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***EXECUTIVE  
SUMMARY***





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# EXECUTIVE SUMMARY

As MEP *to 2050* goes to print the World and the Mediterranean region are still in the middle of a global crisis. The uncertainty about the medium to longer term is even greater than usual, as behaviours of governments and consumers in a post-COVID world are unknown. The 2020 economic contraction and steep fall in primary energy prices are caused by forces that are genuinely new to the modern energy sector. They are not the result of geopolitical, physical, or macro-economic disruptions. The tension between short-term financial imperatives and the longer-term need for investment and adaptation is unusually high under this pandemic. COVID-19 has made even more apparent the duality of economic growth and environmental sustainability, reviving the importance of economic viability and comparative advantage — and the role of regional cooperation with close neighbours.

While 2020 was for many a target year to refresh their vows to decarbonization, the unprecedented shocks of the global pandemic have threatened to derail existing, as well as future targets and energy strategies, while at the same time, they have reemphasized the importance of adopting urgent measures to curb global warming and build societies in a way to minimize the human impact on the environment.

Limiting the increase in global average temperature to 1.5°C, in line with the most ambitious objectives of the Paris Agreement, will require an unprecedented transformation of modern societies and profound emission reductions in all sectors of activity. The Mediterranean region, a home to 7% of the world population, is particularly exposed the effects of climate change.

The energy transition was already well underway in parts of the Mediterranean region before COVID-19. The crisis has brought forward the adoption of solutions and behavioural changes that support the energy transition, such as greater reliance on remote working and education. However, there is no certainty whether this will continue and to what proportion in the future. The recovery programmes put in place in each country and by the European Union will determine the nature and the speed of the transition in the region and could reinforce trends that were already apparent.

MEP *to 2050* considers three scenarios which explore different pathways for the Mediterranean energy system and its 26 member countries to 2050, taking into account the impact of the COVID-19 health crisis in its prognoses. For this outlook, OME has updated its Reference Scenario as a base scenario and developed 2 alternative scenarios: an in-house OME-only Proactive Scenario and a joint scenario, developed with the UfM platforms for the European Commission, the ProMED “Near Zero Carbon” Scenario.

- The **Reference Scenario (RS)** is a Baseline Scenario (BAU), which takes into account past trends, current policies and ongoing projects. It incorporates the Nationally Determined Contributions (NDCs), but it assumes that international financing and other aids will not be forthcoming. Under this scenario, the increased demand for electricity will be met with the traditional primary energy sources and with others that will be available in the future.
- The **Proactive Scenario (PS)** is based on the implementation of strong energy efficiency programmes and increased diversification in the energy mix based on the NDCs submitted by each country. It assumes an increase in clean fuels and technologies substituting to oil and coal input in electricity generation capacity.
- The **ProMED “Near Zero Carbon” Scenario (PM)** foresees more ambitious measures for energy efficiency, significant technology development to further curb CO<sub>2</sub> emissions, as well as increased diversification in the energy mix, tailored for each country based on the

expertise drawn from the extensive works of the three UfM platforms on gas, electricity, renewable energy and energy efficiency. It assumes a substantial increase in renewables, especially in power generation, but also in end-usage with the increase of storage and the introduction of hydrogen. It also assumes a sizeable increase in building efficiency refurbishing, especially for new constructions.

The Mediterranean energy system must undergo a fundamental restructuring and reshaping in order to provide the necessary level of decarbonization, which would create challenges but would also provide various opportunities.

The energy mix is expected to become far more diversified with a corresponding increase in the role of renewable energy as the Mediterranean countries continue down the path of electrification. The scale of this shift varies significantly across the three scenarios, with the share of hydrocarbons in primary energy declining from 76% in 2018 to between 37-73% by 2050 and the share of renewable energy increasing to between 19-57%.

Under the Reference Scenario, CO<sub>2</sub> emissions will increase at the same pace over the next 30 years as they have over the past 3 decades with a doubling of South Med emissions by 2050. In a Proactive Scenario, emissions could be reduced by 30% and by 73% in a ProMED Scenario by 2050.

Regardless of the scenario, the South Mediterranean countries will account for all increase in energy demand through 2050 and will overtake the North Mediterranean demand by early 2030's. The demand in the North will continue to decrease.

Decarbonization would lead to a significant shift away from traditional hydrocarbons (oil, natural gas and coal) towards non-fossil fuels, led by renewable energy. Most of all capacity additions will stem from wind and solar technologies with green gases- biomethane and hydrogen – and battery storage playing a pivotal role in the transition away from fossil fuels. Renewable technologies would account for 90% of the generation mix in the North Mediterranean and over 70% in the South.

