 0.3. According to an R&D study, some estimations were made regarding the number of electric vehicles and charging stations in Turkey for the years 2023, 2025 and 2030, based on the medium scenario.

Table 4. Medium scenario for e-mobility developments in Turkey

Medium Scenario	2023	2025	2030
Electric Vehicle	- 5% market share of electric vehicle sales, especially commercial vehicles, - Electric vehicle stock to reach approximately 75 thousand vehicles,	- 10% market share in electric vehicle sales, - Electric vehicle stock to reach approximately 273 thousand vehicles,	- Electric vehicle sales market share to be 25%, - Electric vehicle stock to reach approximately 1.6 million vehicles,
Charging Station	Having a total of 12.5 thousand public charging sockets (30% DC) installed	Having a total of 36.5 thousand public charging sockets (30% DC) installed	A total of 166,000 public charging sockets (35% DC) are installed

6.2 Role of the regulator & incentives

For some regulators, their role is limited within their competencies and provisions on the regulatory framework, as well as all aspects related to the energy market or tariff setting (ERSE for example).

The Greek regulator (RAE) collaborates with the ministry of energy to resolve energy market issues. Similarly, CERA's role in Cyprus is limited by the provisions of Directive 2019/944/EU relating to common rules for the internal electricity market. Figure 13 in paragraph 6.1 summarizes the subsidies for each type of housing unit in terms of incentives. Furthermore, the Ministry of Interior is examining the inclusion of provisions in legislation mandating the installation of an electricity supply with a capacity of up to 3.7 kW in each parking lot, for newly constructed or undergoing large-scale renovations, with at least two housing units, for future electric vehicle charging. A specific support scheme will be used to fund these charging stations.

Except for aspects relating to the supervision and control of regulated operators, the participation of the French energy regulator CRE is rather limited on the topic of electric mobility. CRE is responsible for defining and approving the connection conditions for electric vehicle charging infrastructures, as well as for ensuring nondiscriminatory access to networks and facilities. CRE is also consulted ahead of time on draught regulatory provisions pertaining to public electricity transmission and distribution networks.

There are a variety of financial incentives available for businesses and private individuals who want to install charging stations, including tax exemptions or reductions.

In Portugal, on the other hand, ERSE establishes the remuneration of the management entity (MOBI.E) and its activity, as it is a legal monopoly activity, as well as the tariffs paid to MOBI.E by suppliers (CEME) and charging point operators (OPC).

For 2021, a budget of 4 million euros has been set aside for acquisition subsidies for light passenger vehicles, light goods vehicles for individual or collective persons/enterprises, and 100% electric plug-in bicycles.

In addition, the state budget law reduced taxes for light passenger vehicles with hybrid plug-in batteries that can be charged using an electric grid connection and have a minimum range of 50 kilometers in electric mode and official emissions of less than 50 gCO2/km. The incentives are described in detail in Annex 3.

In Italy, the regulator ARERA does not take part in the policymaking process directly. The NRA, on the other hand, contributes to the overall regulatory framework that oversees network tariffs and incentives for investments that are deemed to help electric mobility spread. Customers (households and SMEs) have the right to request that the distributor increase the counter's capacity up to 6 kW without incurring any additional costs, provided that the additional capacity is used during off-peak hours (weekend and night-time). This provides a strong incentive for individuals and small businesses to prepare for increased EV charging at home and in private areas.

Financial resources are available to assist municipalities in developing local plans to maintain the deployment of charging stations and services; public funding is also available to individuals to incentivize the replacement of traditional gasoline-powered vehicles with new electric vehicles. More funds for EV infrastructure will be made available through the "Resilience and Recovery Fund," which was set up to meet the EU's requirements for gaining access to financial resources from the "NEXT Generation EU" program.

It's also worth mentioning the "indirect" support EVs get in Italy from RES incentive legislation, which includes incentive mechanisms for RES (self-consuming) installations that include EV chargers. Furthermore, until 2022, fiscal provisions allow private customers to request a 110 percent tax rebate ("super bonus") when purchasing an EV charger.

6.3 E-Mobility market

The market becomes more unbundled as it matures; for example, in Cyprus, where the market recently merged, market prices are not regulated, and the current charging system infrastructure is owned and managed by the Electricity Authority of Cyprus's Non-Regulated Activities Unit (EAC).

On the first invoice, each system user will be charged €25, and invoices will be sent to electric vehicle owners every two months. Other independent operators are expected to enter the e-mobility market in the future.

In Greece, the charging infrastructure can be owned and operated by the same company that also provides e-mobility services and processes the related financial transactions. The charging point operator can enter into electricity supply agreements with one or more electricity suppliers, and the suppliers can also act as a load aggregator for electromobility. EV recharging stations cannot be owned, developed, or operated by electricity DSOs unless they are solely for their own personal use. Furthermore, the prices that car owners pay are market-based.

Similarly, DSOs, including closed distribution systems, are prohibited from owning, developing, managing, or operating charging stations for electric vehicles under French law. Only in the case of exclusive network operator use and in the absence of a market player initiative can this principle be waived (after approval by CRE). Furthermore, the regulatory sandbox allows CRE to grant temporary exemptions to network and facility conditions of access and use, including electric vehicle charging infrastructures.

There is no regulated tariff for charging services in terms of pricing. If the recharge takes place at the customer's home, the price will be the one specified in the supply contract. The e-mobility service provider has set a free market price.

