TRAINING ON CLIMATE OBLIGATIONS

TRAINING REPORT:

CLIMATE OBLIGATIONS, ENVIRONMENTAL STANDARDS, AND REGULATIONS

Empowering Mediterranean regulators for a common energy future

Renewables Working Group (RES WG)

Co-funded by the European Union

ABSTRACT

This document gives an overview on the topics that were discussed during the training on "Climate Obligations, Environmental Standards, and Regulations" that took place in Tirana, Albania on the 17th, 18th, and 19th of May 2022 and that was attended by several international speakers specialized in their fields and an array of representatives of energy regulators from different countries in the Mediterranean region. The event was kindly hosted by the Albanian regulator (ERE).

AKNOWLEDGMENTS

This report is the result of the work of the MEDREG Environment, Renewable Energy Sources, and Energy Efficiency Working Group (RES WG), which helped organise the climate obligations training. MEDREG wishes to express its gratitude to the members of the RES WG for their hard work and contributions. MEDREG is particularly grateful for the support of the speakers who shared their knowledge with the participants and helped reviewing this report.

ABOUT MEDREG

MEDREG is the Association of Mediterranean Energy Regulators, bringing together 27 regulators from 22 countries, spanning the European Union, the Balkans and the MENA region.
Mediterranean regulators work together to promote greater harmonization of the regional energy markets and legislations, seeking progressive market integration in the Euro-Mediterranean basin. Through constant cooperation and information exchange among members, MEDREG aims at fostering consumers rights, energy efficiency, infrastructure investment and development, based on secure, safe, cost-effective, and environmentally sustainable energy systems. MEDREG acts as a platform providing information exchange and assistance to its members as well as capacity development activities through webinars, training sessions and workshops. The MEDREG Secretariat is located in Milan, Italy.
MEDREG wishes to thank in particular all the experts for their work in preparing the training and for sharing their knowledge.
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EXECUTIVE SUMMARY

MEDREG has always been attentive towards the impact that climate change has on the Mediterranean region. In fact, the way energy markets are regulated is closely interconnected with the type of energy sources that are used and the overall goals set by national and regional energy strategies.

A 2020 report[1] issued by the United Nations Environmental Program (UNEP) shows the increasing risk of irreversible degradation of the Mediterranean environment as a result of rising inequality, biodiversity loss, the growing impact of climate change and unrelenting pressure on natural resources. The report points to five main actions having the potential to reduce the environmental damage if adopted as soon as possible:

- Incentives and capacity building: phasing out environmentally harmful subsidies, including removing subsidies on non-renewable energies and groundwater extraction, and incentivizing sustainable options while empowering local administrations and actors to implement nationally or internationally agreed commitments and measures.
- Intersectoral cooperation: ensuring that development pathways are shared by all sectors, not just administrations in charge of the environment, and prioritizing sustainability in all sectoral policies.
- Preventive action: implementing measures that prevent degradation, which are generally less costly and lead to better environmental and social outcomes than clean-up and curative action.
- Resilience-building under uncertainty: directing action and investment towards adaptation to projected environmental stresses, including by harnessing nature-based solutions.
- Enforcement of legal obligations: promoting the adoption of provisions in national legislation to allow for accountability and legal action and strengthening the legal and administrative mechanisms involved in enforcement including those undertaken by the Mediterranean countries under the Barcelona Convention and its Protocols.

MEDREG considers that regulators should and will be a key part of these actions, and the scope of this training is to provide Members with a better understanding of how environmental and climate change matters are intertwined with their daily regulatory work as well as what is expected from regulators in terms of contribution to the ongoing efforts to reduce the carbon footprint. The role of regulators should look into the persistence of sound economic principles, notably the establishment of targets that are consistent and coherent, thus creating cost-efficiency and avoiding the distortion of markets. This last point is intertwined with the economic support given to emerging energy technologies. Such support, albeit necessary, should be well designed to concern technologies with valuable potential as well as foresee a sound phase-out way to progressively reduce economic incentives when technologies, become mature.

While the region is environmentally interconnected, each Mediterranean country displays a unique economic and financial reality, which makes it important to devise sectoral targets that are commonly agreed, but specific to each country's needs. This is particularly important for regulators when we speak about RES, since it falls upon regulators to manage their impact on the planning, balancing and financial aspects of the networks, as well as ensure that costs are overall bearable for the national energy systems.

1. 1 You can read the full report here: https://www.unep.org/resources/report/state-environment-and-development-mediterranean

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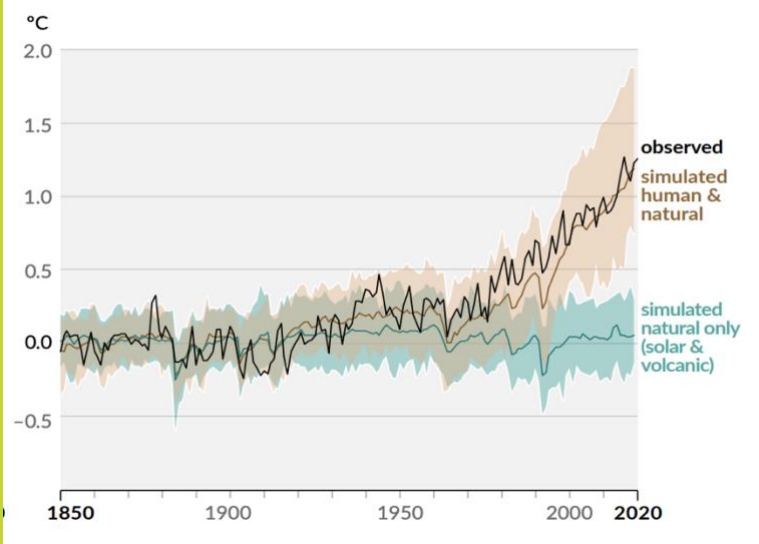
INTRODUCTION

Nowadays, global warming is an increasingly important topic, especially with the severe climate changes that humanity is witnessing daily under the form of extreme weather events. These extreme weather events vary from extended and unprecedented droughts in geographical zones where drought was not previously an issue, to super hurricanes and alarming wildfires.

During the last 150 years, the global surface temperature has increased by almost 1.1°C after being almost stable or with the low variations for 2000 years. This unprecedented increase has been mainly caused by the influence of human activities[2]. As can be seen in Figure 1, the simulated temperature variation due to natural causes alone is not significant and is very close to zero. The observed increase during the last 150 years is closely tied to the simulated increase caused by human and natural causes which highlights the effect that human activity had on this development.