Considering the paramount importance of energy security, especially for South Med countries, the implementation of the ProMED “Near Zero Carbon” Scenario would allow the region to become a net exporter as a whole and for importing countries to drastically reduce their dependence and producers to increase their revenues.

In the ProMED Scenario, non-fossil fuels account for the majority of global energy from the early 2040s onwards, with the share of hydrocarbons in total energy demand halving over the next 30 years. This increased diversification of the energy mix is further enhanced by the growing importance of electricity and green gas (biogas, biomethane and hydrogen) at the final point of energy use.

Achieving carbon neutrality for the Mediterranean region in 2060 would not only involve a significant further acceleration in the deployment of clean energy technologies over the next 30 years but would also require wide-ranging behavioural changes.

The transition to new sources of energy requires major changes to mobility, buildings and industry infrastructure requiring substantial investments. Between 4 and 6 trillion Euros will be needed to achieve these scenarios over the next 30 years, with the bulk of it for implementing drastic energy efficiency measures and also for developing renewable technologies.



## ENERGY DEMAND

Mediterranean energy demand stood at 1 022 Mtoe in 2018. The region was hit hard by the COVID-19 pandemic in 2020 bringing energy demand down to 937 Mtoe – a 9% decrease compared to 2019. Total energy demand is expected to return to its pre-COVID-19 levels in 2023, though trends and timing vary between countries and fuel types. The North Mediterranean countries have been hit the hardest, mirroring the severity and length of lockdowns put in place. Low carbon fuels have proven to be the most resilient to the crisis with renewables achieving a record high increase. Electricity, oil and coal demand have been impacted the most, while demand for renewables proved resilient.

The Mediterranean region has been undergoing continuous changes in energy consumption. The crisis has in some ways anticipated foreseen trends: declining demand for fossil fuels, shift in mobility and in use of electricity in final energy consumption and the need for flexibility in the power sector to facilitate penetration of intermittent renewables and manage congestion on the network.

The structure of energy demand has shifted markedly from a concentration in the industry sector to a wider range of consumption over the last 30 years. Power generation has been taking an increasing share and that trend is set to continue over the outlook period to 2050. Current trends will likely lead to a 37% increase in the region's overall energy demand by 2050. The overall Mediterranean trend hides great disparity across the region. Energy demand in the Mediterranean countries is projected to increase by less than 1% per year on average to reach 1 404 Mtoe in the Reference Scenario and 1 038 Mtoe in the Proactive Scenario by 2050. The South Mediterranean countries currently account for 40% of the region's energy demand, which will expand to 61% in the Reference Scenario and to 44% in the Proactive case by 2050.

Energy demand in the Mediterranean is expected to reach 1 404 Mtoe in the Reference Scenario, 1 043 Mtoe in the Proactive Scenario and 846 Mtoe in the ProMED Scenario by 2050. The potential for energy efficiency and conservation is substantial in the Mediterranean region. According to the Proactive Scenario, around 26% of primary energy demand can be saved by 2050 in the whole region. The potential saving in 2050 amounts to 366 Mtoe. In the ProMED Scenario, savings could reach 559 Mtoe and the mix would be markedly different. Primary energy demand decreases by around 22% in the ProMED scenario over the Outlook while it increases by around 37% in the Reference Scenario.

In OME's outlook to 2050, energy demand is higher in the South Mediterranean countries and lower in the North in all three scenarios. By 2050, South Mediterranean countries' energy demand will grow to account for 67% in the Reference Scenario, 73% in the Proactive case and up to 86% in the ProMED Scenario.

While oil demand will continue to increase in the Reference Scenario, particularly for transport fuels, with fossil fuels remaining as the dominant energy source in the Mediterranean's primary energy mix in 2050, under the Proactive scenario and more so in the ProMED Scenario, oil will be increasingly overtaken by electricity, gas and renewables through 2050.

Natural gas continues to increase significantly in primary energy demand over the next 30 years. In 2050, natural gas will account for 31% of Mediterranean energy demand at 442 Mtoe in the Reference Scenario. In the Proactive Scenario, natural gas is projected to give way to renewables in power generation with a reduction of its share in demand to 28% at 295 Mtoe. Natural gas

demand share would decrease further in the ProMED Scenario down to 20% with the introduction of green gases – biomethane and hydrogen to mitigate. Green gases are expected to be key in this respect making-up for up to 25% of total gas demand in 2050 in the ProMED Scenario.

Encouraged by incentives, forward policies and technological advances, renewables, especially non-hydro renewables, are expected to continue robust growth trends to 2050. Renewables will expand on average by 2.7% per year to contribute 19% of energy supply in the Reference case in 2050. With a more favourable outlook in the Proactive Scenario, renewable supply increases 3.8% per year and will overtake both oil and gas demand by the end of the 2030s to account for 35% of the energy mix in 2050. Both the North and South Mediterranean sub-regions will experience sustained growth in non-hydro renewables.