The charging point operator cannot impose its price structure or price on the e-mobility service provider's end-user in roaming. The developers of a public recharging infrastructure guarantee the infrastructure's

interoperability for roaming recharging under the terms specified by a future decree. Failure to comply with these obligations will result in an administrative fine, which will be determined by the terms of a future decree.

The same rules apply to DSOs in Italy as they do in France and Greece, and prices are free-market prices with a variety of payment schemes depending on the supplier.

Finally, the charging station operator, supplier, and charging point owner may all be different entities in the MobiE grid in Portugal. Furthermore, the car owner pays the supplier (CEME) and the prices are market-driven and agreed upon between the supplier and the user.

7

CONCLUSIONS AND RECOMMENDATIONS

The debates and discussions among energy sector actors, whether public or private, revolve around the same problem: how to successfully complete the energy transition while meeting climate change goals. Since 2014, MEDREG has stepped up its efforts by conducting research and analysis to better understand more effective mechanisms and tools for promoting renewable energy in the Mediterranean. Starting with an analysis of net metering systems in Mediterranean countries, certification systems of origin for electricity generated by RES and CHP, smart grids in Mediterranean countries, auction mechanisms to promote RES, and new regulatory options for RES integration.

The RES WG is focusing on a critical topic for achieving the energy transition once again today. Energy efficiency has always been undervalued in terms of its contribution to CO2 reduction and poorly assessed in terms of cost of implementation.

Experts recognized the critical role that energy efficiency can play in the decarbonization of industry at the COP 26, which coincides with the publication of this paper.

This paper gives us an overview of the existing policies and strategies in the Mediterranean region related to energy efficiency. Furthermore, it demonstrates the critical role of NRAs in improving energy efficiency, which varies from country to country. Nonetheless, energy regulators continue to play an important role, either by proposing an energy efficiency regulatory framework or by providing advice to the relevant authority (either another regulator or Ministry).

The report found that energy efficiency strategies, policies, and action plans exist on a local, national, and/or regional level in the Mediterranean region. There were differences in how they were implemented across Mediterranean countries. The sectors that are targeted vary by country, depending on the country's energy consumption profile and priorities.

In addition, the report provides an overview of the state of e-mobility in the Mediterranean region. A couple of years ago, the north shore began implementing the necessary regulatory framework and e-mobility deployment. However, there is a need to continue to expand the development of e-mobility by developing new mechanisms to support and encourage it. On the other hand, it is recommended that the south shore begin a discussion about the implementation of electric mobility and learn from the north shore's experience. In this regard, knowledge sharing and close cooperation among MEDREG members are critical factors in improving energy efficiency and e-mobility in the north shore while also allowing the south shore countries to benefit from the experiences and know-how of the north shore.

The evidence gathered in this report demonstrates the diversity of approaches as well as a common trend in the Mediterranean region to improve energy system efficiency.

There is a lot of room for improvement, and it needs to be taken advantage of: energy efficiency is now, more than ever, a cost-effective tool for achieving decarbonization goals. Energy efficiency is clearly "one"

of the policymakers' tools for promoting the energy transition, but it cannot be the only one. However, it appears to be of particular importance in the current historical phase, when rising fossil energy prices make it easier to reduce final consumption for any given GDP outcome, and the spread of renewable energy sources is unlikely to keep up with the expected development pace, at least in part of the Mediterranean region.

Building renovations in the private and public sectors, industry adoption of lower-energy-demanding techniques and equipment, smart distribution networks serving increasingly informed consumers, and the spread of electric mobility are all part of a package of actions and policies that are flexible enough to allow each MEDREG country to tailor their choices to their own characteristics, resulting in a well-balanced toolkit. Extensive research and a fruitful exchange of information made possible by this report leads us to conclude not only that the Mediterranean region has significant potential for energy transition as a result of energy efficiency promotion, but also that there is room for institutions, regulators, and stakeholders to collaborate productively.

Through tailor-made training, webinars, and workshops that foster discussions and debates among the NRAs, MEDREG's members will be able to accelerate the development of energy efficiency and e-mobility in the region.

The NRA's primary function of providing a stable, transparent, and competitive regulatory framework will continue to be critical. However, because the transition to a decarbonized energy system has already begun and is a foregone conclusion, NRAs will face numerous challenges, including rising energy prices and developing mechanisms to aid the transition. Aside from the challenges, NRAs will be confronted with new technologies, necessitating the acquisition of new skills and knowledge, such as digitalization tools and cyber-security.

MEDREG members must work together and share information on these critical issues, as well as start discussions about future policies and actions that will lead to a successful energy transition while minimizing the impact on energy costs and consumer costs.

8

ANNEX

Annex 1: Electric mobility in France

- ***Development strategy***

In 2015, the French legislation set a development target of 7 million – public and private – electric vehicle charging points (*installation de recharge des véhicules électriques*, IRVE) by 2030. And France's energy strategy, the Multiannual Energy Programme (*Programmation pluriannuelle de l'énergie*, PPE), set a development target of 2.4 million electric vehicles (EV) and plug-in hybrid vehicles (HV) by 2023. There are specific targets for French islands (*zones non interconnectées*, ZNI).Until now, there is **not one specific electric mobility scheme** but rather **a conjunction of several legal derogations and fiscal incentives** to anticipate, facilitate and develop electric mobility in France.

