Handbook

Figure 1: Renault

The reasons to choose the electric transport

Handbook

Interreg
EUROPEAN UNION
Mediterranean
EnerNETMob

Handbook: The reasons to choose the electric transport

Introduction:

Within the scope of the EnerNETMob project, the partners have tested and improved "Sustainable Electromobility Plans" based on common standards and low carbon policies. They managed to set up the "Interregional Electromobility Network" crossing cities located in the transnational MED area.

Project partners promoted sharing mobility and land-sea intramodality using electric transport systems, by implementing interurban and interregional pilot networks of "Electric Vehicle Supply" Equipment also co-powered by Renewable Energy Sources.
By integrating the SUMP and SEAP models, the Sustainable Electromobility Plans were developed and reached the extended Interregional Electromobility Networks inside the MED area, based on the common approaches for electric transport infrastructure. The partners implemented small-scale investments on electromobility for interurban and intermodal connections in order to allow longer trips and tested the network at transnational level.

The partners exchanged and transferred the main project outputs to a wider group of public authorities and stakeholders. They exchanged the know-how and electromobility experience among the partners of EnerNETMob, the associated partners and other stakeholders in order to ensure the continuation and longer-term impact of policies implemented within the project. Also, they shared SEMPs and the modular EVSE infrastructures for the Interregional Electromobility Network.

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Part A The reasons to choose the electric transport

Global warming: the challenges for a new mobility

In the last 200 years, we as human beings have contributed enormously to global warming. The average temperatures have been continuously rising, hence intensifying natural phenomena. Weather is getting even more extreme which affects the quality of life. Above all, it represents an immense challenge for the future development and life on Earth. The consequences of global warming courtesy of human-generated greenhouse gas emission reflect in the degradation of the natural environment which has been thrown off balance, causing the food production processes to become even more demanding and the preservation of biodiversity increasingly challenging, unveiling difficulties in maintaining the habitat in several parts of the world. Even in terms of energy, life is becoming more challenging, too.

It has become hard to maintain a lifestyle we were used to in the Mediterranean region; a traditional *modus vivendi* passed down from one generation to another for decades, centuries, and even millennia. On a daily basis, global warming is actually imperceptible. Nevertheless, it does destroy, slowly but surely and in the most despicable way, what our fathers have built during their long and rich history.

Great contributions of transport to global warming and air pollution

Traffic remains one of the largest generators of greenhouse gasses. In all countries on the Mediterranean coast, it is atop of human activities which produce the most GHG emissions. And it does not go for EU members, it is a global leader as well. The current way of living is expressed mainly in the growing need for mobility. Each day, people commute long distances for family or business purposes. And the trend is notable also in our leisure time. On weekends or during holiday season and vacation, private car is a must for anything we do from as long as we remember. Though, unfortunately, the mobility it provides is responsible for global warming. Greenhouse gasses from vehicles powered by internal combustion engines cause an extremely high percentage of all GHG emissions in traffic, which also contributes greatly to carbon footprint. In the Mediterranean region, in the EU and globally.

More people die from traffic than in traffic

However, car emissions have a much darker side to it. Despite carbon dioxide does not have an immediate impact on the environment, sadly, air pollutants d
o, especially the deadly particulate matters (PM_{10} and $PM_{2,5}$), nitrogen oxides (NO_x) and ozone (O_3). Noise from internal combustion engines is also becoming burdensome in recent times,

thus, in the EU as well as in the Mediterranean countries it is more common to die from traffic than in traffic. And the same, or perhaps even more, applies for the influence of transportation on chronic diseases, prolonged illnesses and a relatively large range of difficult to cure or fatal diseases. It all translates into a reduced productivity of employees, lower economic growth and highly strained health system, which lead to the social security and pension schemes also being under severe pressure. Therefore, both traffic noise and emission of air pollutants cut deep into the living space and reduce the quality of life extremely.

If global warming is a long-term process which finds itself in a crucial phase thanks to the humankind effect on the environment, the emission of air pollutants generated by internal combustion engines bear even greater responsibility in reducing the level of safety and health of people living by the Mediterranean Sea, in the EU and globally, too.

Figure 2: EU commission media center

Figure 3: EU commission media center

Sustainable mobility

One of the great answers the challenges of traffic-generated global warming is, of course, sustainable mobility. The term defines a series of activities and measures to tackle the problems of everyday mobility by preserving a safe and healthy lifestyle.

Sustainable mobility consists of five pillars:

- integrated planning;
- walking;
- cycling;
- public passenger transport, and
- optimization of motor traffic.

Beside integrated planning, which constitutes the foundation for an effective mobility management as far as both the safety and healthy lifestyle are concerned, the efficiency of the other four aspects listed is largely associated with the size of the city, population pattern and distribution of employment. Outside large urban areas, particularly in environments with dispersed population and small towns, it seems difficult to address the challenges of modern-day mobility with non-motorized transportation. Similarly, where it is not included in mobility solutions of large cities or metropolitan areas, public passenger transport simply cannot meet the demands of an increasingly tailor-made needs.