Per capita energy demand in the South Mediterranean is currently less than half that in the North. As South populations improve their access to more efficient modern energy services, this average should increase substantially to 2050 (+47% compared to current levels) under the Reference Scenario. This increase in per capita energy demand in the South could be capped efficiently in the Proactive Scenario, yielding a 5% increase to 2050 and a 17% decrease in the ProMED Scenario.

Energy savings in total final energy consumption could reach 254 Mtoe in 2050, about 70% of total energy savings. Most of the end-use energy savings stem from the South Mediterranean and from the buildings and transport sector.

Buildings are the highest energy consuming sector in the region, accounting for 34% of total final energy consumption in 2018. Given the outlook for population growth in the South Mediterranean, the buildings sector could yield 79 Mtoe of energy savings in 2050 alone. In the ProMED Scenario, the buildings sector energy consumption will be reduced by a third by 2050, and the energy mix will shift markedly away from fossil fuels with a strengthened electrification process of end-usages.

The transport sector is the second highest energy consuming sector in the region accounting for 32% of the regions energy consumption. Currently nearly all transport consumption is oil (94% in 2018). Oil remains the main fuel in the sector in the Reference and Proactive Scenarios but is set to see its share decrease drastically in the Proactive Scenario to reduce to 65% in 2050 in favour of electricity, gas and biofuels. In the ProMED Scenario, the transport sector will be heavily decarbonized with oil accounting for less than a third of transport energy consumption in 2050 and electricity usage soaring.

Energy consumption in the industry sector is set to increase over the outlook period in both Reference and Proactive scenarios – +53% in the Reference Scenario and +20% in the Proactive Scenario mainly on account of industry energy demand in South Mediterranean countries. Substantial energy savings can be achieved through energy efficiency measures and technology improvements. Electricity and oil savings are expected to contribute the most to energy savings in the Proactive Scenario. In the ProMED Scenario, Mediterranean industry sector will still remain strongly carbonated in 2050 but demand increase would be limited to 8% and emissions would be reduced further by the switch to gas and increased use of electricity and renewables.

The electrification of the end-use sectors is set to continue and lead electricity to account for the largest share of total final consumption over the outlook period in all three scenarios. Electricity demand sees robust growth in the Reference and Proactive scenarios, albeit at a lower rate in the Proactive Scenario. Electricity demand in the Mediterranean region is increasing much more rapidly than the rate of total energy demand. Important energy savings can be achieved, provided appropriate policies and measures are implemented rapidly for both the supply and demand sides.

In the ProMED Scenario, the electrification process will be amplified, bringing electricity demand to account for 41% of Mediterranean total final consumption. Electricity demand will increase by 75% to 2050 in the ProMED Scenario with an increased share in all end-usages by 2050. This increase will be strongest in transport where a 63-time increase compared to current levels is expected. Electricity demand will more than double in the South Mediterranean and increase by 43% in the North Mediterranean.



## HYDROCARBONS & SYNTHETIC FUELS

The Mediterranean region has less than 5% of the world's proven oil, gas and coal reserves. The North Mediterranean is relatively well explored. In contrast, most areas in the South, especially offshore, are either underexplored or unexplored.

The Mediterranean region is estimated to hold substantial undiscovered (or yet-to-find) resources. The region's oil and gas resources represent respectively almost 7% of world's conventional oil resources and over 9% of world's conventional gas resources. More precisely, the volume of undiscovered coal resources in the Mediterranean region is around 45% more than the region's current coal reserves (almost all lignite), undiscovered oil resources are 60% more than oil reserves, and natural gas resources are more than three times the gas reserves.

Development of unconventional resources in the region is still in its infancy. However, there is a growing consensus among industry experts that those unconventional resources, especially in the North, are unlikely to be produced commercially and in significant volumes in the future.

The year 2020 has brought several challenges for the oil and gas industry in the Mediterranean region. First, the COVID-19 pandemic has led to substantial drops in oil and gas demand. Second, oil and gas oversupply that was already building up before the pandemic has led to plummeting prices. The combination of these two developments has forced all major international oil and gas companies to take drastic measures on capital expenditures. In some cases, this has caused delays, postponements or temporary suspensions of exploration and drilling activities, as well as some of the field development and infrastructure projects. At the same time, accelerating global societal and political advocacy for energy transition and decarbonization policies continue to put pressure on the hydrocarbons industry.

Oil production in the Mediterranean region decreased significantly since the early 2010s, to less than 3 million barrels per day (mb/d) in 2020, with Libya dropping the most due to the political situation. Oil production in the region will increase slightly and remain stable in the next three decades. More precisely, production is estimated to increase to 3.9 mb/d by 2040 and decline to 3.8 mb/d in 2050. Increase in Libyan oil production will compensate decline in most countries.