- ***Technical standards***

In 2017, a French decree imposed standards for the plugs installed on charging stations, whether for so-called "normal" charging or so-called "fast" charging. It allows for a homogeneous development of charging points.

- ***Legal framework***

In 2019, the French legislation marked a turning point in the development and exploitation of charging points. First, the 2019 Law **qualified the activity of the charging point operator (CPO) as a service provision** and not as a purchase of electricity for resale to final consumers. This qualification simplifies the act of recharging by not imposing rights and obligations deriving from the supplier status, as recommended both by the French national energy regulatory authority (*Commission de régulation de l'énergie*, CRE) and by the French Council of State (§§ 68-69).

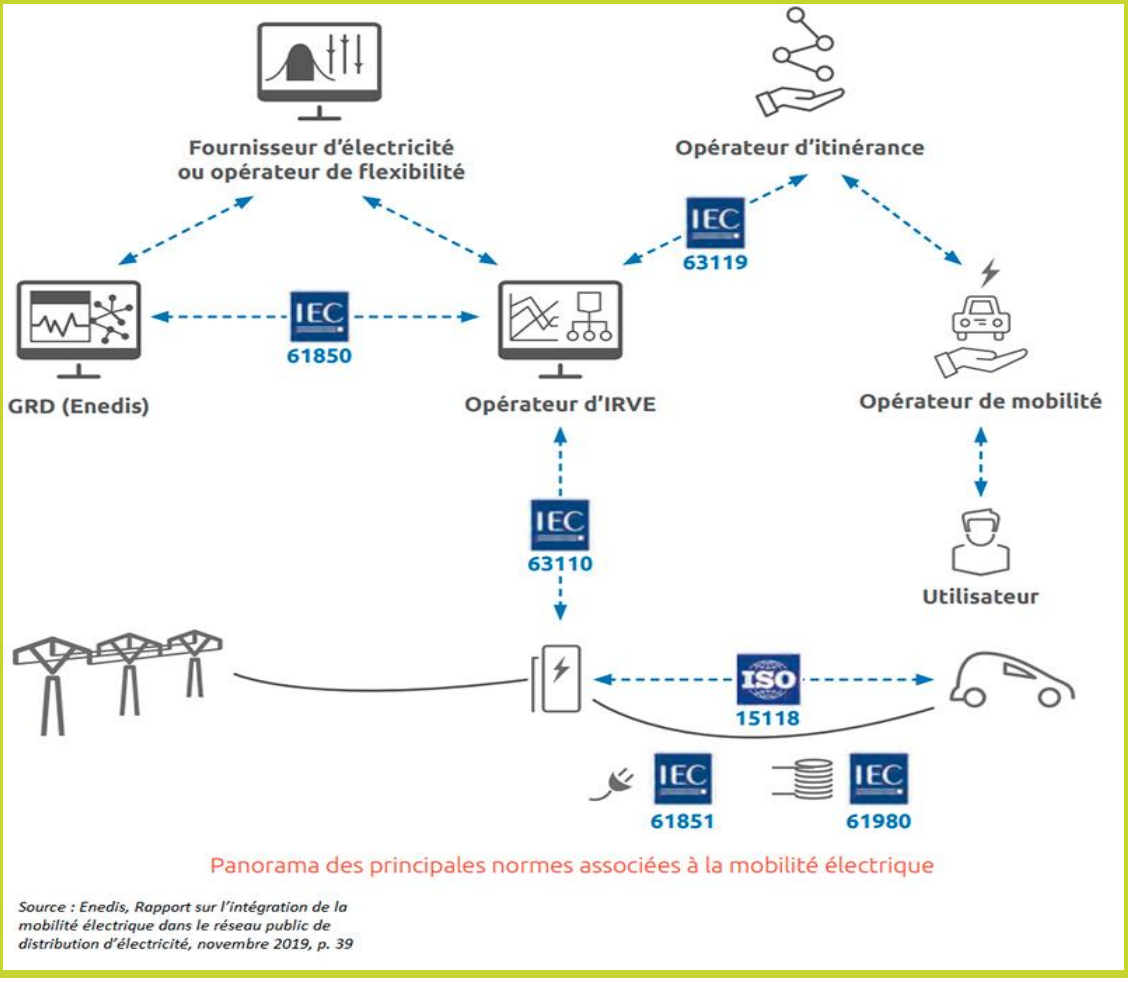
Second, the 2019 Law took **several measures to facilitate the connection of electric vehicle charging facilities**. It provided for (i) the extension and simplification of the right to plug in in collective buildings, (ii) the reinforcement of the obligation to equip and pre-equip parking lots as well as (iii) the possibility of creating development plans for charging infrastructures open to the public.

Third, for charging points which are open to the public or which are on the premises of entities carrying out public passenger road transport services, **up to 75% of their grid connection costs are covered by the electricity network tariff** (*tarif d'utilisation du réseau public d'électricité*, TURPE). The level of the cost coverage (i.e., 75% or less) is determined by the government after consulting the regulator.

- ***Entities involved***

The following diagram describes the complex chain of actors participating in electric mobility actions:

How to access the activity



Panorama des principales normes associées à la mobilité électrique

Source : Enedis, Rapport sur l'intégration de la mobilité électrique dans le réseau public de distribution d'électricité, novembre 2019, p. 39

Free access to the activity

As shown in the diagram above, the activities of supplier (*fournisseur*) and charging operators (*opérateur d'IRVE*) are unbundled from the activities of the network operators (*GRD*). These activities are also open and market oriented.

