European Union
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EMOBICITY
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Publishable Report

- Integration of RES in the energy mix for EV charging-

Author:
Centre for Renewable Energy Sources and Saving (CRES) – lead partner

Contribution:
Energy Institute Hrvoje Pozar (EIHP)
Regional Management Northern Hesse GmbH (RMNH)
Portuguese Energy Agency (ADENE)
Azorean Government – Regional Directorate for Energy (AZORES)
Northwest Regional Development Agency (NWRDA)

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1.1. Greece

1.1.1. Latest developments related to RES and EV charging

One of the most interesting developments regarding RES and EV charging in Greece is happening on the **island of Astypalea**. Through the specialized subsidy program **"e-Astypalea"** (available to the island inhabitants only), te citizens are offered generous incentives in order to replace their conventional vehicles with EVs. The program also foresees the installation by 2023 of a 3MW PV power plant installation on the island coupled with energy storage provided by a Battery Energy Storage System of 7 MWh. This clean energy is expected to cover the 100% of EV charging on the island. It should also be mentioned that the overall target for e-mobility on the island is the replacement of the current 1500 conventional vehicles with about 1000 EVs in parallel with increased used of shared transport options like shared vehicles and Transport-On-Demand.

Another interesting development in Greece is the **project ELECTRODOTO** which was presented at the EMOBICITY thematic workshop (Thessaloniki, 10/05/22). The project is about Zero carbon footprint electrification on the National Highways with the utilization of RES, innovative technologies of energy production and harvesting, energy storage systems and optimization of energy transactions with the electricity network. The project duration is 28 months (29/07/2021 – 28/11/2023) and one of the most important objectives is to study models for EV charging on the highways through the integration of RES, battery energy storage and net-metering.

Energy Communities are expected to have a significant role regarding EV charging provided from clean energy sources. A recent example in Greece has been the recently established energy community **ChalkiOn**, with members from the Chalki island in Greece. Chalki has been the first GrecoIsland in Greece and as such clean energy measures are already implemented on the island. More specifically, a 1MW PV plant has been installed for the purposes of the energy community in Chalki, which powers (among other) for the moment 6 electric vehicles through 4 charging stations. In the future more EV charging stations and vehicles are expected to be deployed on the island.

To the aforementioned developments, other smaller initiatives could be mentioned at this point, including indicatively the EV charging station that uses energy from PV modules to charge electric cars and an electric mini bus in the **campus of Piraeus University** (the EMOBICITY partners and stakeholders had the opportunity to visit the installation during the 1st Study Visit organized by CRES).

In addition, some municipalities (including the **municipality of Rethymno** on the island of Crete) are starting developing EV parking stations where energy for charging is provided by PV modules installed on the rooftop of the parking spaces.

1.1.2. Challenges, barriers, opportunities and possible solutions for the integration of RES in EV charging

A recent opportunity for further deployment of RES and clean EV charging, is the **national Climate Law** in Greece (currently at the final stage of adoption) which foresees several measures that will accelerate the integration of RES in EV charging. More specifically:

- No electricity production from solid fossil fuels will be permitted after 2028 (*of course, natural gas will still be used for electricity production, nevertheless it is expected that the share of RES will be much higher in 2028 comparing to the current RES share in Greece*)
- For new domestic buildings after 2023, a great part of them (covering area >500m2) will be required to install PVs on the 30% of the area. This means greater RES integration for EV charging at home.
- The **GrEco Islands initiative** is further promoted in Greece regarding the clean energy transition of the small Greek islands. Among other, the foreseen programs include the higher penetration of RES through local production on the islands, usually coupled with energy storage. Under the same initiative, further promotion of e-mobility on the islands is foreseen. Also from 2030 on, the use of diesel for power plants on islands is prohibited. Given that the interconnection of the islands with the mainland proceeds as planned, it may be assumed that there will not be natural gas power plants on the islands but only RES installations.

Another opportunity for further integration of RES in EV charging is provided through the **rapid development of RES production in EU**, through the Green Deal strategy, the National Energy and Climate Plan and the recent **RePowerEU**. Among other, the RePower EU foresees a further increase of the EU's 2030 target for renewables from the current 40% to 45%. Moreover **clean EV charging from PV installations in building roofs** will increase through the announced **EU Solar Energy Strategy** which will boost the roll-out of photovoltaic energy. As part of the REPowerEU plan, this strategy aims to bring online over 320 GW of solar photovoltaic newly installed by 2025, over twice today's level, and almost 600 GW by 2030. Furthermore, the **European Solar Rooftops initiative** will bring a gradual obligation to install solar rooftop panels in certain buildings, combined with renovations, while promoting self-consumption and energy communities.