Natural gas production in the Mediterranean increased by 120% between 1990-2008, declined till 2015 (due to Egypt), and rebounded to 196 bcm in 2020. In the future, gas production in the region is estimated to increase by about two thirds until its peak at 325 bcm in early 2040s, remain above 300 bcm for a while and then decline to 290 bcm by 2050. Algeria and Egypt will remain the largest gas producers.

Coal production in the Mediterranean region declined by almost 25% between 1990 and 2020. It is estimated to peak at slightly above 210 million tons (Mt) in the early 2030s, remain at around that level for a while and decline to 160 Mt in 2050. Turkey will remain the largest producer in the region.



To reach carbon neutrality implies a major transformation of economies and energy consumption patterns. Substantial reductions in hydrocarbons use are key to achieving this goal. In the ProMED Scenario total use hydrocarbons would be reduced by more than half by 2050. Most of the reduction in absolute values would occur in oil and coal use. The efforts in moving away from hydrocarbons will not be equal in the North and South Mediterranean. In 2018, the North and South Mediterranean sub-regions used more or less the same amount of hydrocarbons. The share of the North in total Mediterranean hydrocarbons use will decline substantially over the next decades, from 51% in 2018 to less than 20% in 2050 in the ProMED Scenario. Although more hydrocarbons are estimated to be used in Mediterranean in the Reference Scenario, substantial reductions are expected in the Proactive and ProMED scenarios in 2050. The increase in the use of hydrocarbons in the Reference Scenario is in fact due to the South Mediterranean sub-region. In the North Mediterranean, however, the use of hydrocarbons is estimated to be lower in all scenarios.

Coal consumption in the Mediterranean region is set to decline in the next decades irrelevant of the scenario. However, the speed of decline will depend on the future path chosen concerning the decarbonization and energy efficiency efforts. Compared to 2018, coal consumption in 2050 in the Reference Scenario will be almost the same. In the Proactive Scenario coal consumption would be reduced by three-quarters and in the ProMED Scenario by 90%. In this scenario there will be only a few countries in the Mediterranean region using coal. Of these, the second largest lignite consumer in the world, Turkey, will remain the largest coal user accounting for two thirds of the coal use in the Mediterranean region.

Gas consumption in the Mediterranean region is estimated to increase by about 45% between 2018 and 2050 in the Reference Scenario due to strong growth in many economies in the South Mediterranean. In the Proactive Scenario, as a result of switching from coal and oil to gas, combined with aggressive implementation of energy efficiency measures, gas demand in 2050 would be almost the same as that of 2018 in this scenario. The ProMED Scenario results in lower gas demand than the Proactive Scenario due mainly to economy wide decarbonization efforts. Therefore, gas demand in 2050 in ProMED Scenario is a quarter less than that of 2018.

The natural gas sector has already started to embrace the idea of “greening” natural gas by developing and using more renewable gases (such as biomethane from organic sources, bio-LNG and synthetic natural gas) or by blending hydrogen—produced either from water using renewable electricity (green hydrogen) or from natural gas combined with CCUS (blue hydrogen)—into existing natural gas networks. However, the scale of their development will be rather limited, particularly in the South. The share of renewable and low carbon gases in total gas demand is expected to be at about 10% (or over 30 Mtoe) in 2050 under the Proactive Scenario and close to 20% (nearly 45 Mtoe) in the ProMED Scenario. The type of gases in those amounts will depend on government policies and industry involvement.

When compared to the quantity of gas use in 2050 in the Reference Scenario, in the ProMED Scenario, all but one sector see significant reductions. The largest relative reduction occurs in power generation, around 70%, followed by the buildings which is more and more electrified.

Oil demand in the Mediterranean region is set to decrease in the Proactive and ProMED scenarios compared to the Reference case which foresees a 30% increase between 2018 and 2050. In the ProMED Scenario, oil demand in the Mediterranean region in 2050 is estimated to be about three quarters less than its value in 2018 and 80% less than the 2050 demand under the Reference Scenario. In the North, demand for oil will decrease in all scenarios whereas in the South a decrease in oil demand is expected to occur only in the ProMED Scenario.

The sharpest difference between the two scenarios in 2050 would be observed in power generation (almost 100%), followed by buildings and transport sectors.

One of the most important implications of the ProMED Scenario is on the hydrocarbons trade balance. The Mediterranean region was a net hydrocarbons importer in 2018. In the Reference Scenario this balance would deteriorate by 40% in 2050. In the Proactive Scenario, it could be reduced by almost 70%. In the ProMED Scenario, however, the region as a whole could become a net hydrocarbons exporter, thanks to substantial reductions in coal and oil consumption. In fact, this would be due to the South Mediterranean, because although the North Mediterranean will remain net hydrocarbons importer in all cases, the South Mediterranean could be a net hydrocarbons exporter in the ProMED Scenario by 2050.