Regulated access to the activity

The installation and maintenance of charging stations for EV with a power of more than 3.7 kW are subject to certain obligations, in particular a **training and qualification obligation**, whether for individual or collective housing or a building in the tertiary sector.

By law, distribution system operators (DSOs), including closed distribution systems, may not own, develop, manage, or operate charging points for electric vehicles, except for their own needs, or if the service is not provided by market actors (in which case the authorization by the regulator is needed and limited in time). The second exception pertaining to an inexistent or insufficient market offer also applies to municipalities.

- ***Costs and tariffs involved and billing arrangements***

Whether the charging point is accessible to the public or only available to users on a private site, the price for B2C charging will be **market-based**.

In roaming (i.e. the ability for the user to charge an electric vehicle on the networks or charging stations of different charging infrastructure developers; *itinérance*), several private operators may be involved as shown in the diagram above. **Billing arrangements** between the charging point operator (CPO ; *opérateur d'IRVE*), the eMobility service provider (EMSP; *opérateur de mobilité*) and the interoperability platform (*plateforme d'interopérabilité*), are provided for in agreements that establish B2B market-based prices.

There is **no typical prices structure** for charging at publicly accessible charging stations, as explained by the French Senate in its 2019 legislative report :

(i) Local authorities generally charge for access to charging stations to cover operating costs, but with widely varying fee schedules.

(ii) Some car manufacturers creating fast or ultra-fast charging networks include part of the cost in the price of the vehicle but may also charge for all or part of the charging.

(iii) Large retail stores, such as supermarkets, may provide charging for free in exchange for the customer's visit to the store.

(iv) Some charging point operators also set the price as a flat rate to cover operating costs.

Overall, the average costs of charging stations open to the public vary, but the grid connection costs can be significant, especially for fast charging stations when they involve reinforcing the network.

- ***Financial and fiscal incentives***

Article 273 septies B of the General Tax Code (*Code général des impôts*, CGI) provides for the deductibility of **VAT** on electricity recharges for electric vehicles exclusively, excluding plug-in hybrid vehicles. Normal 20% VAT still applies when buying or renting EV or HV.

The **Tax Credit for Energy Transition**, created in 2014 to encourage owners to invest in electric vehicle charging infrastructures (IRVE), was extended in January 2021 to tenants and free occupants. The tax credit is equal to 75% of the amount of eligible expenses up to a ceiling of 300 euros per system of charge.

Furthermore, a number of bonuses exist to support electromobility. First, there is a **conversion bonus up to 5,000€**, for private or professional, switching their old thermic vehicle to EV or HV, new or second-hand. The amount of the conversion bonus depends about the beneficiary. The conversion bonus is cumulative with an **ecological bonus** up to 7,000€ for EV and up to 2,000€ for HV. The amount of the ecological bonus depends on the type of beneficiary (private or moral person). The conversion bonus is cumulative with a **microcredit** for modest households.

Finally, several mobility-related operations are eligible to **energy saving certificates** (*certificats d'écononomie d'énergie*, CEE) through standardised transport forms.[17]

Annex 2: Electric mobility in Greece

Primary legislation defines issues relating to e-mobility. The definition of the Charging Point Operator- CPO was included in Law 4277/2014, which amended Law 4001/2011. Following an opinion from the Regulatory Authority for Energy (RAE), the law called for the adoption of a Joint Ministerial Decision to clarify the role and obligations of recharging point operators.

In February 2019, RAE issued Opinion No. 7/2019. In accordance with Directive 2014/94/EU, the Opinion defined the terms of all parties involved (EV charging station owners, charging point operators (CPOs), Electromobility service providers (EMSPs), EV load aggregators, and so on), described the proposed market model for publicly accessible EV recharging infrastructure, addressed specific interoperability issues, and foresaw the creation of a national registry for public recharging infrastructure (2 year compliance period).

The RAE's Opinion No 7/2019 was incorporated into Law 4710/2020, which included additional provisions to promote e-mobility in Greece, as well as provisions for the development and operation of the required EV recharging infrastructure. A registry for EV market participants was established under the same law. Under the provisions of Law 4710/2020, a new unit at the Ministry of Energy has been established to develop a National Plan and track all e-mobility developments.

- ***Entities involved (suppliers, charging operator, management entity, regulator, national authorities, municipalities)***

Charging Point Operator: A natural or legal person who is involved in the operation of charging infrastructure for which electricity is provided in order to provide electric vehicle charging services.

Electromobility Service Provider: A sole proprietorship or a legal entity that provides e-mobility services to contracted parties and is registered in the General Commercial Registry.

A natural or legal person who owns an EV charging point is known as the owner of the EV charging infrastructure.

Transaction processor for electromobility: A sole proprietorship or legal entity registered with the General Commercial Registry with the goal of developing and operating information systems to facilitate data exchange and financial transaction processing between Charging Point Operators and Electromobility Service Providers in order to achieve charging infrastructure interoperability.

Electromobility load aggregator: A legal entity that aggregates the load of electric vehicles connected to the electricity grid, allowing them to participate in the electricity market and providing services to the DSO.

Electricity supplier: A natural or legal person who engages in the business of supplying electricity (including supply of electricity to the EV charging points).