The fifth pillar, i.e., optimization of motor traffic, is hence gaining relevance, especially in small towns with numerous migrants commuting to large centres for work, education or other purposes. These are the areas in which people highly depend on private vehicles and only in some cases can walk, cycle or take public transportation to travel to work or handle daily businesses.

In the last decade, the biggest leapfrog in terms of optimisation of motor traffic and the entire sustainable mobility was experienced in electric mobility.

Figure 4: Halogenlamp

E-mobility

From nuisance, funnily designed car with limited usefulness on one hand, to extremely expensive, luxury vehicles on the other, e-cars have experienced an amazing evolution in development in the recent decade. Today, virtually every brand, predominantly those who dominate the largest piece of the pie in the automotive industry, offer at least one electric car. The range includes vehicles of all shape, sizes and price brackets, high-end brand and so-called people's cars. The price gap between electric automobiles and cars with internal combustion engines is getting smaller and smaller.

Moreover, people have recognized and appreciated their dynamic nature, good driving features and versatile progress. Being available in various size classes as well as many different bodies and style editions, one can pretty much find the e-car tailor-made to tick all the boxes.

Also, the exponential evolution of battery technology in the recent decades cannot be overlooked. Not only they are more powerful, looking at their weight and dimension, batteries have a higher storage capacity. Thanks to the advanced technology of temperature management, batteries are increasingly durable and resistant to degradation despite being able to recharge in a very short amount of time, as unimaginable as unheard-of just a couple of years ago.

The outstanding technological improvement enhanced the reach of e-cars also in everyday traffic regardless of the circumstances and way of use up to 300 or 400 kilometres with a single charge. Electric vehicles are not only small cars anymore and thus most suitable for transportation in urban areas. They have evolved in family cars which can easily handle long routes and in time comparable to the journey in classic ones, thanks also to the vast network of charging stations. From AC stations with 11 or 22kW to fast and fantastic DC chargers with nominal already reaching 350kW. The difference between the energy supply time for e-cars and fossil fuel supply for conventional vehicles is therefore diminishing constantly.

E-car users with some experience who charge the battery at DC stations mainly to the level required to finish the journey only to leave the vehicle recharge for longer and at more favourable prices can spend similar amount of time on lengthy routes compared to the user of conventional cars, without direct GHG emissions and discharging air pollutants and even saving on travel costs.

The highly widespread charging infrastructure in urban areas, near shopping centres, tourist attractions, by administration offices, as well as cultural and sporting sites brings the electric vehicles in pole position compared to driving conventional cars.

Especially since authorities on local and national scale have recognised the plethora of advantages of e-cars the users of which can benefit from positive discrimination.

Electric mobility beneficial effects on environment and economy

Zero emissions while driving

Put simply, electric car does not own a tailpipe. That is why it does not leave any smoke or its engine does not produce any greenhouse gas emissions which accelerate global warming and pollute the air. Such vehicles do not take a toll on health and do not degrade the environment. Not to mention, electric car engines are almost noiseless. Another reason a lighter impact of noise and dangerous air pollutants in the areas with multiple e-cars and the quality of life is higher there. Therefore, these places are gaining value in tourism and other economies in which a safe and healthy environment as well as conservation of natural heritage is of utmost importance.

Figure 5: Audi

Limited indirect emissions or emissions considering electricity generation

Truth be told, electric cars do have an exhaust; the chimney of a thermal power station, for that matter. However, the share of power generated from fossil fuel grows smaller and smaller in Europe. Some countries by the Mediterranean are a success story as far as reducing the carbon footprint. Especially those who have already integrated to a great extent the renewable sources, such as wind, and of course solar power, into their energy systems. Hydroelectric energy remains one of the pillars of decarbonisation or the generation of carbon-free electricity. A significant reduction of greenhouse emissions in the energy industry and wider is ensured by nuclear power plants. But also in EU Member States, in which the power is still largely generated and reliant of fossil sources, considering the well-to-wheel analysis, GHG emissions from electric cars are considerably lower compared to classic vehicles running on fossil fuel. In fact, the well-to-wheel standard in fossil fuel must consider emissions generated during the oil extraction and processing, as well as the emissions of oil and petroleum products cause by the logistics from extraction to each and every gas station. In a sense and based on the well-to-wheel analysis (taking into account the source of electricity production), an average cut of at least 50% of GHG emissions is registered in the EU and in the Mediterranean region compared to fossil fuel cars. And several countries by the Mediterranean coast and in the EU, the numbers are even more striking, with emissions reduced by as much as 80%.

Reduction of overall GHG emissions

Notwithstanding the great direct and indirect reduction of GHG emissions while driving in everyday traffic, battery production and decomposition remain among the relatively largest comprehensive sources of e-cars emissions throughout its lifetime, from obtaining raw materials onward.