Figure 1. Change in global surface temperature, observed, and simulated

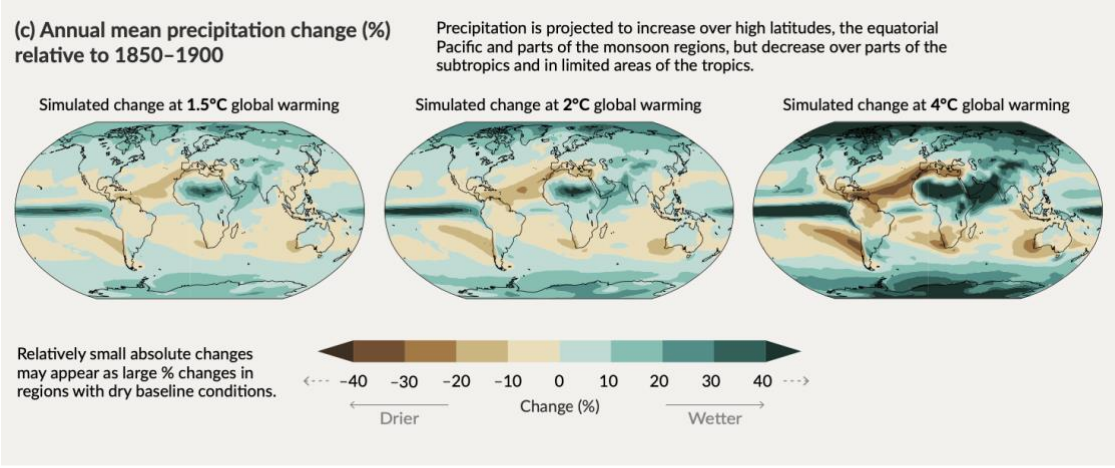


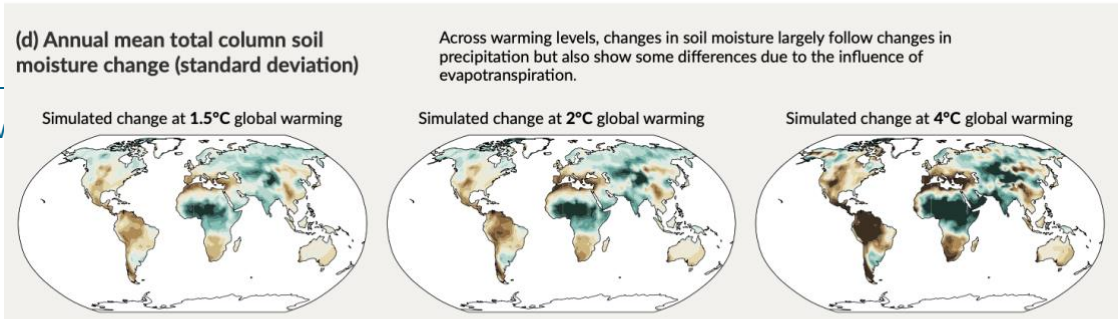
Error! Reference source not found. highlights the impact of global warming on the development of precipitation and the soil moisture under different scenarios at 1.5, 2, and 4°C. One of the regions that will be witnessing an extreme change is the Mediterranean region as can be seen, will be highly affected by the global warming both in terms of lower precipitation and of soil moisture, leading to water and agricultural problems. Multiple actors can contribute to the reduction of CO_2 emissions such as energy production, agriculture, buildings, transport, industry, and other sectors. The earth overshoot day, which is the day of the year where humanity would have consumed the entire biological resources that the earth regenerates during the year, is coming earlier each single year. In 2022, overshoot day was on the 28th of July. Interesting studies are being done comparing the behavior of consumers in each country and when would the

[2] https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf

Figure 2. Changes in mean precipitation and total column soil moisture under different global warming scenarios

overshoot day land if the entire world consumed like these countries. For some countries, overshoot day is as early as the 10th of February[3].





[3] https://ww

2
Day 1

2.1. Aspects of Energy Transition in the European Union (Mr. Stephen Ressl, Consultant)

Based on the Paris agreement, the European Commission adopted several goals such as making Europe the first climate neutral continent by 2050, reducing GHG emissions by 55% by 2030, and working towards affordable and sustainable energy supply which includes all aspects of economic life such as transport, building performance, and agriculture. To cope with this plan, massive investments from the EC are necessary, and they agreed on the "Fit for 55" package to tackle it. It includes propositions on energy/emission price formation level and targets/limits on these various emissions and how the emissions trading system should develop. Before 2030, the EC should strengthen the policy measures on transport, taxation, and trade as well as revise the directives on renewable energy and energy efficiency. Electrification is one of the most important solutions, but the problem would be in the storage and building of the network along with problems in the security of supply and the resilience of the system. Renewables and hydrogen might be the solution for this as they will help with producing cleaner energy and having a way to store the excess of clean electricity under the form of hydrogen. Another solution is the decentralisation as it will help reducing the losses in the network and catering to the demand locally. The EU has set a roadmap for the hydrogen system where it will work on the gradual development of the H_2 infrastructure, integrate hydrogen in the system, and use it in large scale applications as appropriate. Additionally, taxonomy will play an important role as it acts as a classification system which establishes a list of environmentally sustainable economic activities.

After several major events such as the COVID pandemic, the war in Ukraine, and the return of inflation, the European Commission reacted by developing the REPowerEU which sets as main goals some suggestions for price containment, achieving independence from Russian gas supplies, a proposal on joint gas purchase, and a legislative proposal on strategic storage. Hence, with all these factors at hand, it is apparent that after 2 years of the start of the Green New Deal, the global situation is more complex than expected, and there is no easy solution available. So, there should be an open mindedness for new and disruptive technologies and not rely only on well proven technologies such as the PV.

Currently, the EU is too dependent on external parties for the power sector, was it for natural gas or other types of fuel, or for the PV panels which are mostly manufactured in China and other places outside of the EU. One of the ways to mitigate this effect is to opt for energy communities which are autonomous and controlled by its members and shareholders. These communities have a primary purpose of providing environmental, economic, or social community benefits for their members and the local areas where they operate. They are allowed to produce, consume, supply, provide aggregation, and other services for the community. There are multiple phases in establishing the energy community, starting with the governance (type of legal entity, rules on sharing the benefits…), passing by the construction (availability of local supply

chains, installation of RES plants…), then the management which should be provided through an IoT digital platform, and the replicability of the community.

If the energy networks opt for local optimization such as with energy communities while keeping an eye on the bigger picture of the wider network, might bring fast and resilient solutions while at the same time reducing the risk of total failure. New technologies can be tried out locally, and if successful, multiplied on the bigger scale.