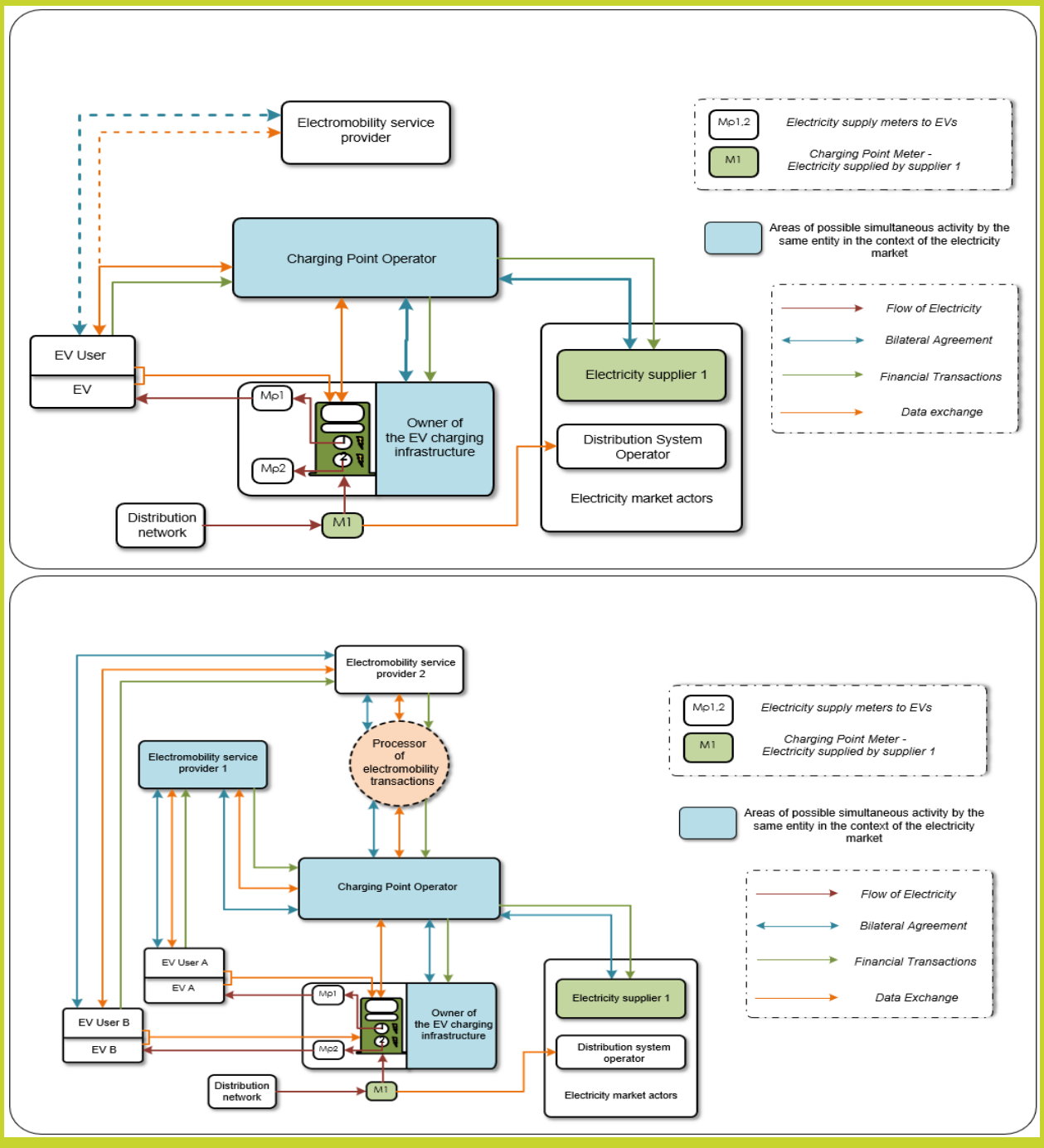
RAE (regulator of energy): The energy regulator is in charge of developing the electromobility regulatory framework. The Ministry and the NRA will work together on issues that fall under its purview and are related

[17] For more details on the CEE mechanism, see CRE's MedReg Case Study on Energy efficiency in electricity consumption.

to the energy market. To this end, RAE provides the Ministry of Energy with its Opinion on various electromobility issues.

The Ministry of Energy is in charge of developing electromobility policies. Furthermore, Law 4710/2020 mandated the Ministry of Energy to develop a National Action Plan based on the targets set forth in the National Energy and Climate Plan (NECP) and the National 2050 long-term strategy.

Municipalities (local governments): Local governments must develop Electric Vehicle Charging Plans that include potential locations for the development of a sufficient number of publicly accessible EV charging points and public EV parking spaces. They are also in charge of holding an open tender for the development of EV charging infrastructure. Except for DSOs, any party interested in participating in the market can participate in these tenders.



The second figure is a slightly different as it represents the EV market model of operation for EV users (in this specific figure its EV user B) that have a contract with an e-mobility service provider that uses a Processor of electromobility transactions to settle his financial transactions with the charging point operator.

- **To whom does the user (owner of the car) pays the charging service?**

The user pays the Charging Point Operator or to the Electromobility Service Provider for the charging service.

- **Who sells the energy is the one who operates the charging station? Is it the same entity? Is there any kind of unbundling?**

It could be the same entity. Furthermore, the same entity can be the owner and operator of charging infrastructure, as well as provide service related to e-mobility and process the relevant financial transactions. The charging point operator can conclude electricity supply agreements with one or more electricity suppliers while the suppliers may also assume the role of the Electromobility load aggregator. The electricity DSOs cannot own, develop, or operate EV recharging stations unless they are solely for their own private use.