Ten or just five years ago, the specific emission factor of manufacturing and dismantling e-car batteries was between 145 and 195kg CO_2 per kWh of capacity. After reviewing the calculation, today experts agree on 61kg CO_2/kWh for batteries made with electricity for which only carbon-free energy sources have been used, up to 146kg CO_2/kWh for batteries manufactured in countries with the highest electricity-specific emission factors or in which power is generated predominantly from fossil fuel. The average emission of manufacturing and dismantling batteries for electric vehicles is 106kg CO_2/kWh.

This way, also the emission aspect of e-cars' carbon footprint is being reduced, considering the higher number of kilometres made by an e-car the smaller the battery lifetime emissions. Those who make the most kilometres compensate for drivers of conventional vehicles discharging the most greenhouse gasses and pollutants. By driving as much as possible with e-cars you also decrease the level of GHG emissions generated during the production and decomposition of batteries.

The overall emission reduction in the process is also increasingly minimised by the other life of electric car battery packs used as storage devices, which are becoming one of the pillars of the society-wide energy transformation due to their ability to ensure a significantly higher share of carbon-free sources of energy, such as solar and wind power. However, not only batteries in their second life but also batteries in e-cars can improve the stability of electricity grids. The guided electricity consumption when recharging e-cars ensures the extreme flexibility of the electricity network despite the high percentage of viable renewable energy.

Thanks to it, as well as many other aspects, electric vehicles and their batteries represent the backbone of the transition towards a low-carbon or carbon-free society.

Figure 6: Renault

Figure 7: Volkswagen

Manufacturing process of electric cars is becoming more and more environmentally acceptable

The launch of modern mass e-mobility approximately ten years ago face many environmental challenges when obtaining raw material for manufacturing purposes of electric car batteries. Even recently it seemed that the supply of lithium has been very limited and suffered from a strongly uneven distribution worldwide. The latest discoveries deny the abovementioned theory and how the supply of lithium is greater and more balanced. Above all, mankind can take advantage of over century-long know-how in oil and gas extraction to avoid any *faux pas* in mass lithium extraction committed in processing and use of hydrocarbon as well as other raw material required to manufacture cars. Those were the times when society was not as aware as it is today in terms of preservation of natural habitats and ensuring the appropriate living and work conditions of people included in production chains.

Not only lithium, other battery components are troublesome, too, especially rare metals used also to catalyse exhaust gasses from cars, commercial vehicles and machinery. It needs to be underlined how mass e-mobility can reduce significantly the need of catalysts and how raw material used to build them could be applied in battery production. To remedy problematic practices during the extraction of raw materials for electric car battery packs, one of the key aspects is to establish circular economy, a strict control and apply firm measures in the degradation of worn-out cars, commercial vehicles and machinery. By recycling used catalysts and batteries, the need for mining will obviously decrease. The same applies to rare earth materials, including the components of electric engine magnets. However, the latest technologies already provide increasingly efficient engines for electric cars even without permanent magnets,

and the swift evolution of battery technology also cannot be overlooked. Sodium-ion batteries are virtually ready to be launched, whereas magnesium EV batteries are just few years from being sold for city cars. Many promising features are also provided by aluminium and calcium batteries. There represent the most common elements evenly found all over the worlds, the extraction of which is far less troublesome compared to the processes known for obtaining lithium. Perhaps lithium batteries will remain available only for the most powerful electric cars.

Moreover, people are getting more and more aware of the fact that large quantities of lithium can be found in geothermal water and in the sea, and the acquisition of this element has virtually no impact on the environment. Remarkably, lithium excretion can become another part of exploitation of geothermal energy or extraction of freshwater from the sea. With the ever-increasing use of e-cars, we must therefore strive to replace the currently prevailing method of lithium extraction around salt lakes with other much more eco-friendly ways as soon as possible. Of course, the development of new lithium-free battery technologies also needs to be accelerated, promoting the evolution of batteries without rare metals. The direction has been shown by the newest electric car engines running without permanent magnet and manufactured with rare earth elements.

Massive savings with electric cars

One of the most outstanding benefits of electric cars is the significant cost reduction, which goes far beyond the mere energy used for driving. Compared to cars running on petrol, not to mention diesel, maintenance of EV is far more economical, in fact, it is as much as five times cheaper for some e-cars.

Virtually every country supports the purchase of electric cars with subsidies or other forms of financial incentives. There are also many non-financial stimuli, known as positive discrimination including parking and other policies. If nothing else, parking during charging time is free of charge in the most popular city areas.

As far as e-car charging expenses at public stations, multiple variables must be taken into consideration, as well as other circumstances and the ways EV are used and charged.

Figure 8: Ž. Purgar

100km for one or two litres of fuel

Those who generate their own private power are naturally the ones to save the most. It is far easier for people living in their own houses or buildings with private parking and equipped with a secure source of energy. Thanks to EV, they can reduce up to five times the costs of fuel or energy. Supplied by private solar power stations, they can even enjoy complete energy independence, something owners of fossil fuel cars can only imagine. On average, there is more than enough sunny days in the Mediterranean region to ensure carbon-free energy, so anyone could actually drive their car without GHG emissions and with minimal costs. Perhaps even for free.