A major implication would be felt on the oil trade balance. While the region as a whole would be more dependent on imports to meet demand in the Reference Scenario between 2018 and 2050, this dependence would be reduced by more than half in the Proactive Scenario and would be eliminated in the ProMED Scenario. What more, while it will remain a major net oil and gas importer in the Reference scenario, in the ProMed Scenario, the Mediterranean region would become net oil and gas exporter,

This picture would look more interesting in the subregional level. In the North Mediterranean due to sharp decline in oil use, dependence on imports would be reduced drastically in the Proactive Scenario and be almost eliminated in the ProMED Scenario. In contrast, the South Mediterranean would turn from an oil exporter into a net oil importer in the Reference Scenario and barely maintain its exporter status by 2050 in the Proactive Scenario while becoming a net oil exporter in the ProMED Scenario.

Gas trade follows a similar trend as oil. The Mediterranean region as a whole would remain a net gas importer in the Reference and Proactive Scenarios but would be a net gas exporter in the ProMED Scenario in 2050. This region wide picture has two distinctive characteristics at the sub-regional level. Irrespective of scenario, the North Mediterranean will remain a net gas importer, but the magnitude of imports will diminish sharply from Reference to ProMED Scenario. Whereas the South Mediterranean region will turn into a net exporter by 2050 already in the Proactive Scenario, and even more so in the ProMED Scenario.

As some fossil fuel usage is non displaceable, fossil fuels will still have a role in 2050. To mitigate their impact on climate change, two avenues will need to be developed: synthetic fuels, notably biomethane and hydrogen synthetic fuels, such as green gas, could help bring down emissions by 4%. The share of renewable and low carbon gases (biomethane and hydrogen) in total gas demand in 2050 in the ProMed Scenario is estimated to be close to 20%. In addition, carbon capture technologies could help reduce CO<sub>2</sub> emissions by nearly 10% in 2050.



## ELECTRICITY

Electricity consumption in the Mediterranean region is closely linked to economic development, population growth, increased urbanization, and the increasing electrification of the economy. Economic development is expected to evolve at higher rates in the South and East Mediterranean, with an average annual GDP growth rate of around 3.3% between 2018 and 2050, while in the North Mediterranean the expected rate should be about 1.5%. As for

demographic changes, population is expected to increase by around 140 million people in the South and East, whereas a decrease of about 13 million people is expected in the North.

The Mediterranean electricity sector is expected to face several challenges in the next three decades. In the South Mediterranean Countries sustained economic development, population growth and rising electrification of the economy, have led, and are expected to lead, to an increase in electricity consumption, at an annual average growth rate of 3% up to 2050 in the Reference Scenario (RS), 2.1% in the Proactive Scenario (PS), and 2.5% in the ProMED Scenario thanks to a better exploitation of the energy efficiency potential. In the North, economic and population growth has been, and should be in the future, more moderate, with a decrease in population, progressing electrification of the economy coupled with the implementation of strong efficiency measures, leading to a weak increase of power consumption, regardless of the scenario (0.8% in the RS; 0.5% in the PS; 0.9% in the ProMED).

Variable renewables, and to a lesser extent natural gas, are expected to dominate future investments in power generation across the region. By 2050, in the ProMED Scenario, non-carbon electricity generation would represent 93% of total Mediterranean power generation (90% in the South and 98% in the North). Among renewables, with a 57% share in total, solar and wind will account for the lion's share of power generation. A net additional 727 GW of power capacity will need to be installed over the outlook period – more than double the current existing installed capacity, masking the decrease of fossil fuel capacity and the soaring increase by 832 GW in renewable capacity.

In the North Mediterranean, the increase in variable renewable-based generation will come mainly from solar energy, particularly due to the fall of photovoltaic (PV) technology costs: more than 130 GW (116 GW of PV) of additional capacity by 2050 in the RS, about 170 GW in the PS (around 143 GW of PV) and 205 GW in the ProMED (around 180 GW of PV). Regarding wind power, about 94 GW of additional capacity should be brought online by 2050 in the RS, about 106 GW in the PS and almost 250 GW in the ProMED. Renewables (excluding hydro) should account for 56% and 67% in 2050, respectively in the RS and PS, almost 70% in the ProMED.

Most of the growth in electricity demand is expected in the transport sector regardless of the scenarios. In South Mediterranean countries, the growth of electricity demand in the residential and industrial sectors could be considerably curtailed if energy efficiency measures are duly implemented. Turkey and Egypt, which represent more than 60% of the total electricity consumption in the South Mediterranean, are poised to significantly increase their global demand for electricity, with an average annual growth rate of 2.7%, between 2018 and 2050 in the RS (1.5% and 2% respectively in the PS).