- ***How to access the activity***

The legislative framework for the participation fees and registration requirements is not completed yet.

- ***Costs and tariffs involved and billing arrangements***

The price is not regulated.

The estimated costs of the charging, on a charging/public station, of 12.5 kWh) including taxes: About 5€ but it depends on the terms and conditions of usage.

Typical prices of structure ((€/kWh, €/min, activation cost …): Some charging point operators charge just a fixed fee per session (e.g., 7€/session). Others may charge per minute (e.g., 0.025€/min) or per hour. The costs may also be a mix of the above (e.g., 0.5€/session + 0.025 €/min or 1€/session + 0.27€/kWh). There is not a typical price structure.

Annex 3: Electric mobility in Portugal

- **General description**

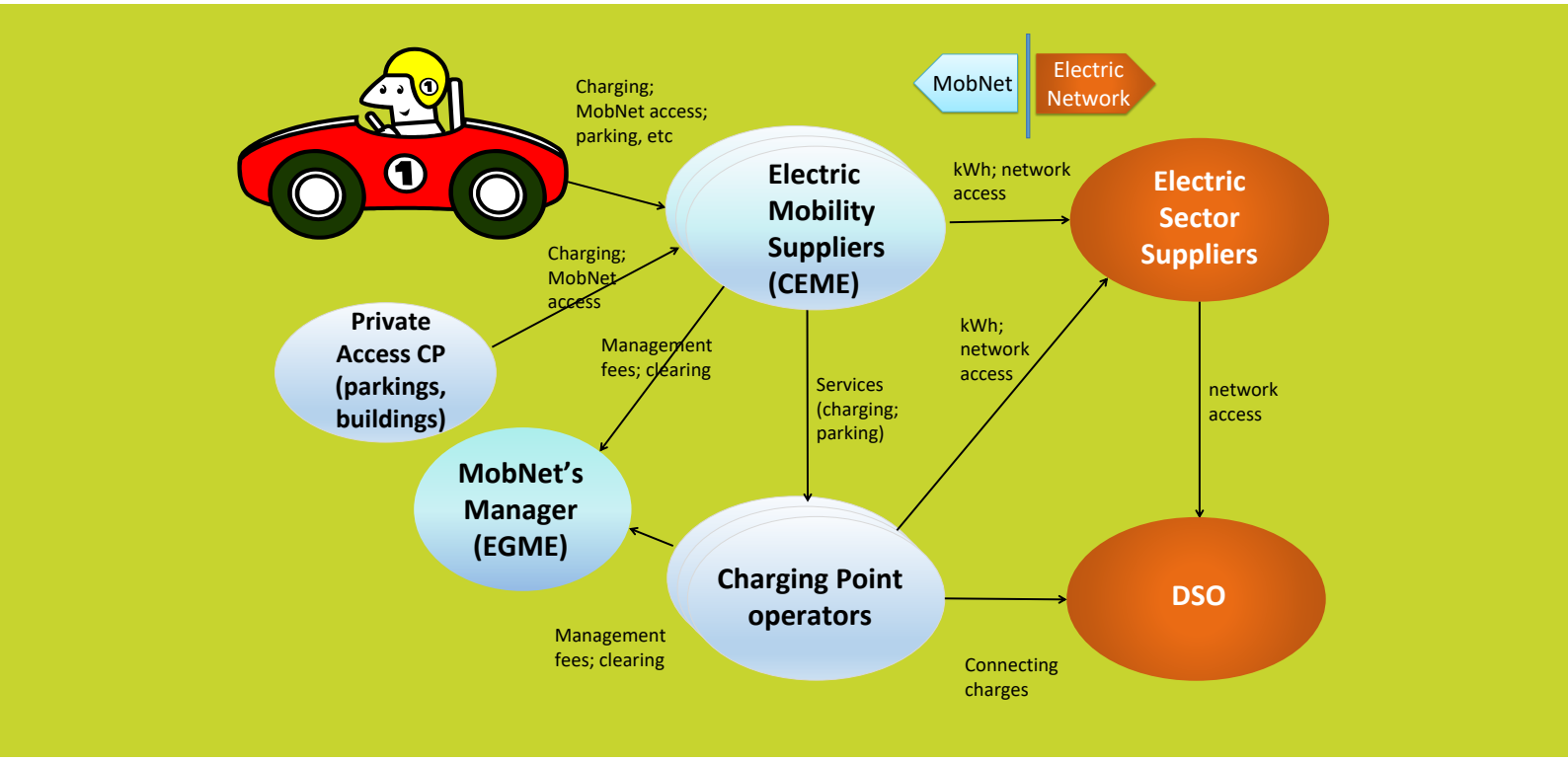
In 2010, the Portuguese legislation defined an electric mobility network model, updated in 2014[18]. The Portuguese framework foresees two main possibilities for charging electric vehicles (EV): private and public. Private means the possibility to charge an EV at home or at a charging point in a shared garage (for example). The public possibility is based on a fully interoperable platform, managed by MOBI.E (the public electric mobility network operator), where all charging station operators (OPC) operate on a roaming basis, i.e. the OPCs grant access to all electric vehicles (EV) regardless of the supplier (CEME) to which the consumer is contracted. This is true also in the islands, Madeira and Azores.