Another rule of cost-efficient use of electric cars is that we should make relatively large number of kilometres with them. Since their range has exceeded 300 or even 400km with a single charging, over 250km or more can be made in one business day, meaning that with an average of 20 business days per month, an e-car user makes at least 60,000km annually, which can be easily compared to conventional cars reaching the highest speeds allowed in everyday traffic. What differentiates one from another is the cost of power supply, which can be five or even more times lower compared to fossil fuel cars, especially if electric cars are being charged at home or at the company stations during office hours.

Those who drive themselves around 120km to work with an electric car and cannot take advantage of suitable public transportation, given a daily distance of approximately 250km, could save 10, 20 or even more thousands of euros only on driving costs, that is at least half of the investment necessary to purchase an EV. Not to mention zero GHG emissions compared to conventional cars which could exceed as much as 30 tonnes of CO_2. And considering source-to-wheel criteria, emissions are cut in half of even reduced to 25%. The countries of the Mediterranean such as France and Croatia with exceptionally small specific emission factor (CO_2/kWh) of power consumed, the overall reduction of GHG emissions is exponentially higher.

Therefore, drivers of e-cars save the most and contributes highly to the reduction of GHG emissions and air pollutants of the whole society.

Figure 9: Audi

Figure 10: Renault

Convenient charging on public stations

Naturally, charging at home is much cheaper than charging on public stations. But the costs still do not exceed 50% of the expenses necessary to drive fossil fuel cars. Unfortunately, there is no standardised principle as various charging operators provide different prices under contrasting conditions. Nevertheless, people should be made aware that they could conclude a contract with the operator for more convenient energy prices on public charging stations. Countries follow their respective pricing standard, making it impossible to agree on unified charging tariffs. In some countries, charging is still free of charge, while other have relatively high prices, particularly for *ad hoc* charging on stations the user has no contract with.

It should be noted that manufacturers of electric cars also conclude exclusive contract with providers of charging services. This way, drivers of a specific brand can charge their vehicles on infrastructure provided by various operators throughout the EU and at lower prices compared to everyday users. People can also charge at stations built exclusively for a specific car brand and at considerably cheaper compared to the tariffs at public charging stations, especially on high-performance DC ones.

Fast DC stations: charging duration similar to refuelling

E-mobility technologies are experiencing a very swift evolution both for vehicles, especially their main components and battery packs, and charging infrastructure. The same applies for electricity grids required to supply power and mass charging of electric cars. Nowadays cars car recharge for 100km and more in less than ten minutes on high-performance stations. Since these points do not allow to fully recharge batteries, a 500 or 600km route lasts almost the same as journeys with fossil fuel cars. It should be noted that 20 minutes of high-performance charging guarantee enough power for 200-300km drive the latest cars. The range of over 400km with one charging, 600-700km can be easily travelled taking just a short coffee break. In other words, you can recharge the battery in approximately the same time as refuelling your conventional car. Still, keep in mind that traditional vehicles can be refuelled at gas stations, whereas EV provide comfortable recharging at a reasonable cost, or even cost-free, on destination or where you park the car for an extended period of time.

Hence the charging infrastructure at hotels, tourist attractions, shopping centres or near cultural and sporting events is key for driving state-of-the-art electric cars as we used to ride conventional vehicles. In fact, it offers a cheaper experience with many benefits, particularly the ones arising from positive discrimination stimuli.

Figure 11: Ž. Purgar

Best available technologies for charging systems

Connectors

Electric cars can be generally connected to any power outlet by the parking space. However, public charging infrastructure is built differently and with other types of connectors. The same are applied to charging points at home with systems ensuring the safe installation and communication between the car, the station and the wiring or distribution network backend safety systems. The advanced charging stations also guarantee the administered consumption as well as other aspects of remote control and operation management.

All of it can be successfully provided by the standardised Type 2 connector, well-established for low-power charging points in Europe. All cars recently sold on the European market are equipped with this connector.

Combo connectors, previously known as Combined Charging System, are gaining popularity in fast charging infrastructure, i.e. DC charging points. Certain Japanese cars employ ChaDemo connectors.

Tesla cars have a special kind of connector used on private infrastructure which could also be used on AC charging points through Type 2 connectors. At the same time, the latest models are equipped with CCS connectors for fast DC charging.

Compared to a decade ago, cords, sockets and outlets, as well as connectors on charging stations are all standardised, preventing any issue with cords and different charging requirements in Europe. Every electric car currently for sale in Europe can be charged on whichever station you wish, with the exception of the outdated ones, which are very few. Some locations do not provide charging stations *per se*, only 3- of 5-pole connectors which can be still used together with special chargers and dedicated adapters. The range of products and services these EV fittings is spreading swiftly, providing solution to every on-field situation imaginable.