A potential challenge for the further integration of RES in EV charging is that RES production at a local or national level, may not coincide with EV charging needs. For example, a great percentage of EV charging is expected to take place during the night (through domestic chargers) where PV plants do not produce any energy. To tackle this issue, production from other RE sources need to be further developed (including wind and biomass energy) together with adequate energy storage (battery, reverse hydro etc) to minimise any energy curtailments.

1.2. Croatia

One of the essential goals of Croatia's energy policy is to increase the share of renewable energy sources in energy consumption. Integrated National Energy and Climate Plan for the Republic of Croatia defines Indicative national targets for the shares of renewable energy sources until 2030. Indicative national target for the share of renewable energy sources for the Republic of Croatia in final energy consumption in transport amounts 14 %.

1.2.1. Latest developments related to RES and EV charging

The progress of the integration of RES and EV charging infrastructure can be observed from three different aspects:

1. Development of integrated EV charging station and photovoltaics solutions.
2. Procurement of certified electricity from RES provided at EV charging station.
3. General development of the share of renewable energy sources in the energy mix at the national level with the support of EV smart charging for easier integration of RES into the power system.

<u>Integrated EV charging station and RES production</u>

This solution refers to the infrastructure where the production of electricity from photovoltaics and its consumption through EV charging takes place at the same location. Such a system may additionally include a battery system to store excess energy produced during low demand.

In Croatia, there is only one example of such a solution on publicly available infrastructure. It is made as a demonstration place (pilot), however in the current

conditions it is not possible to develop business models that would justify such investments as profitable.

The station was developed by CPO/EMSP HEP d.d. and consists of two canopies with solar panels and a fast-charging station for charging electric vehicles of 50 KW DC and 43 KW AC, with the possibility of simultaneously charging two vehicles. Energy obtained from solar panels is used as a fuel for electric vehicles. With the help of solar panels, the station annually produces about 3000 KWh of electricity from renewable sources (solar energy).

Figure 1 Canopy Charger with integrated photovoltaic power plant owned by HEP d.d. (Source: HEP d.d.)

Procurement of green electricity

In order to achieve the national target of the share of renewable energy source in transport sector, the user of electricity in railway transport is obliged to procure exclusively electricity produced from a plant using renewable energy sources and which is in the guarantee of origin system (pursuant to the Law on Biofuels for Transport, Official Gazette 52/21 in force since 22.05.2021, Article 30). Furthermore, the user of electricity in public road transport and in public coastal liner transport shall also procure exclusively electricity produced from a plant using a renewable energy source and which is in the guarantee of origin system.

General RES and e-mobility synergy

The ability to provide flexibility services to the power system is one of the key aspects of e-mobility. There are a number of stakeholders with different interests who have motives to participate in this process, and in addition to power companies, they are also manufacturers of electric vehicles, manufacturers of battery systems for electric vehicles, users of electric vehicles, owners and operators of charging infrastructure, etc.

The provision of flexibility services by e-mobility can be viewed through two dimensions:

a) **Charging management,**
b) **Distributed energy storage.**

The energy potential of the fleet in the Republic of Croatia for the provision of flexibility services at a given time is a function of the total number of electric vehicles, the share of connected vehicles with electricity system at that time, battery charge status and vehicle owner default settings. According to the scenarios of the Energy Development Strategy of the Republic of Croatia until 2030 with a view to 2050, the total potential capacity of electric vehicle batteries for the provision of flexibility services in 2050 will be 45 GWh or 70 GWh depending on the scenario.

1.2.2. Challenges, barriers, opportunities and possible solutions for the integration of RES in EV charging

In the context of general RES and e-mobility synergy some technical and regulatory aspects are described below.

Charging management in refers to charge process management in a way that coincides with the availability of intermittent energy sources. Electric vehicles can be considered as distributed energy storage tanks with the functioning of a system in which two-way flow of electricity is supported, ie electric vehicles can transfer the energy stored in batteries to the electricity grid. This solution is known as "Vehicle to grid" or "V2G" for short.

For the functioning of a system in which electric vehicles represent a **distributed energy storage** for intermittent energy sources, and then the potential to provide flexibility services, it is necessary to meet certain prerequisites which can be divided into (i) technical, (ii) legal-regulatory and (iii) economic.

From a technical point of view, the basic precondition for providing flexibility is the existence of infrastructure, vehicles and other parts of the system that support

bidirectional electricity flow and data exchange, all elements of which are integrated into a smart grid concept.