2.2. The European Green deal: Integrating Existing Capacity with New Forms of Energy Transition (Mr. Bardhi Hoxha, Deputy Director of MEDREG)

Before the Green Deal was introduced, energy efficiency, security and affordability of energy, and the integration and interconnectivity of the European market were not considered as top priorities or as pressing issues. After the presentation of the Green Deal in December 2019, several major steps followed such as the proposal of a climate law, circular economy action plan, and industrial strategy in March 2020. Additionally, in September 2020, the 2030 climate target plan was presented. In April 2022, the European Commission joined the European climate pact and pledged to make its operations climate neutral by 2030. The Green Deal will transform the EU into a modern, resource efficient, and competitive economy. The Green Deal has several goals spanning on different sectors aiming to enhance the well-being of people while maintaining the current standards of living. These sectors include energy, public transport and smarter mobility, healthy and affordable food, globally competitive industry, future-proof jobs for transition, longer lasting recyclable products, renovated energy efficient buildings, and fresh air and clean water.

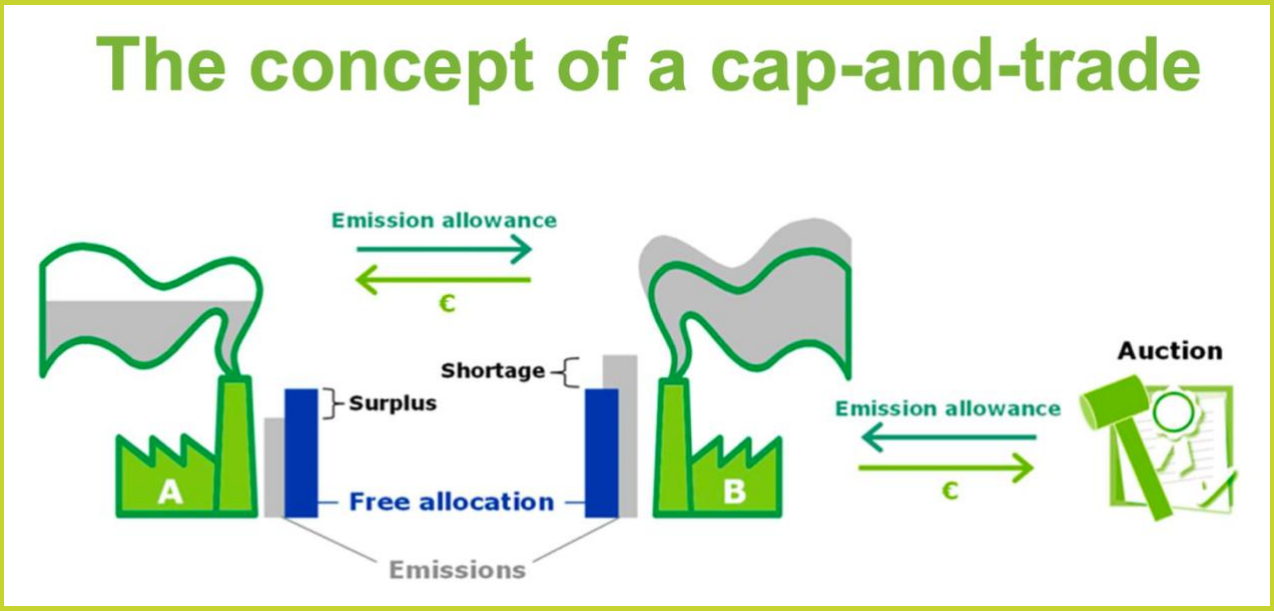
There are eight targeted areas in the Green Deal. The first target is the climate where the long-term target is to have climate neutrality by 2050, and the short-term target is to reduce the emissions by 55% by 2030. The second target is energy where almost 75% of emissions result from energy production and use. Third target is agriculture where the aim is to ensure food security and strengthen the EU food system's resilience while reducing the environmental and climate footprint of this system by at least 25% by 2030. The fourth pillar is the industry that can provide global markets with low-emission technologies. The fifth objective is to improve the health and quality of life of the citizens and address the environmental problems and reduce the emissions. The sixth target is transport which produces 25% of the EU total GHG emissions and with a target to be reduced by 90% by 2050. The seventh target is to mobilize 1 trillion euros in sustainable investments over the next decade. The last target is to modernize the economy and re-orient it towards a just and sustainable future through research and innovation. All in all, the European green deal will help transform the economy and the societies, make transport more sustainable, allow the EU to lead the third industrial revolution, clean the energy system, renovate buildings, use nature in the fight against climate change and restore biodiversity, and boost the global climate action.

From the energy point of view, before COVID-19 and the Green Deal, European energy generation relied heavily on fossil fuels, mainly oil and petroleum products and natural gas. The current energy system is linear and monodirectional going from the production site to the consumer either under the form of petroleum products or as energy. In the future, the energy system will be more integrated with the energy flowing between the users and producers. Currently, there are lots of challenges for integrating current capacity with new forms of energy generation such as the lack of investments, grid expansion costs, and the need to ensure the system's flexibility.

2.3. The EU Emission Trading System: A Policy Tool to Drive Decarbonization (Ms. Helena Fabra Cadenas, Policy Officer, DG CLIMA)

An emissions trading system is a market-based instrument which provides an economic incentive with the aim of reaching an environmental benefit. It aims at reducing the collective emissions of pollutant gases by industrial installations by making them pay if they pollute the environment. In this system, a certain amount of emission allowances is issued and put into circulation based on the environmental objective. The scope of the system should have defined parameters concerning the sectors involved, the gases emitted, and the point of regulation. After a defined period, the industrial installation must surrender as many allowances as emissions put in the atmosphere. These allowances can be bought and sold if the installation has a surplus or needs more allowances under the market regime that can be described by the figure below.

Figure 3. Trade mechanisms available for industrial installations that need extra allowances