Figure 12: Audi

AC charging stations up to 22kW

The so-called AC charging points are the most frequent stations allowing up to 22kW of charging power. The standard today is 11kW on AC charging station. In other words, a car driving on regional roads or highways with 15-16kWh or 20kWh of energy consumption per 100km (charging losses included), respectively, will have to charge one hour to make another 50-75km. In normal weather conditions and with reduced driving speed, small electric cars will need to recharge for an hour before hitting the road for the next 100km. Generally, a three-hour layover on such station will recharge the car for another 150km even if you drive on highways. Some cars, including the most popular among European customers, can reach almost 300, if not 400km with a three-hour charging session of 22kW station, meaning that a dinner in a restaurant, a play or movie, or seeing your friends should be enough to fully recharge the empty battery in your EV.

Figure 13: Ž. Purgar

DC up to 50kW, fast charging

To charge your electric car faster you must plug it in on DC stations. The ones providing a maximum of 50kW are also amongst the most frequent points of this category. They are located near the most important traffic connections, at gas stations or by shopping centres, hotels and main roads. Recently, the UE supported the building of large amount of these stations within the TEN-T trans-European traffic network. Today, virtually every single Member State achieved the target of 50kW DC stations situated approximately 50km among themselves within the core transport corridor. This way, drivers can enjoy their e-car wherever and whenever they decide to, without fearing for charging the battery in reasonable sessions.

With some planning, after 300km and more of journey, a range totally possible in everyday traffic and with speeds comparable to conventional cars, you would need just some 10-minute break to recharge not only the electric car, but also your battery, which is necessary for a safe and care-free continuation of the route. Join your charging with a coffee break or some shopping and it will become of the most anticipated aspects of your electric adventure.

Figure 14: Ž. Purgar

Rapid DC charging up to 350kW

The rapidly expanding high-performance charging infrastructure is just one aspect proving how the area of electric cars is experiencing a true revolution and how recently, expensive and state-of-the-art technology solutions are becoming more and more incorporated in affordable vehicles. We talk about rapid DC stations with nominal charging power of 350kW, a number approachable by vehicles with 800V system power, which are expected to gain popularity compared to the 400V systems. Beside high-end luxury brands, the market has launched electric vehicles with 800V known as 'popular cars', ensuring lots, if not the most features for their value. For this reason, the democratisation of the most efficient and innovative charging technologies for mass e-mobility is already under way.

In rapid charging, one simply cannot overlook the ground-breaking car brand in electric mobility. One of the causes being that it has been building its own network of rapid charging station operating exclusively for its cars.

The capacities of 100, 150 or even 270kW for the most powerful e-cars guarantee another 100km on the road in less than a ten-minute charging session. A stopover like the one used to refuel conventional cars will augment the reach of high-performance EV up to 300km. With a base range of 400km, your journey of 600 or 700km, coffee break included, will not take longer than a ride with fossil fuel cars.

The only difference being that the latter can stop only at gas stations, whereas e-car owners can fully charge their battery at home even before their adventure begins or on destination without losing any time.

Surely, the prices for rapid services are very high, but only for single *ad hoc* charging. If the uses adhere to a monthly rate or takes advantage of the promotional prices for specific car brand, charging in time slots becomes more budget-friendly compared to petroleum products.

Figure 15: Ž. Purgar

How to be cost-efficient of fast DC stations?

No doubt fast infrastructure must be used for fast and cost-efficient on-the-road charging to guarantee us to reach destination or point in which the car is expected to be parked longer and therefore subject to slow charging, minimizing the expenses. Everyday driving on repeated journeys allows us to recharge the battery at home or during work where electricity is significantly cheaper compared to the costs of fossil fuels.

Those who use their e-cars within a specific range pay much less for their ride compared to owner of conventional cars running on gas or diesel. However, it is true that for longer routes, charging could be more expensive. That being said, long-term electricity costs must be considered. Particularly on an annual basis, where you can sum the charging costs on occasional longer runs and the expenses of regular charging at most favourable prices. The calculation proves how charging electric cars is still considerably more economical compared to fossil fuel.

Hence, users must be fully familiar with their electric cars: on repeated routes you can see how far can you drive with one charging and what is the minimum battery re-fill required to reach the target destination.

Users can enjoy the assistance of increasingly intelligent and accurate navigation system in modern electric cars which are able to detect automatically all the circumstances, considering the remaining battery, and provide where and when it would be the most convenient to charge your EV. Thanks to it, even e-mobility rookies can master the technologies in a heartbeat and turn the electricity costs to their advantage.

And when they become aware of the law of e-mobility, the latest navigation systems and information provided by onboard computers, as well as a myriad of other exclusive data and assistance provided by electric cars can only help you out even extensively. Driving soon grows into an intuitive act in which freaking out about the battery level is completely pointless. The ride does not differ in any aspect from the one in a conventional car. You can only add up the benefits of electricity compared to fossil fuels.

Figure 16: Audi

Figure 17: Renault

E-mobility in the Mediterranean Region

Electric cars are increasingly popular among buyers

The recent years have seen a big shift in trends amongst buyers of new cars in the EU. In 2019, Otto engines covered a 57.8% and diesel cars 32.3% of the market, whereas in the first nine months of 2021, the shares plummeted to 41.3 and 20.5, respectively. No one can deny anymore the exponential growth in sales of partially or completely electric cars. In 2019, there was only 1.9% of battery electric cars (BEV) sold in EU, in 2020 the share increased to 5.4% and in the first nine months of 2021 for another 2.2%. Similarly, plug-in hybrids cars (PHEV) with driving range of 50km running exclusively on electric operation had a 1.9 share of all cars sold in EU in 2019. In 2020, the percentage was already up to 5.11 and by the end of September 2021 to 7.6%.