From the legal-regulatory point of view, it is necessary to recognize the elements of the concept of e-mobility in terms of providing new services, including the possibility of providing flexibility to the electricity system, and their definition within the legal framework.

Finally, the need to manage the whole process of providing flexibility services opens space for creating new business models and opportunities in which various stakeholders will find their interests, one of the basic conditions being the existence of sufficient electric vehicles and appropriate infrastructure for economic justification of such processes.

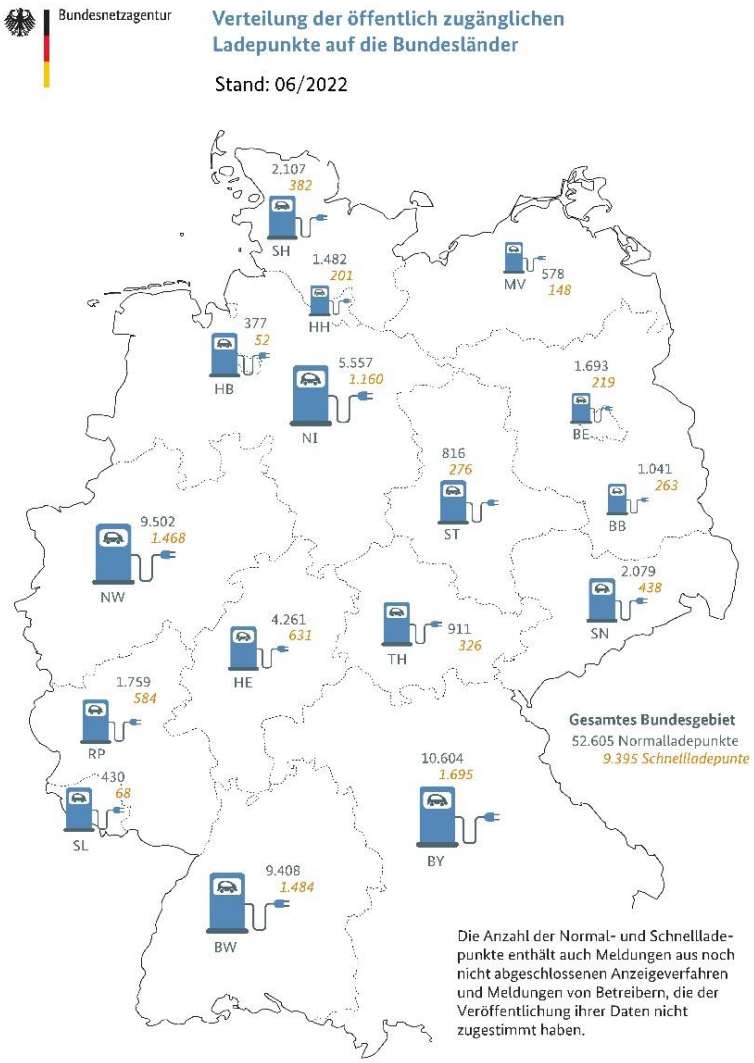
1.3. Germany

1.3.1. Latest developments related to RES and EV charging

New registrations of electric cars in Germany

Record number of new registrations of electric cars in Germany - in the course of 2021, around 356,000 more passenger cars with purely electric drive systems were newly registered than ever before. The year 2022 also started with a year-on-year increase; so far, more electric cars have been sold in every month.

Publicly accessible charging point



A total of 52,605 normal charging points and 9,395 fast charging points in operation on June 1, 2022 have been reported to the Federal Network Agency. These figures include reports from notification procedures that have not yet been completed and from operators who have not consented to publication of their complete data. [1]

There are many more privately used charging stations. However, these are not recorded.

Project unIT-e²

In unIT-e², representatives from the automotive, energy and IT industries as well as science are working together to develop concepts for the optimal and holistic integration of electric vehicles into the energy system. An essential part of this is the testing and demonstration of future-oriented solutions in four large field trials throughout Germany. The objectives of the project are multifaceted and range from the establishment of suitable infrastructure to the development of new business models for electromobility:

- Alignment and exchange of perspectives and objectives of the energy and automotive industries for a holistically optimized dovetailing of the mobility and energy transition.

[1] Bundesnetzagentur - E-Mobilität

- Analysis of different incentive concepts and their impact on the charging behavior of electric car users and the resulting utilization of the distribution network infrastructure.

- Consolidation and evaluation of different energy-related and vehicle/charging infrastructure data.