The car owner only needs to have a contract with a supplier (CEME) and can go to any charging station, identify themselves (with an RFID card or through an App), and charge the car. Subsequently, the owner of the car will pay the contracted price with their supplier plus the cost of using the charging station. Afterwards, there is a settlement between the supplier (CEME) and the various charging stations used by

[18] Decree-Law no. 90/2014.

the car owner. A large quantity of data is needed to deliver this scheme. All the information is managed centrally by MOBI.E.

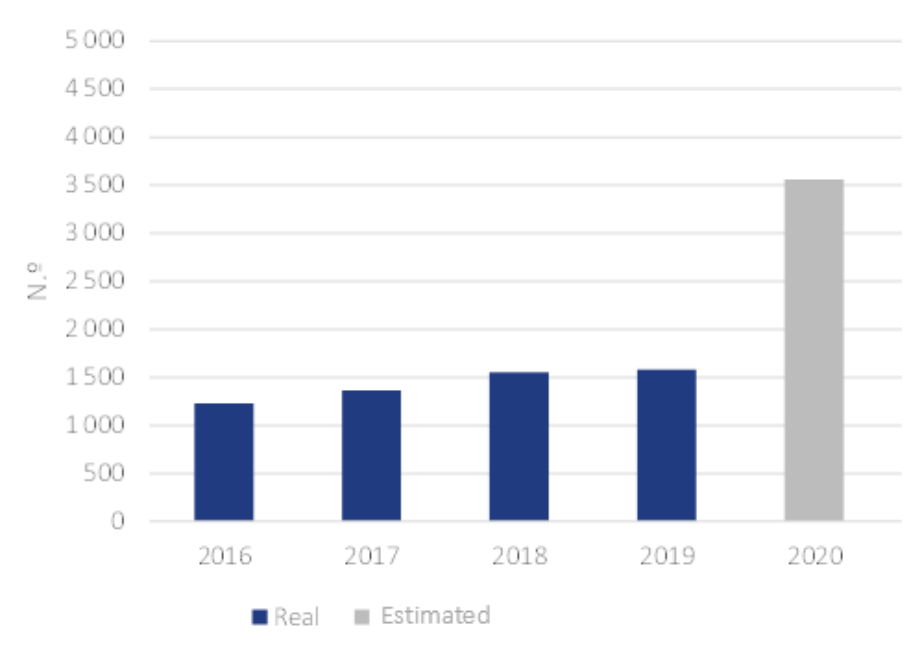
The following diagram describes the scheme:



The activities of the supplier (CEME) and the charging operators (OPC) are unbundled.

The next graphic represents the evolution of the number of the charging points[19] in Portugal in the public grid (MOBI.E) between 2016 and 2020, showing the expected growth in charging points. The geographic location of charging points is available at MOBI.E website.

[19] A charging station usually has several charging points.



MOBI.E began operating in 2010 as a pilot project. During this period, the use of the charging stations (and the energy consumed) were free of charge for users (and recovered by a government fund). The commercial phase started in November 2018 for fast charging points, with users starting to pay according to the model described above. The full implementation of the model (commercial phase for all types of charges) began in July 2020.

- **How to access the activity**

Access to the activity of supplier and charging point operator is open and market-based, after fulfillment of the technical requirements and payment of licensing and registration fees. Charging stations on public roads require municipal authorization.

The centralized management of the network is carried out under a legal monopoly regime and is attributed to MOBI.E (100% state-owned).

- **Cost, tariffs and billing arrangements**

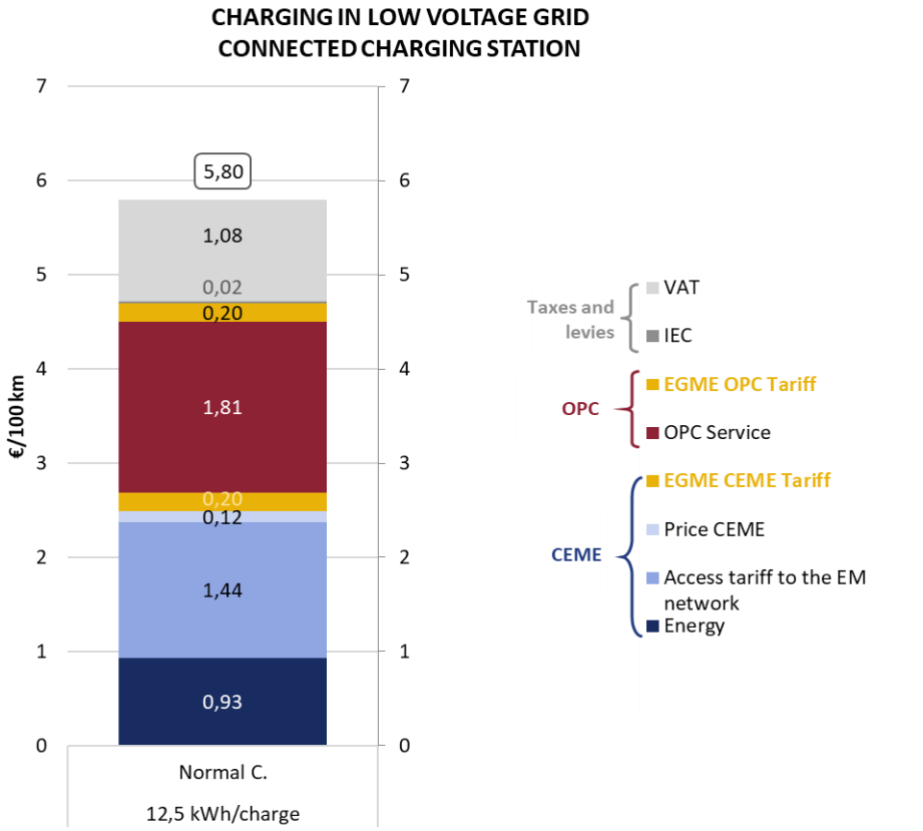
The price paid by the car owner to the supplier (CEME) is market oriented and established between the supplier and the user.