A rise of distributed energy resources is progressively decentralizing power generation and delivery, creating new types of interactions on a two-way grid, within the context of the increasing electrification, decentralization, and digitalization of the economy. In this context, cross-border interconnections are expected to play a more proactive role at regional level, enabling a better integration of variable renewables into the grid by allowing the exploitation of complementarities between power systems with different load profiles and energy mixes across the Basin. Findings from studies within the Mediterranean Master Plan 2030 indicated that the regional load curve is better than single country ones, even better than the best single country load curve, resulting in an overall saving ranging from 60 to 67 GW, according to the different scenarios.

The growing deployment of renewables implies the gradual replacement of traditional electric generation with variable flows of power injected into the network by Distributed Energy Resources (DER). In this context, the role of DER in the future infrastructure is questioned, making it important to consider how their control should be designed to better support grid operation. The Alternating Current (AC), still considered the most suitable solution for the grid, could be accompanied by a

progressive implementation of Direct Current (DC) technology, through local insertions of DC circuits that may increase flexibility and improve efficiency.

As grids are becoming more digital, distributed and smart, investment depends less on traditional equipment and more on new drivers: smart meters, utility automation and EV charging infrastructure. Such investments are supporting new business models by aggregators to integrate small-scale renewables, demand response, and other distributed resources into power grids, when regulatory conditions and market design are appropriate. They can also facilitate the integration of power systems with more localized networks for heat supply as another source of flexibility.

The progressive digitalization of the electricity sector, and its morphological metamorphosis that implies increased interconnectivity, have also increased its vulnerability to cyber-attacks. While the Internet of things (IoT) has become a key enabler in the modernization of critical utilities' infrastructure, it has also exposed power utilities to a host of new threats and vulnerabilities. Moreover, the structural changes brought on by the global pandemic are further exacerbating these risks. The World Economic Forum's COVID-19 Risks Outlook highlights that the third greatest concern for companies is that new working patterns may increase cyberattacks, having the digitalization of the electricity ecosystem further accelerated during the COVID-19 crisis, highlighting specific intrinsic systemic issues that mainly relate to the unprecedented pressure on the digital architecture and supply chain dependencies.



## RENEWABLES

Since 2005, the reference year of OME's first MEP, renewable energy sources have been showing robust growth in the Mediterranean region. Renewable energy supply doubled from 65 Mtoe in 2005 to more than 130 Mtoe in 2020. Today, renewables account for 15% of the Mediterranean energy mix.

Renewable energy progress has been uneven across end-use sectors. Nearly 60% of renewable energy is used for power generation, which is by far the closest to complete decarbonisation. In the direct end-use sectors, renewable technology share is still very low representing currently less than 9% of total final consumption. Significant efforts need to be made in all end-use sectors, and particularly in industry and transport.

Power generation capacity of renewable energy technologies stood at 686 GW in 2020, or 43% of total capacity. Most of the increase has occurred in the North Mediterranean. The South and East account for 20% of total Mediterranean renewables capacity in 2020. However, in absolute terms renewable capacity in the South and East increased by nearly three times in 2005-2020 to reach 69 GW.

The development of renewable energies in the Mediterranean has benefited from an enabling regulatory framework, particularly in EU countries. Climate mitigation policies in accordance with the Paris Agreement have also pushed forward the implementation of renewable energy programmes in several South and East Mediterranean countries. All South and East Mediterranean countries have adopted national renewable energy plans for different time horizons.

In 2019, the Mediterranean region attracted some 19 billion USD of investments in new renewable energy capacity, about 6% of total renewable investments at the global level. The largest share of renewable energy investments is concentrated in the North Mediterranean region; however, several South and East Mediterranean countries are increasingly positioning themselves as very attractive markets for renewable energy technologies thanks to huge resource availability

combined with well-designed auctioning schemes and PPAs. World price records were announced, and further cost reductions could be expected in future auctions.

As larger deployment of renewables is taking place, a positive impact on socio-economic development is gradually observed. In the South and East Mediterranean, the number of jobs in the RE sector increased from around 39 thousand in 2010 to more than 72 thousand (estimated) in 2019 according to OME estimates.