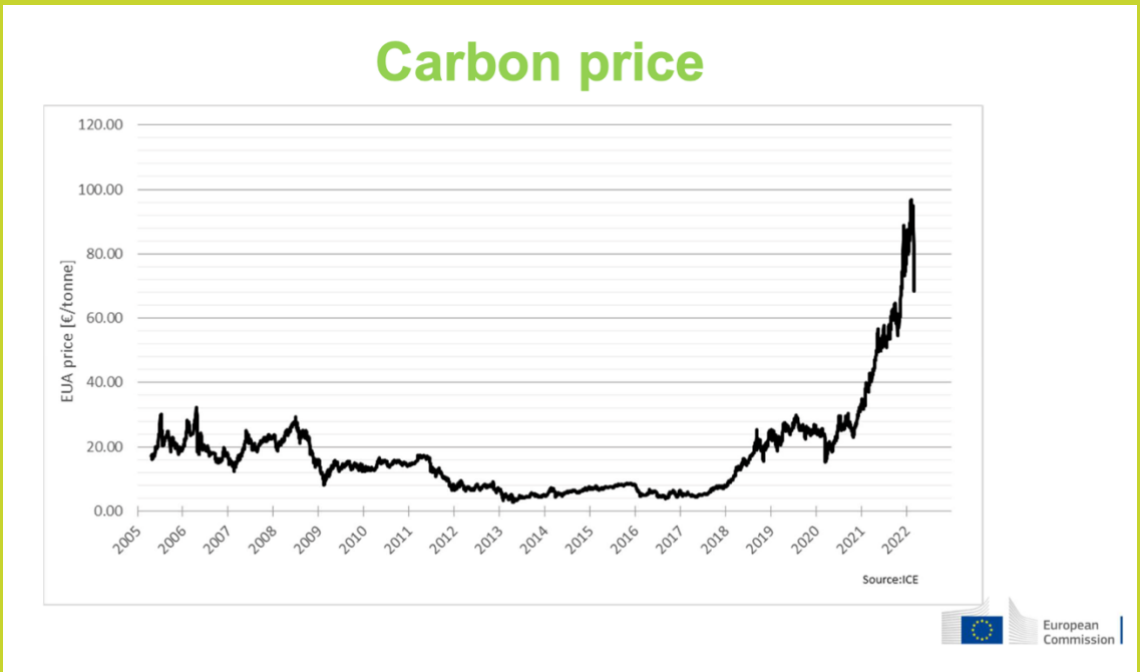
The world's first major carbon market started in 2005 and works on the basis of "cap-and-trade" principle. The cap is set on the total covered emissions and reduced yearly by a linear reduction factor. This market operates in 30 countries and covers 40% of the EU's GHG emissions. Sectors that are covered in the ETS include power, steel, cement, chemicals, papers, refineries, and other sectors totaling around 40% of the EU emissions. In the power sector all production units larger than 20 MW are included, with some EU states opting to include even smaller capacities. An installation can receive free allocation if they are industrial sectors that are prone to carbon leakage which is a risk that the industry is relocated to other countries where emission policies are less stringent, hence avoiding the mere relocation of emissions and the loss of production power in the EU. The aviation sector can also receive free allocations.

Benefits of the ETS is that it is a way to price pollution to reduce it, and it is currently around 80 Euros/tonne of CO_2. It is also an important revenue for the member states as the auctioning of their allowances have reached around 30 billion euros in 2021. Additionally, member states are using 70% of this revenue to tackle climate change issues. It also allows the redistribution of the revenues from rich to poor states generated by the states' allowances.

A company covered by the ETS must balance between costs if they buy additional allowances or act upon the issue and invest in reducing their consumption. If the carbon price is too low, they might opt for paying the allowance but if it is higher, they might decide to produce in a cleaner way that does not pollute as much. As the ETS is a trading system, the market decides where the emissions take place, and it tends to be in the most efficient places. Hence, abatement has mostly taken place in the power sector, but also has an important effect in the industrial sector.

The EU is revising the ETS, and it is seen that the ETS is working well as emissions have already been decreased. The total emissions since 2005 have been reduced by 43%. Real emissions have been under the assigned cap for the several years which is a good sign. The allowances must be monitored on a continuous basis to avoid their surplus in the market which will lead to lower carbon prices. This is to avoid these allowances becoming excessive as energy efficient measures are increased by the affected sectors and the difference between the allowed emissions and the cap will be constantly increasing. To do this, the Market Stability Reserve (MSR) was founded, to control the balance of the allowances by absorbing or releasing them to cater to the market's needs. The figure below shows the evolution of the carbon prices. The initial phase was from 2005 to 2007. The second phase which was based on national levels spanned from 2008 to 2012. From 2013 to 2020 we see the third phase with a very low price and since 2021 we see the fourth phase in which the MSR started its operation and absorbed the excess allowances leading to higher carbon prices. The EU ETS is a cornerstone for the EU to reach the EU Green Deal objectives. However, it cannot be used alone to achieve these goals as there are multiple barriers that it does not address such as RE and transport sector policies. There also should be an energy taxation directive which focuses only on the energy content.

Figure 4. Evolution of carbon prices



The Carbon Border Adjustment Mechanism (CBAM) aims to push partner countries (outside of the EU) to implement national carbon pricing mechanisms to achieve an international carbon price system and to address the risk of carbon leaking and equalize the price of carbon between domestic and imported products. The main sectors included in CBAM are cement, iron and steel, aluminum, fertilizer, and electricity.

3
Day 2

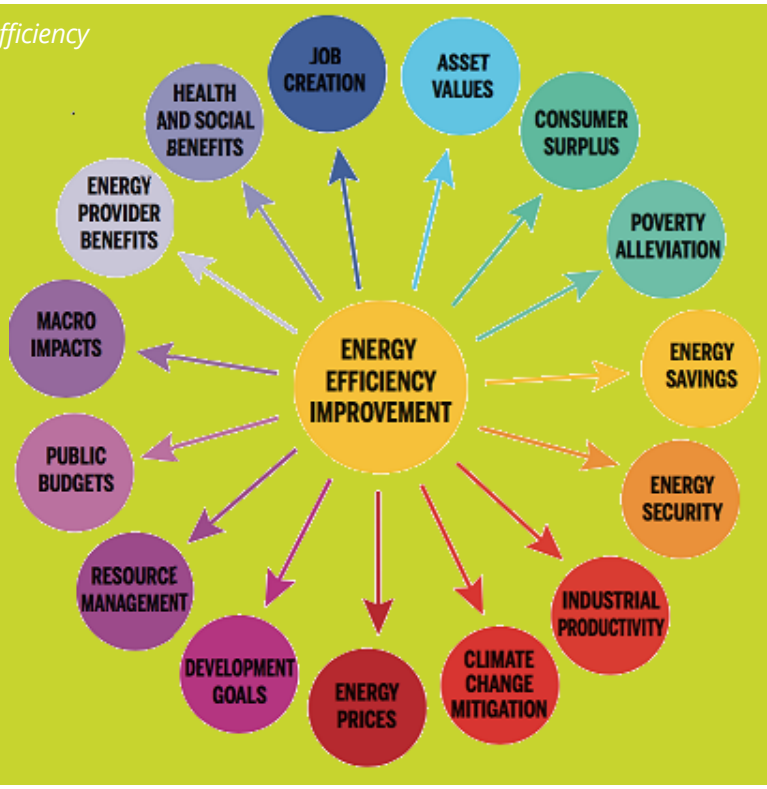
3.1. Decarbonization Tools: The Role of Renewables and Energy Efficiency (Ms. Sorina Mortada, Technical Consultant, LCEC)

Decarbonization has 4 main pillars consisting of the decarbonization of the electricity generation, fuel shifting in transport heating and industries, efficiency in all sectors including building, transport, and agriculture, and the preservation and increase of natural carbon sinks. Recent analysis shows that the fast deployment of RE and EE measures can help meet 90% of the decarbonization needs set by the Paris Agreement. Energy intensity is the ratio of energy use to gross domestic product. It indicates how well the economy converts energy into monetary output. The lower the energy intensity ratio is, the better the country is doing in terms of energy efficiency.