Though only by small margins, Member States along the Mediterranean coast are falling slightly behind the European average. In 2020, the region had a 4.1 sales share of electric cars, but after 3/4 of 2021, the percentage went up to 5.4. It cannot be ignored, however, that certain countries which did overlooked the beginning of mass e-mobility, have finally picked up the pace. Take Greece, where the sales of electric cars in the first nine months of 2021 experienced a growth of as much as 410% compared to the same period the year before.

E-cars a sold more in Italy as well. By September, the country had a 169% increase of new e-cars sold compared to 2020.

If over 110,000 brand new electric cars were sold to French clients in 2020, by the end of September the market enjoyed a 52% increase compared to this period last year. From January to October, 106,945 new EV were sold. The same share of growth in sales of electric cars in the first nine months of 2021 was registered in Spain. Compared to the entire 2020, the sales of e-cars by September 2021 increased by 52% in the Mediterranean Region of the EU. And by the end of the year, the achievements will be even more striking.

Similarly, to the other EU Member States, electric cars have the momentum in sales in the Mediterranean counties, making more and more drivers abandon their gas or diesel engines. Europe and the Mediterranean area are rapidly driving towards a low-carbon or even carbon-free future on roads. Once the energy transformation of the society is concluded with the decarbonisation of the entire energy sector, EV will round up the integrated decarbonisation of society.

In any case, clients are certainly expressing their interest toward e-cars and have fewer doubts about their applicability. Actually, the numbers above are just another testament of the increasing number of buyers recognising year after year the advantages of electric cars compared to fossil fuel engines.

Figure 18: Renault

Wide range of options: to each his own

The blistering expansion of electric cars is grounded on two key facts. The technological evolution of e-mobility is extremely fast. Ten years ago, battery technologies in cars could be compared to those in laptops or mobile phones. But today, they tell an entirely different story. Temperature management of battery packs has also developed beyond imaginable, making batteries more durable even under aggressive discharge, when driving on highways and aggressive charging with the highest powers. Despite retaining similar sizes and weights, the battery capacity has increased by almost three times in the last decade without any change in prices of the battery pack. In fact, the costs have been even cut. The efficient battery cooling and heating ensure a mileage of up to 300,000km without losing more than 10% of battery capacity. A 300 or 400km range is becoming virtually ordinary, and with a widespread network of charging stations, even long voyages are not a problem anymore.

Moreover, today every single manufacturer has an electric car among their vehicles; from the smallest, economically accessible cars to the utterly popular SUVs (large ones included). The price gap with fossil fuel cars can be easily bridged within a few years by reducing dramatically the costs of energy.

Frankly, there is no purpose, need or requirement that an electric car cannot satisfy among the vast range of cars and customers' demands. Purchasing an electric car has become an act with multiple benefits for the users.

Figure 19: Volkswagen

The evolution of the infrastructure: careless charging

The use of e-cars is strongly related to the charging infrastructure. Thankfully, the Mediterranean Region goes hand in hand with the global trends. At the end of 2020, there were 165,751 plugs on 36,757 locations throughout the countries of the area. Similarly, to the sales of EV, the progress of the infrastructure has also taken off. Compared to 2020, the number of charging station in the Mediterranean Member States increased by 23% by the end of 2021. Particularly in Greece and Spain, which experienced a growth by 51 and 38 percent, respectively. The most extensive and branched charging infrastructure enjoy drivers in France. The highest share of fast DC stations can be found in Croatia with 27.8% of all locations. Spain also enjoys numbers alike, whereas all other countries have over 10% of such stations.

All these facts and figures show that electric cars are becoming more common than ever. Wherever the road may take them, drivers can be sure to find a station to charge the battery, even on the road itself. The numbers concern solely the public charging infrastructure; therefore, the network is even greater and wider considering the private stations at home or in businesses.

Figure 20:Renault

E-mobility: generating economic growth and welfare

Since multiple countries of the Mediterranean depend on tourism and visitors are arriving mainly by car, charging infrastructure seem extremely important for the future development of the sector and the entire economic growth of the region.

E-mobility represents the perfect opportunity for economic growth even in times when the car industry and business is facing major shifts. That being said, the Mediterranean countries must take advantage of the momentum.

E-cars have truly become part of our everyday life. With all their positive effects. We can travel anywhere and anytime. But the biggest difference compared to conventional fossil fuel cars remains unchanged and very clear: electric vehicles reduce the annual carbon footprint by several tonnes, with rides with no carbon emissions at all.