The outlook to 2050 indicates that renewable energies could supply 268 Mtoe in the Reference Scenario - almost doubling the output in 2050 compared to 2020 levels - and 358 Mtoe in the Proactive Scenario. Renewable power capacity would be 725 GW by 2050 in the Reference Scenario and 884 GW in the Proactive Scenario. In both scenarios, the share of renewable energy technologies would be higher than the one of fossil fuels: 62% against 33% in the Reference Scenario and 83% vs. 12% in the PS. In the PS, renewable energy technologies would account for more than three-quarters of cumulative installed power capacity in the Mediterranean region by 2050 (884 GW). This implies adding capacity of about 18 GW per year over the next 30 years, most of which by non-hydro technologies. By 2050, RE could create about 285 thousand jobs under the Reference Scenario and more than 345 thousand under the Proactive Scenario.

In the ProMED Scenario, renewable energy will play a key role in the decarbonisation of the Mediterranean energy system. Their share in 2050 is projected to be 48% of the Mediterranean energy mix, against 12%, currently. Hydro should grow by 10% in 2018-2050 in the northern region to approximately 20 Mtoe, and by 40% in the South Mediterranean. Non-hydro renewables would jump from 73 Mtoe to 223 Mtoe in the North – a three-time growth, and from 23 Mtoe to 158 Mtoe in the South, a sevenfold increase.

By adopting energy transition policies to reach carbon neutrality by 2050, North Mediterranean countries would see renewable energy demand growing up to 243 Mtoe, compared to 91 Mtoe in 2018, a 2.6-times increase. In the South Mediterranean countries, renewable energy demand would be 167 Mtoe in 2050, with an increase of six times compared to 2018 levels. Although South Mediterranean countries have not yet adopted carbon neutrality targets to the 2050 horizon, it is expected that the drastic acceleration of energy transition in the northern shore, coupled with more ambitious climate mitigation targets under the UN framework, will give impetus to renewable energy deployment in the South.

The share of renewable energy is set to increase in all sectoral uses. As long as energy transition takes place, renewable energy consumption increases to cover 45% of total consumption in the power transformation sector by 2030, and two thirds in 2050. In the direct use sectors, total final consumption of renewable energy is set to increase from 58 to 115 Mtoe between 2018 and 2050, for a total share of 17% in 2050 as opposed to a modest 8% today.



## CARBON EMISSIONS AND ENERGY DEPENDENCE

The Mediterranean energy system should undergo a fundamental restructuring and reshaping in order to decarbonize, which would create challenges and opportunities.

MEP *to 2050* clearly illustrates that under both the Reference and Proactive scenarios, the desirable environmental targets for the region will not be reached. Even though the Proactive Scenario is a clear step forward, it would still not be enough to be on track with the 1.5-degree increase cap. Only a carbon neutral path with the ProMED Scenario can achieve a desirable clean,

affordable, safe and sound energy future in the Mediterranean region. However, this requires a shared vision to be implemented through cooperation and adapted strategies across all the Mediterranean countries.

Current policies will not be enough for the Mediterranean to sizeably curb its energy demand and CO<sub>2</sub> emissions. The European Green Deal represents a reference model for neighbouring countries but only a Euro-Mediterranean Green Deal can instil the needed change.

Embarking on a carbon neutral path will have profound implications for the energy transition strategies of Mediterranean countries, not only in the North, but also in the South. It will lead to a net decrease of CO<sub>2</sub> emissions to the 2050 horizon: - 2 billion tonnes compared to the Reference Scenario, with an overall amount of 529 million tonnes of CO<sub>2</sub>eq projected in the Mediterranean in 2050 according to the ProMED scenario.

A carbon neutral economy requires joint action in several strategic areas, with priority being placed on energy efficiency; a greater diversification of energy sources; an increase in electrification; the fast and massive deployment of all clean and efficient energy technologies – available technologies and technologies currently at demonstration or prototype phase.

All technologies and policies will be needed to efficiently curb CO<sub>2</sub> emissions. From 1970 to 2018, carbon dioxide (CO<sub>2</sub>) emissions from fuel combustion more than doubled in the Mediterranean region, exceeding 2 billion tonnes in 2018. By 2050, under the Reference Scenario, emissions would increase by 28% to reach 2 686 Mt whereas in alternative scenarios, with the help of carbon sequestration, CO<sub>2</sub> emissions could be limited to 1 275 Mt in the Proactive Scenario and further capped to 529 Mt in the ProMED Scenario – 75% less than the current levels and 65% below 1990 levels.

South Mediterranean countries are projected to progressively expand their share of the region's CO<sub>2</sub> emissions, accounting for 67% of total emissions in 2050 under the Reference Scenario, 73% under the Proactive Scenario and 86% in the ProMED Scenario. In 2050, in the ProMED Scenario, North Mediterranean CO<sub>2</sub> emissions would fall below 76 Mt – 11 times less than 1970 emissions.