Although energy efficiency and energy conservation are seen as related terms, they are not the same concept. A better energy efficiency can be a way to achieve energy conservation, but this not applicable the other way around. Energy efficiency is related to the technical performance of energy conversion while energy conservation consists of eliminating certain activities which will lead to energy savings without improving the efficiency.

Though energy efficiency is multifaceted and can have a huge effect in cutting the emissions, it is mostly invisible to the people who do not know about it and hence is not seen as impactful. As can be seen in the figure below, energy efficiency can induce several benefits to society.

Figure 5. Benefits of energy efficiency



The energy that you put into a system will always be extracted under a combination of useful energy and wasted energy. The overall system efficiency is equal to the product of all of the efficiencies of the system components which means that the system is less efficient than its least efficient component. This also applies to the macroscale energy systems.

The 2012 energy efficiency directive established a set of binding measures to help the EU reach 20% energy efficiency by 2020. These measures included policy measures for energy savings, obligation for renovation of public buildings, national long-term renovation strategies along with multiple other methods. The 2018 amending directive was agreed to update the policy framework for 2030 and beyond. In the fit-for-55 package, several proposals which will push forward the use of energy efficient measures are mentioned such as the reduction of 9% in energy consumption by 2030, and the obligation of member states to achieve annual energy savings in end-use consumption.

The power sector has historically evolved around 3 main axis, generation, transmission/distribution, and the end-user. There are several methods to enhance energy efficiency in power generation by ameliorating the operating conditions of the plants, or by opting for more efficient means of generation such as the hydropower plants. In the transmission system, it is normal to lose roughly 2% of the energy under the form of heat, while in the distribution system an additional 3-4% could be lost due to the lower voltage nature of the system which incurs higher losses. For the end-user, an energy audit could be very beneficial in terms of identifying the possible solutions and applying the most cost-effective ones. This can apply in several sectors such as industries and buildings where lots of savings potential present themselves. In the transport sector, although several advancements have been accomplished in the internal combustion engine, this engine will always have its limitations that lead to a low efficiency in the transport system. This is why for transport, the optimal solution would be to go for hybrid electric vehicles and electric vehicles which will present a higher efficiency. The cleaner the source of electricity for these types of vehicles, the higher the efficiency. Another important thing that helps optimize the efficiency of the car is the behavior of the driver and his tendencies to drive at average speeds with uniform driving patterns. Policy approaches to foster energy efficiency in multiple sectors are divided into command-and-control policy instruments, market-based policy instruments, and voluntary policy instruments.

According to IRENA, 65% of energy use could come from RE by 2050 through accelerated uptake, and according to IRENA's Remap there is a potential to generate 80% of all electricity needs by 2050 from RE. The cost of renewable energy technologies has dropped significantly in the last decade with PV costs falling by 80% since 2009 and wind turbines by 30-40%. The levelized cost of electricity has also seen huge drops in values from green technologies. The battery electricity storage is also witnessing a rise in the installed capacity and may reach 100-167 GWh in 2030. Currently the most used storage technology is pumped hydro storage, leading the market by a high margin, and followed by molten salts and then batteries.

3.2. Buyer Power in the EU: How to Support Energy Transition and Reduce Energy Poverty (Mr. Ignacio Herrera, Associate Professor, University of Bergen)

Buyer power is a concept that expresses the ability of a buyer to reduce the price he pays for a service. Its impact on the society and economy can be both positive and negative. It is positive when it increases the number of units bought due to discounts that could be offered due to bargaining power and economies of scale. It is negative when used to decrease the number of units bought and push the prices down, also known as monopsony which is a market situation where there is only one buyer. Monopsony is the old approach to buyer power which consists of withholding the demand to reduce the prices. On the other hand, bargaining power tends to enhance welfare if the downstream market is competitive. Bargaining power does not involve withholding demand and might be efficient if a price reduction is agreed upon. When a certain entity buys the same product in bulk, it will have lower prices for it. This is due to multiple causes such as the desire of the seller to keep this client, economies of scale, and reduced transaction costs.

Energy poverty can be showcased under several forms such as energy fuel poverty, energy polluting poverty, energy efficiency poverty, and energy access poverty. It is a problem that has proliferated throughout the world as 13% of the world population do not have access to electricity, mostly in Africa and South Asia, and 50 to 125 million people in Europe are not able to afford proper indoor thermal comfort.

The EU is currently facing rough conditions due to a compilation of difficulties such as high gas prices, the ongoing conflicts, the proposed embargos, and the post-COVID recovery. Therefore, the commission is opting for a joint purchasing strategy to diversify the energy supply and thus increase the security of supply. The REPowerEU has set plans to become independent from Russian gas by 2030 with a legislative proposal to keep the gas storage across the EU at a minimum of 90% by the 1st of October of each year. Another aim of this joint purchase is to benefit from the collective political and market weight of the EU to benefit from reduced prices. This joint purchasing strategy is not a mandatory or centralized initiative; however, the different countries will benefit from it to negotiate better and cheaper contracts then if they were on their own. The scope of the gas contract, the economic implications, and the implementation of the contract should be very clear and straightforward. Concerning electricity, international joint purchasing is not as obvious as the gas one, because it is not easy to import electricity due to the limited interconnections and the non-readiness of the sellers. On a national level, countries can develop the aggregators system or opt for PPAs which would bring more price stability as renewable power make the grid more volatile. The EU electricity price toolbox which is an EU document published in October 2021 and revised in March 2022 proposes several measures to deal with the energy crisis on the short term such as delaying the bill payments or giving social payments and developing aggregator models.