The use of the charging points has also a free price, set by the charging point operator. The user can choose the charging point they prefer, taking into account the announced price and other variables, such as location.

The regulator (ERSE) establishes the remuneration of the management entity (MOBI.E) because it is a legal monopoly activity. According to ERSE's Regulation, ERSE establishes the remuneration of MOBI.E's activity and tariffs paid by the suppliers (CEME) and by the operators of charging points (OPC) to MOBI.E. ERSE will set these tariffs for the first time in a near future.

Concluding, the total price paid by users includes three price components: taxes and levies, supplier (CEME) charges and charging station (OPC) charges. The regulated costs of the management entity MOBI.E are recovered within the CEME and OPC charges.

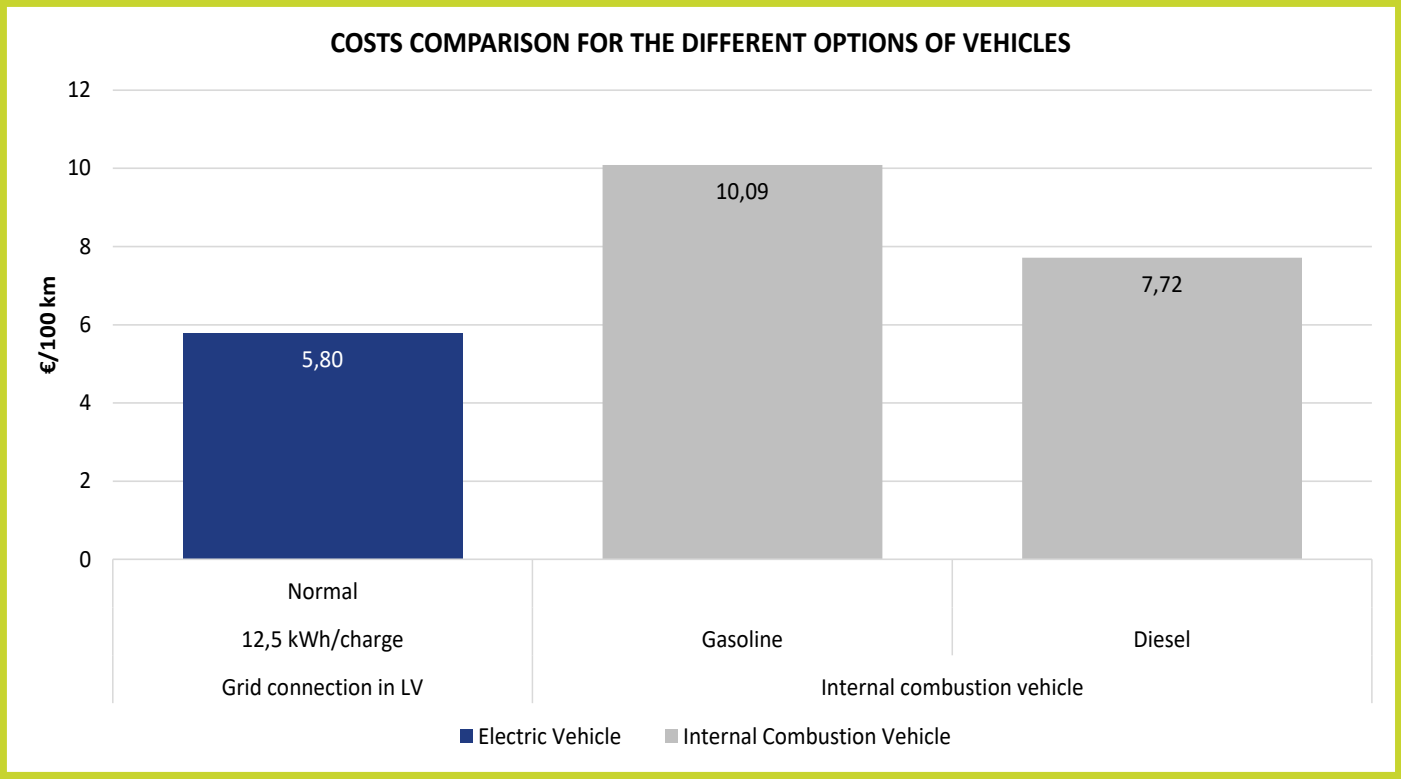
Suppliers and charging stations can use different cost variables to establish their prices, e.g., €/kWh, €/minute and activation fee. At fast charging points it is more common € / minute.



Note: provisional values

Taking into account the actual market prices (supplier – CEME plus charging operator – OPC), the average cost of a load of 12,5 kWh (100 km) is €5,80. The previous figure shows the breakdown of costs.

The following figure compares the operating costs (that is, variable costs) of using an electric vehicle (charged at the MOBIE grid) with a combustion vehicle. The figure illustrates that it is possible to reach savings between 25% and 50% when using an electric vehicle.



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