It is not only climate change that is at stake but also the energy dependence of the region and the strains it currently poses. One of the most important implications of the ProMED Scenario is on the fuel trade balance. In contrast to the Reference Scenario, in 2050 as well as the reference year 2018, the Mediterranean region as a whole could be a net hydrocarbons exporter thanks to substantial reductions in fossil fuel consumption. While in this Scenario the dependence on imports would be substantially reduced or almost eliminated, the South Mediterranean would switch from being a net importer to a net exporter of coal, oil and gas.

Overall, the Mediterranean region is currently a net importer of energy (about 39% in 2018). Energy Import dependence is expected to rise from 39% in 2018 to 40% in 2050 with a 42% increase of net imports in the Reference Scenario, exacerbating the tensions in the region. At the same time, implementation of energy transition policies could turn the region into a net exporter by 2050 through widespread deployment of the readily available renewable sources in southern countries.



## ENERGY INVESTMENTS

Over the period to 2050, the investment required each year to supply the Mediterranean's energy needs will range between €135 billion to €200 billion per year. This results in a cumulative investment bill for the region of €4 to €6 trillion. To achieve a carbon neutral future, total energy cumulative investments would reach

€6 trillion over the outlook period to 2050 for the Mediterranean region. This would entail a net increase in funding of €2 trillion compared to the Reference Scenario and, more importantly, reallocating financing, which is currently unfavourable to carbon neutrality, towards favourable investments.

Nearly 90% of total investment required will be for energy efficiency and the power sector. With half of total investment alone, energy efficiency will soak-up most of the investment and 40% for the power sector (25% for power generation and 13% for electricity network and storage). The remainder will be needed for upstream in oil & gas producing countries, for end-use renewables and new technology deployment for green gas production and carbon capture.

The investment requirements are not only 55% higher in the ProMED Scenario, but the structure of the investments would also be radically different with more than double in energy efficiency investments (from €1.4 to €3 trillion). Energy supply investments stand between €2.5 trillion and €2.9 trillion in the three scenarios, but their destination is quite different. There is a much stronger emphasis on renewables in the ProMED Scenario where investment in renewable energy would account for 21% of total investment and 43% of energy supply investments.

In the power generation sector, the phasing-out of fossil fuels and the increase in demand caused by the growing electrification of the economy will entail significant investments in increasing renewable capacity and, as existing renewable capacity reaches the end of its useful life, in its replacement (part of the region's existing wind and solar capacity reaches the end of its useful life before 2050 especially in North Mediterranean countries and will have to be replaced by new capacity). More than three quarters of the required investment in power generation will be for the installation of solar and wind capacity. Solar would account for 30% of total generation investments, more focused in a first phase on centralised solar plants and in a second phase on decentralised production of photovoltaic energy. There will also be significant investments in wind power – 50% of total investments in power generation, primarily focused on onshore wind power and the introduction of offshore wind power in the second half of the period.

With a total of just under €3 trillion to 2050, the lion's share of energy investment will be required for energy efficiency across the buildings, transport and industry sectors. The transport sector alone would require 43% of total energy efficiency investments at about €1.3 trillion, making it just under 10% less than the level of investments required for the entire power generation sector. The buildings sector is the second largest sector in terms of investment requirements, accounting for a third of all energy efficiency investments. Industry will require less investments than its counterparts but would still account for 20% of total Mediterranean energy efficiency investments over the outlook period. Investments would be needed to ensure the electrification of the processes.

The path to carbon neutrality also requires investments in innovation and knowledge, qualification and training in all sectors of the economy. Specific research and innovation investments will also be required.

Of the total €6 trillion needed in the ProMED Scenario over the outlook period, 60% will be required in the North and 40% in the South. Except for the production of conventional fuels (fossil fuels and nuclear) where the South investments requirements are much more substantial, the North Mediterranean persistently accounts for the larger share of investments for all the remaining energy investments segments. The larger investment needs in the North are the result of the higher cost associated with updating the already existing infrastructure and technologies, as opposed to new ground-up investments which will be expected in the South.

# to 2050

## MEDITERRANEAN ENERGY PERSPECTIVES

*2021 edition*

On its 30th anniversary, OME presents a special edition of the Mediterranean Energy Perspectives

- MEPTo2050 (2021 edition).

This edition provides an in-depth analysis and overview of the most important factors and uncertainties likely to affect the Mediterranean energy trends over the next 30 years under three different scenarios, as well as the impact of the global COVID-19 pandemic on energy transition in the region.

The scenarios range from a baseline scenario, to one where the Paris Agreement is realized in full, and introducing for the first time, a joint scenario, developed together with the Union for the Mediterranean energy platforms, which provides a glimpse at what carbon neutrality could be like by 2050.

Find out how these varying paths will affect energy supply and demand by fuel and by sector, the scale of investments required, and how the Mediterranean can feasibly achieve carbon neutrality and enhance regional energy security.