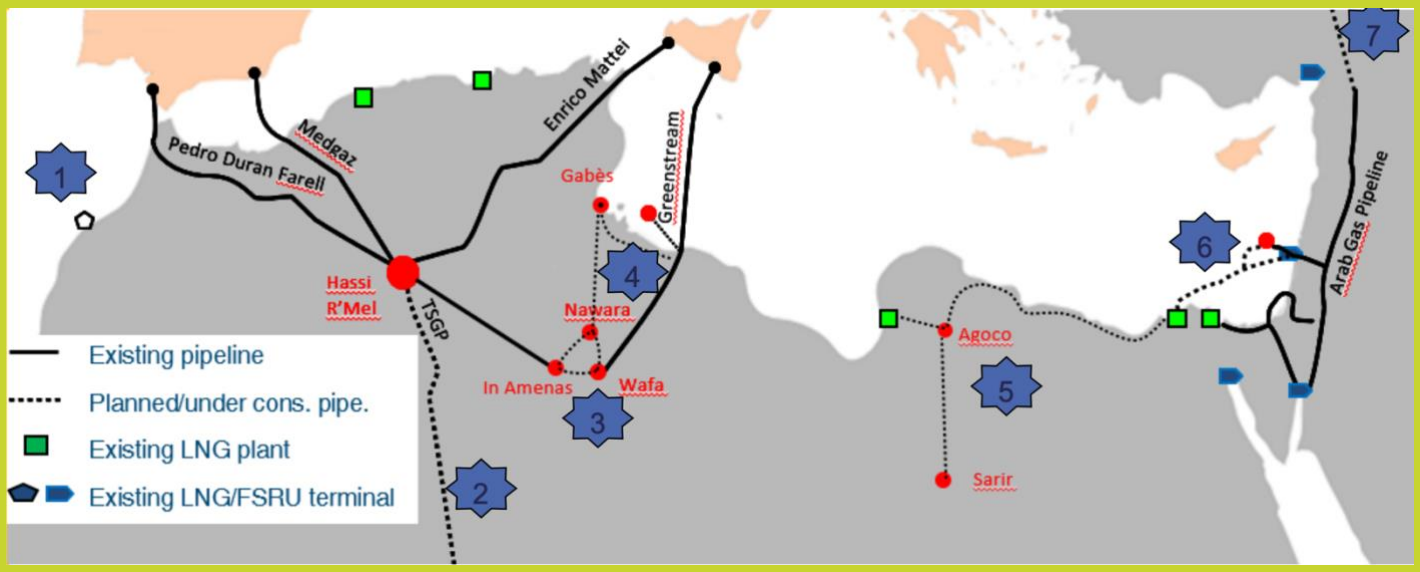
Renewable energy should be priced properly to send the right incentives and to make the client opt for more efficient use of the power. This is why the concept of citizen energy communities (CEC) in EU/EEA law

is very important. The CEC is an entity based on voluntary participation that is controlled by natural persons, municipalities, or small enterprises. It provides environmental, economic, and social community benefits to its members and can participate in activities such as power generation, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles. The countries should provide an enabling regulatory framework to protect the rights of the final consumer towards the CEC and to protect the CEC from being overcharged. Energy communities can help address energy poverty by coordinating the actions, producing its own energy, fund investments in efficiency measures, reduce consumption, lower supply tariffs, allow for market participation, induce consumers to develop into prosumers, and reduce the infrastructural burden. The aggregation model is also interesting to be tackled as aggregators are third parties that combine the flexibility of electricity users and sells it back to the market. In this case, countries must ensure that customers can buy and sell aggregation services independently of their electricity supplier and without its consent. And finally, customers should be able to receive demand response data or data on supplied and sold electricity free of charge.

3.3. The Role of Natural Gas in Energy Transition (Mr. Vincenzo Cioffo, Head of Technical Secretariat in the Environment Division, ARERA)

Since 2014, the south shore of the Mediterranean has been consuming more gas than the north shore. The figure below shows the existing gas pipelines in the South shore of the Mediterranean, along with the planned ones, the existing LNG plants, and the existing LNG/FSRU terminals.

Figure 6. Gas infrastructure in the south shore



In the North shore, the TAP pipeline has been operational since 2020 and passes through Greece, Albania, and Italy spanning over a distance of 878 Km with a capacity of 20 bcm/year, while another potential

pipeline, the IAP is planned to pass through Albania, Montenegro, Bosnia and Herzegovina, and Croatia which spans over 511 Km and a capacity of 5 bcm/year. The economic impact in the south shore points towards a continuous increase in gas demand which is currently mainly being used for power generation which accounts for 80% of the gas use. Gas reserves in the region are abundant but concentrated in specific geographic place. The lack of a suitable infrastructure in the region is a main cause for the limited gas trade in the area. However, infrastructure projects and pipelines should be assessed on a project-by-project basis to evaluate their economic and environmental impact and to judge their feasibility. Investments in gas-fired capacities should be aware of the potential of stranded assets risk or the potential to accommodate hydrogen when it becomes competitive pricewise.

In 2021 the MEDREG GAS WG developed a study titled "Analysis of gas infrastructure to improve the flexibility and interoperability of energy systems" where the defined terms mention that flexibility refers to all the solutions for maintaining the stability of the different parameters of the network and balancing the mismatch between supply and demand while interoperability in the gas sector refers only to the gas quality. In many countries of the Mediterranean, interoperability requirements are enforced as part of the infrastructure planning. Improving flexibility is crucial to integrating bigger levels of renewable energy. To improve interoperability, the natural gas pipelines should be extended, but this is a very costly and time-consuming process.

In 2020 the GAS WG developed another study titled "Design mechanism for gas market able to foster energy transition". This report mentions the fact that LNG exports grew by 12.7% worldwide while the European LNG imports have increased by 68% (49 bcm). Greece worked on diversification of its gas supply changing from being extremely dependent on Algerian gas in 2016 to having a well-diversified import sheet from several countries with a balanced market share of these countries. Natural gas has helped enhance the strategies of countries by cleaning the electricity production process, increasing the share of RES by providing more flexibility, decarbonizing the transport sector, and phasing out coal. The north and south shore of the Mediterranean should increase their cooperation to develop and orient the future of the gas sector.

The gas infrastructure is a monopoly and needs to be regulated by an independent entity and through a sound regulatory framework. The infrastructure for natural gas is one and shared among users and has physical limits. The European Internal Energy Market (IEM) has five key objectives by 2025 and consist of establishing a competitive and integrated wholesale energy market, enhancing Europe's security of supply, moving to a low carbon society, developing a functioning retail market that benefits customers, and building stakeholder cooperation. It is important to ensure that the accessibility to gas resources is geographically widespread, and that member states cooperate fully in a supply emergency. For hydrogen, it currently benefits from a flexible regulation transitory period until 2030 which will be tightened afterwards.