- Further development of the intelligent charging infrastructure[2],[3]

The Electricity Mix

The term electricity mix refers to the composition of electricity generated in Germany by energy source. In 2021, the German electricity mix was composed of 46% renewables and 54% conventional energy sources, with the electricity mix having been shifting in favor of renewables for years (Figure 2). In terms of electricity generation in Germany, the conventional energy mix currently consists of hard coal and lignite, natural gas and nuclear power. Wind energy, photovoltaics, biomass and hydropower contribute to the renewable energy mix.

A total of 490 terawatt hours [TWh] were fed into the power grid in Germany in 2021. This is 2 % more than in the previous year [481 TWh]. According to preliminary results from Fraunhofer ISE, renewable energy sources supplied 224 TWh. Wind power was the most important energy source for electricity generation in 2021, accounting for 23 % of the total amount of electricity fed into the grid, followed by lignite with 20 % (Figure 1).

In the first 4 months of 2022, 174 TWh of electricity was generated in Germany. The share of renewable energies in electricity generation in Germany was 52% [net]. With 90 TWh generated, solar, wind & co. are the most important source in the German electricity mix in 2022.

This result was mainly due to electricity generation from wind and sun thanks to favorable weather conditions at the beginning of the year. The stormy weather in February produced a record month for wind energy, with 20.6 billion kWh. With above-average sunshine hours, March 2022 provided a very good result for photovoltaics [+33% compared with March 2021]. [4]

Figure 1: German electricity mix in 2021 in Detail[5]

[2] Wir mobilisieren die digitale Energiewende · UN|IT|E² (unit-e2.de)
[3] Feldtest Elektromobilität Nordhessen der unIT-e² (webflow.io)
[4] Strommix 2022: Stromerzeugung in Deutschland (strom-report.de)
[5] https://www.ise.fraunhofer.de/content/dam/ise/de/images/news/2022/Kreisdiagramm_2021.jpg

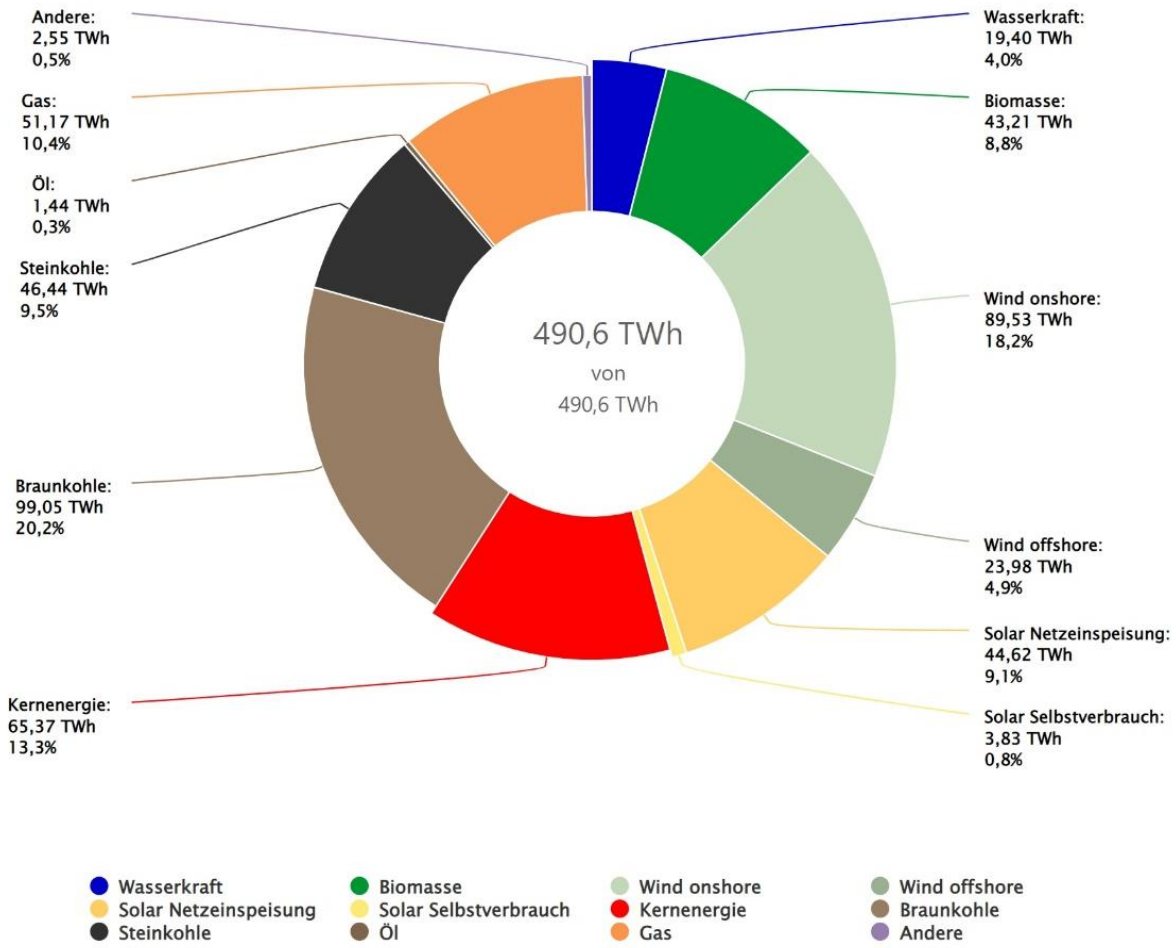
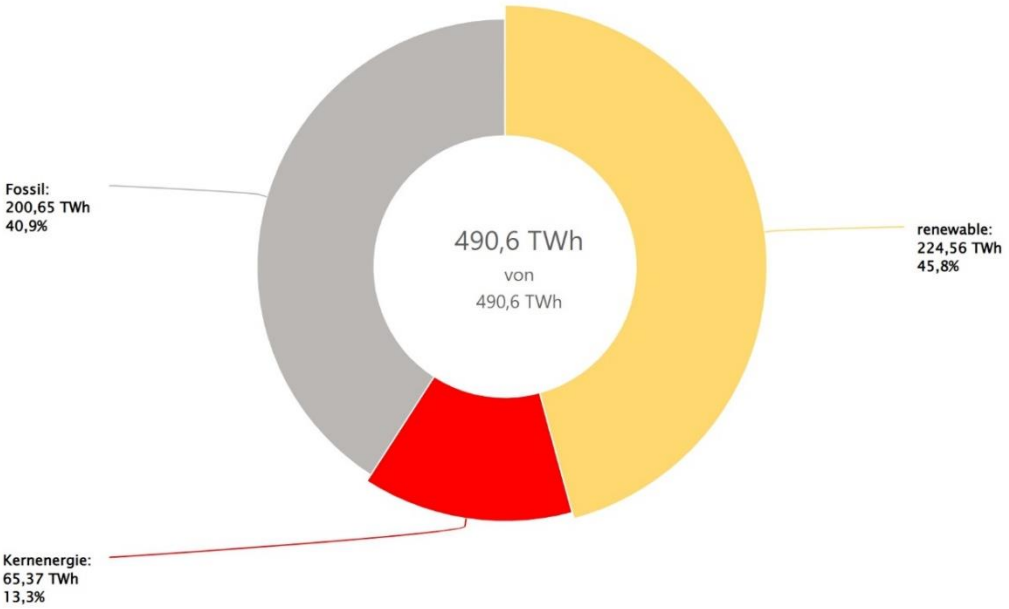