Figure 21:Nissan

Part C The EnerNETmob project

Purposes and experience of the project

Project partners from 12 countries were working together with the aim to improve Sustainable Electromobility Plans (SEMPs) and set an Interregional Electromobility Network across the MED area, with a funding of 5,74 million EUR from the Interreg - MED programme.
The consortium has been coordinated by the Region of Peloponnese - Department of Management for Development Planning (Greece) and it comprises of 16 partners from 12 different MED countries, including local authorities, sectoral agencies and transport infrastructure authorities.
Partnership: Authority of transport in Malta (Malta), RAM Logistica Infrastructure e Trasporti S.p.a (Italy), Ministry of Transport, Communications and Works (Cyprus), Albanian Institute of Transport (Albania), Region of Thessaly – Department of Development and Planning (Greece), County of Primorje and Gorski Kotar (Croatia), University of Palermo – Department of Agricultural, Food, and Forest Science (Sicily, Italy), Regional Development Agency of Northern Primorska (Slovenia), Energy and Environmental Agency of Arrabida (Portugal), Free Municipal Consortium of Ragusa, Sicily (Italy), Dynamic Vision P.C., Athens (Greece), Port of Bar Holding company (Montenegro), CIMNE, International Centre for numeric methods and engineering, Barcelona (Spain), CAPENERGIES, Aix-en-Provence (France), Austrian Mobility Research FGM-AMOR (Austria).
EnerNETMob aim was to plan, test and promote electromobility plans following common standards for electric transport systems at transnational level, by integrating regional networks of Eclectic Vehicles Supply Equipment (EVSE) using same communication protocols and distributed in the territories in order to allow medium-range interurban and interregional displacements. The overall objective has been to enhance capacity to plan and implement "Interregional Electromobility Networks" connecting cities and regions in the Mediterranean area at transnational level with the application of common policies and standards.
The EnerNETMob project aimed to: decrease GHG emissions due to the transport sector in Mediterranean cities; improve the living environment in high density areas; improve the mobility and quality of life populations in contexts of economic crisis; improve transnational road-sea multimodal transport services for passengers and freight; promote electric transport and logistics as leverages to boost the competitiveness in MED area; increase use of renewable energies to charging points.
Specific objectives of the project were:

- To analyse and implement joint strategies for mobility and urban planning of electromobility systems in the framework of existing regional mobility and intermodal transport networks in the MED region.
- To create regional "Small scale Infrastructure Networks allowing interurban electric transport displacement among cities, rural areas, and intermodal terminals in the MED region.
- To share common design guidelines for electromobility systems according to same technical standards and communication protocols.

The project has approached and integrated national and regional low carbon transport policies by interconnecting electromobility systems at interregional and interurban level. A transnational cooperation approach has been necessary to integrate different national/regional/local policies and to merge low carbon transport strategies, in order to spread and transfer the project outputs and results.

Results and outputs of the project

The project covers 12 states and the different partners contributed and cooperated to transfer and capitalize the results of policies and plans. The partners have also implement pilot actions to test and share a first group of integrated local infrastructure networks that connect transnational regions and urban areas.

Project results are:

- Increased capacities to implement policies on regional/urban planning of electric transport infrastructure/services thought transnational cooperation.

EnerNETMob aimed to reach the maturity and the transnational coordination of investments planning in multimodal, environmental – friendly and low carbon transport and in mobility infrastructures and services to be funded by ESI Funds. This result has been realized thought the pursuing of the 1st specific project objective "To analyse and implement join strategies for mobility and urban planning of electromobility systems in the framework of existing regional transport networks in the MED region".
To this end, National/Regional Authorities will coordinate their policies and regulations to develop and implement Sustainable Electromobility Plans (SEMPs) within the framework of a shared transnational low carbon strategy. The direct benefit of implemented SEMs is to overcome transnational restrictions by integrating electromobility infrastructures in existing intermodal terminals.

- Increased transnational cooperation trough the integration of the national/regional Small Scale Infrastructure Networks in the MED area:

The project has increased options for implementation of multimodal and low carbon transport plans trough electromobility infrastructures and services. By pursuing of the second specific objective “To create regional Small-Scale Infrastructure Networks” allowing interurban electric transport displacement among cities, rural areas and intermodal terminals in the MED region, EnerNETMob has created a Mediterranean Interregional Electromobility Network, interconnecting local networks. Such electromobility network will be transnational and modular in order to overcome interurban distances and spatial restrictions by installing/extending charging infrastructures within a medium-range distance, so that a BEV can cover longer distances by using several electric fuel stations along its trip. EnerNETMob transnational cooperation actions will enhance competencies/skills of public-private stakeholders and National/Regional Authorities in order to transfer regulations and policies to local level and to develop and implement sustainable plans including low carbon transport and multimodal connection soft actions.