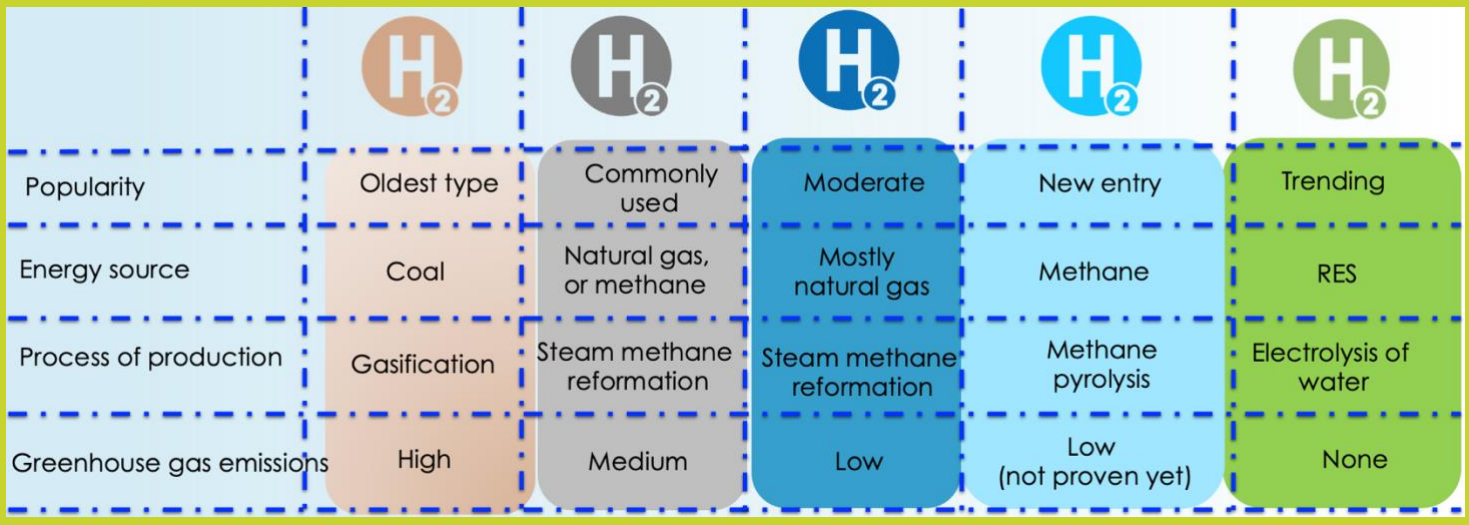
4

Day 3

4.1. The Role of Hydrogen in the Mediterranean Energy Transition (Mr. Hasan Ozkoc, Director, MEDREG Secretariat)

Hydrogen is the lightest element in the periodic table and makes up more than 90% of the atoms in the universe and exists on Earth in molecular forms such as water and organic compounds. Hydrogen has a high energy content per unit of weight, triple as much as gasoline. Because of this, it presents a great potential to be used in power generation, transportation, heating, synthetic fuels, ammonia and fertilizers, and metal refining. Hydrogen production in our current era is divided into a color spectrum that indicates the level of emissions tied to its production, with green hydrogen being produced using power from renewable energy. This spectrum can be seen in the figure below.

Figure 7. Colour spectrum of Hydrogen production



The current energy system is linear and wasteful. Future integrated energy systems will have a circular energy flow encouraging energy transfer between the stakeholders of the system and reducing the wasted resources. They consist of an energy efficient system, deep electrification of consumption, and the use of renewables and low carbon fuels in hard-to-abate sectors. Hydrogen can help reach these objectives in many ways. The EU hydrogen strategy consists of starting with 6 GW of renewable hydrogen electrolysers by 2024 to replace the current hydrogen production, then 40 GW by 2030, all while opening up the market to reach the hard-to-decarbonize sectors and EU-wide infrastructure network and open market in 2050. The Renewable Energy Directive has set specific sub-targets regarding renewable hydrogen in hard-to-decarbonize sectors such as reaching 50% hydrogen consumption in industry by 2030, and 2.6% in the transport sector. Additionally, the natural gas prices' volatility has impacted the world economy, and alternative sources should be used to reduce its usage.

Hydrogen can be integrated in the energy system in multiple steps such as the production of energy, storage of energy, industrial and heat production, refueling and transportation, along with other opportunities.

Hence, it is important not to isolate it as an energy vector, but to use it in the different sectors where it can be beneficial. The development of hydrogen projects is dependent on several factors among which are the need to have a strategy policy supporting its development along with clear regulatory framework that incentivized the investor and well-established technical standards and security indicators. There is also a need to develop the infrastructure and increase the intersectoral cooperation. The European hydrogen backbone has identified five supply and import corridors, the first coming from North Africa and Italy, the second from Morocco and Southwest Europe, the third comes from the North Sea, the fourth from the Nordic and Baltic regions, and the fifth from East and South-East Europe.

It is very important to have a cooperation between the private and public sector to push forward the hydrogen sector as industries are interested in investing in hydrogen projects and regulators are open to create the relevant framework. In the Mediterranean region, there is a huge potential for collaboration between south and north shore countries, as the southern countries have abundant resources to produce green hydrogen, and northern countries are willing to import this produced gas.

4.2. Upgrading the Power Systems for a Smooth Energy Transition (Mr. Luca Ruffino, Program Officer, Med-TSO)

Energy efficiency is the primary instrument to reach carbon neutrality. Electricity is a dominant energy carrier, and the grid is a backbone for decarbonizing other energy sectors by direct and indirect electrification of energy consumption. Although electrification is an important factor to reach carbon-neutrality, alone, it will not be able to cater for all the sectors. Hence, power-to-gas can potentially complement the efforts of electrification. In the EU, the energy sector should lead the decarbonization path as it accounts for nearly 75% of the European GHG emissions. In the Mediterranean context, all countries should be involved in energy transition by increasing their investments in gas and renewable sources. TSOs should adapt to this new context especially with the growth of renewable energy sources and the need for more system flexibility. Multiple challenges exist in the region such as the limited interconnections between countries and grids, and the unstable environment for investors. Integration of power systems is a key driver for achieving energy transition and it has become a necessity.

In the figure below, it is obvious that the interconnection level is sufficient in the north shore of the Mediterranean, while on the south shore there are very few interconnections between the countries themselves, and the interconnection between the south and the north is still limited to 2 interconnections on the eastern and western side of the sea. The 2020 Mediterranean Master Plan consists of defining consistent energy scenarios, selecting the future interconnection projects, setting up a reference model for the regional power system to perform market and network studies, analyzing the network behavior and the investments needed to reach the security requirements, and performing a shared cost-benefit analysis for the new investments.

Figure 8. Colour spectrum of Hydrogen production

Electricity demand in the Mediterranean is expected to increase between 25 and 33% by 2030, mainly in south shore countries and north-eastern countries, as north-western countries tend to have a stability in the energy demand. However, the generation mix is foreseen to have a similar installed capacity for fossil fuel and nuclear with most of the increase in demand being met by an increase in renewable energy generation. If the countries continue the RES development as they are currently doing, they will not be able to meet the point where they need to be in 2050. But RES are becoming cheaper and cheaper, pushing these countries to invest more in them. Nevertheless, if the quantity of renewables increase too much, flexibility of the system must be also increased. This will pose new challenges to the TSOs as the power sector is witnessing a shift from monodirectional to a fragmented and bidirectional system.

Flexibility presents itself in multiple time ranges ranging from hours to instantaneous, and each of these steps can be mitigated by the appropriate measures such as dispatch capacities and reserved capacity along with naturally balancing processes in the system such as the rotating masses and the synchronous torque. Energy transition requires throughout the entire power sector value chain including flexible generation, increased interconnection, demand side response, and electricity storage.

Energy storage systems (ESS) can be of large-scale (GW), medium-scale (MW), and microsystems (KW) and they can be used for multiple services. Depending on the size of the storage, it can be used for services such as synthetic inertia, frequency regulation, load shifting, and virtual lines. If the ESS is behind the meter, it is not required to be coordinated with the grid and it may lead to an over investment in the ESS. If it is in front of the meter, thus serving the whole grid, then the service is provided to the grid and profits from mutualization.

TSOs are enablers of the energy transition. They are managing an increasingly complex energy system in which the consumers are gradually turning into prosumers. They do so by expanding and developing their grids, integrating flexible assets and services into the grid, and encouraging developments in the market design and regulatory frameworks.

4.3. Technology Innovations: Smart Cities and Electric Mobility (Professor Francisco Ferreira, Universidade Nova de Lisboa)

A smart city is a city based on Information and Communication Technology (ICT), aiming to develop, deploy, and promote sustainable development practices to address growing urbanization challenges. In this city, networks and services are more efficient with the use of digital solutions. It includes smarter transport networks, upgraded water supply, safer public spaces, and a more interactive city administration.

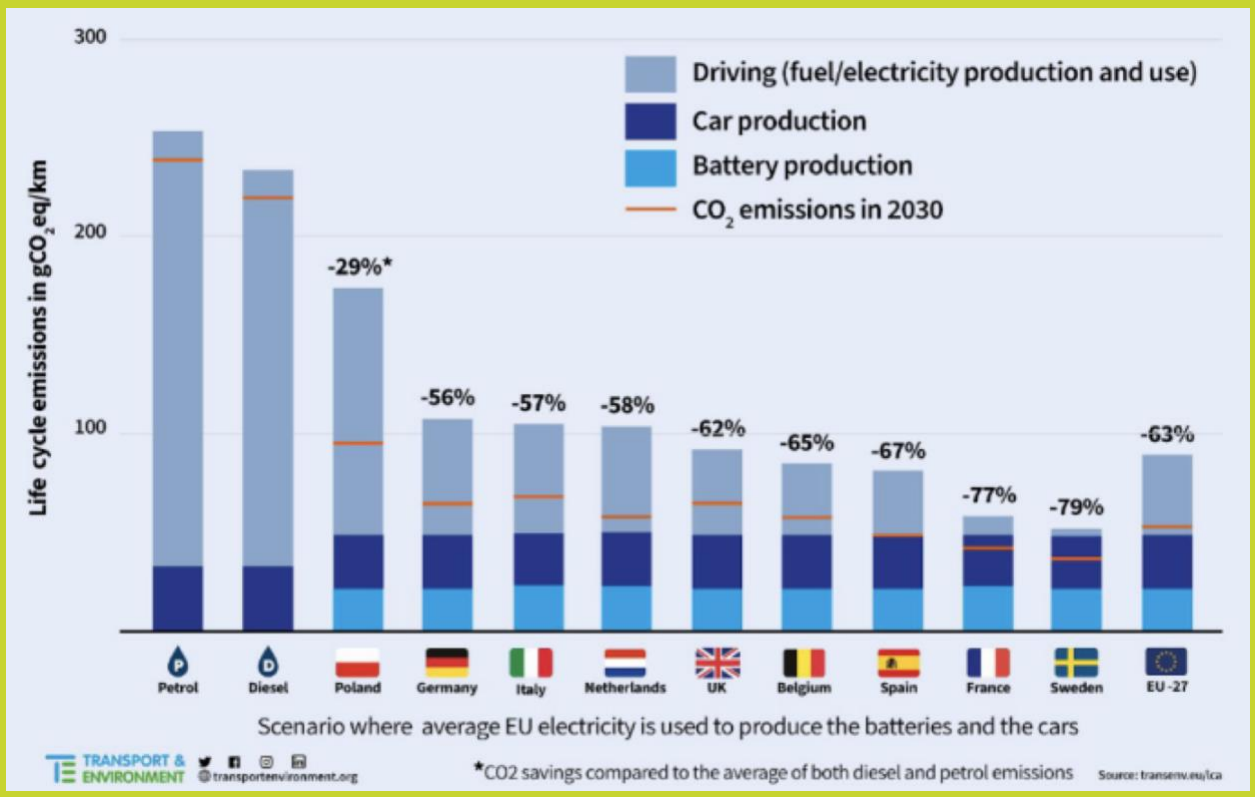
Mobility is essential for our daily lives and helps people get to their place of need in a fast way. However, it creates lots of pollution, traffic, and noise in the surrounding area. The transport sector emissions have shown small variations during time, and now constitute 30% of the overall emissions. The European emissions standards for passenger cars have been set for both diesel and gasoline cars since 1992 and are being always updated to have more stringent emission reductions, and they follow up on them with procedures from controlled testing to on-road testing. After a set of filters and catalyzers, the car catalyst lets three types of gases escape at the end of the system, CO_2, N_2, and H_2O. Although the pollution rate of the cars has been decreasing with the years, the number of miles driven has always been increasing. Road transport constitutes 72% of the emissions released from transportation, 14% is the share of aviation, 13% the maritime transport, and 1% for the rails.

Deep decarbonization in the following decades will depend heavily on the decarbonization of the energy, building, and transport sectors as other sectors are harder to decarbonize. To decarbonize the transport sector, several instruments can be used such as the supply instrument by creating new roads, bike lanes, and railways. Another instrument can be from the regulation point of view by restricting access to certain zones. Additionally, economic and fiscal instruments can be used by subsidizing EV or by putting higher taxes on emission emitting fuels.

Currently, there are several types of vehicles that are on the way to decarbonization such as hybrid vehicles, plug-in hybrids, electric vehicles, and vehicles using fuel cells. Electric vehicles however are far more efficient than other options such as hydrogen vehicles who in their turn are more efficient than power to liquid vehicles. Now, petrol and diesel cars emit almost 3 times more CO_2 than the average electric car in the EU as can be seen in the figure below. However, the emissions of the EVs depend on the emissions of electricity used to recharge, but in all cases, it will emit less than a car powered with diesel or gasoline. EV usage is advantageous on several axis such as reducing fossil fuel dependence, eliminating direct emissions, low

noise, decrease in costs, ability to assist in the flexibility market of the grid. It also presents lots of obstacles such as the vehicle price, the long charging periods, the limited charging locations along with several other issues.

Figure 9. Difference in emissions between petrol and diesel cars, and electric vehicles in different countries



Aviation and shipping are responsible for around 5% of the yearly global emissions. Green hydrogen and ammonia seem to be suitable replacement for fuel in shipping applications. On the other hand, sustainable advanced fuel (ASF), which are produced using feedstock that do not compete with food or feedstock derived from renewable electricity, should be under focus to replace Kerosene in the aviation applications.

In summary, like other sources of pollution, the optimal way to reduce transport pollution is to avoid unnecessary travel and use travel modes that are less pollutant than the ones currently in use.

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