- Enhanced knowledge on electromobility infrastructures design by using same technical standards and integrated protocols for all MED regions:

Such EnerNETMob results will affect the harmonization of electromobility infrastructures, ICT tools and management infrastructures and the development of common understanding for intermodal and electric transport infrastructures and services in the MED area. By pursuing the 3rd specific project objective “To share common design guidelines for electromobility system according to same technical standards and communication protocols, the National/Regional/Local Authorities will adopt and share electromobility standards and integrated protocols at transnational level. Direct benefit of using shared standards and guidelines is to overcome interregional and transport restrictions by using common and integrated communication protocols of charging operations, so that same BEV can cross over to different EU States using common charging standards and EVSEs. Moreover, this knowledge will be achieved by National and regional authorities with competencies to implement plans and transfer regulation policies to Municipalities and local Institutions for the implementation of further local plans.
On the basis of existing Best Available Technologies, the project has initiated the pilot actions in order to test the functionality, benefits and the replicability of the parallel “Small-Scale Infrastructure Networks” and their links with the common ICT protocols and standards. Implementing Project Partners (PPs) will test their local “Small-Scale Infrastructure Networks” planned in studying phase. As a matter of fact, all partners together have implemented pilot actions with small-scale investments to test and share a first group of integrated local infrastructures networks in order to connect transnational regions and urban areas.
The activity has faced three main thematic challenges for electromobility: intermodal sea-road transport, sharing mobility and city logistics.

PILOT 1: Connecting islands and urban areas:

The partners in charge of this pilot were working towards the implementation of intermodal sea-road electromobility networks. At the core of this project there is the combination of different means of transport, with a particular focus on sea-road combined transport lines. The main goal was to enhance the mileage of battery electric vehicles. In order to do so, several public charging points and electric vehicles have being installed across some areas of Albania, Greece, Montenegro and Malta so as to implement the trans-border interconnection between small-scale infrastructure networks.

PILOT 2: Sharing electromobility:

Car-sharing and e-bike sharing systems of bigger urban areas of EU have been taken as a model in order to combine RES and sharing electromobility systems. The pilot has been implemented in several MED areas as Cyprus, Greece (Corinth and Argolis), Italy (Ragusa), Slovenia (Goriška) and Spain (Barcelona). The responsible partners have developed local small-scale infrastructure networks, so that to assess the sharing electromobility systems, with particular attention on e-car pooling, e-car sharing and e-bike sharing. Additionally, the partners have tested bike-sharing systems with e-bikes especially designed for people with disabilities.
The ultimate goal was to manage electricity peak-demand of electromobility and to make cross-border interconnection between small-scale infrastructure networks possible.

PILOT 3: City logistics: reducing environmental and economic impact:

The partners in charge of this pilot have developed small-scale infrastructure networks at a local level. Their objective has been to implement electric urban freight transport solutions for city logistic systems throughout urban areas. Battery electric vehicles (BEVs) have being employed as the main means to reach a sustainable and cheaper solution in order to reduce the environmental and economic impact. The aim of the pilot was to testing city logistics for the last mile freight transport connections in urban areas as Bouches-du-Rhône (France), Lisbon (Portugal) and Trapani (Italy), by implementing a distribution model both in metropolitan and in local basins.
Alongside farmer associations and SMEs, the partners were testing a business model for agri-food chains provided with battery electric vehicles and co-powered by RES. Cross-border interconnections between small-scale infrastructure networks have being explored, as part of a wider interregional electromobility network.

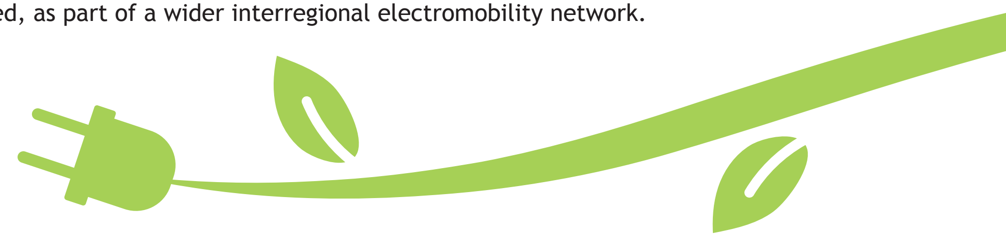

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Figure 22: Region of Peleponnese

Figure 23: RRASP Nova Gorica

Figure 24: Grčija

Figure 25: Libero consorzio comunale di Ragusa


Figure 26: Primorsko Goranska Županija

Figure 27: I.T. Alabania

Figure 28: Universita degli studi di Palermo


Figure 29: Port of Bar

Figure 30: Port of Bar

Figure 31: Capenergies

Figure 32: Universita degli studi di Palermo

Figure 33: ENA

Figure 34: Capenergies

Figure 35: Region of Peloponnese

ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
ΠΕΡΙΦΕΡΕΙΑ ΠΕΛΟΠΟΝΝΗΣΟΥ

Ελληνική Δημοκρατία
ΠΕΡΙΦΕΡΕΙΑ ΘΕΣΣΑΛΙΑΣ

primorsko goranska županija

Ministry of Transport, Communications and Works

Capenergies

ENA AGÊNCIA DE ENERGIA E AMBIENTE DA ARRÁBIDA

Transport Malta

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PORT OF BAR

RRA severne Primorske
Regijska razvojna agencija d.o.o. Nova Gorica