Andere:
2,55 TWh
0,5%
Gas:
51,17 TWh
10,4%
Öl:
1,44 TWh
0,3%
Steinkohle:
46,44 TWh
9,5%
Braunkohle:
99,05 TWh
20,2%
Kernenergie:
65,37 TWh
13,3%
Wasserkraft:
19,40 TWh
4,0%
Biomasse:
43,21 TWh
8,8%
Wind onshore:
89,53 TWh
18,2%
Wind offshore:
23,98 TWh
4,9%
Solar Netzeinspeisung:
44,62 TWh
9,1%
Solar Selbstverbrauch:
3,83 TWh
0,8%
490,6 TWh
von
490,6 TWh
Wasserkraft
Biomasse
Wind onshore
Wind offshore
Solar Netzeinspeisung
Solar Selbstverbrauch
Kernenergie
Braunkohle
Steinkohle
Öl
Gas
Andere

Figure 2: German electricity mix in 2021[6]



Status quo - the state of electromobility in times of Corona

In order to cushion the economic impact of the pandemic, the German government launched an economic stimulus package in June 2020 that not only distributes aid but also strengthens the structural framework for long-term ecological economic activity and ***decarbonization***. Three measures stand out and can lead to increased sales of an additional 650,000 vehicles with alternative drives:

Electricity price: setting the EEG levy at 6.5 and 6.0 cent/kWh on the electricity price for the next two years

Customer premiums: The short-term doubling of the purchase premium for electric vehicles to 6,000 EUR with a simultaneous increase in the eligible purchase price limit from 40,000 to 60,000 EUR

Innovation funding: Direct funding of manufacturers and suppliers for future investments with a maximum of 2 billion EUR until the end of 2021 and funding of the charging infrastructure master plan, research and development projects in the field of electric mobility as well as battery cell production with a maximum of 2.5 billion EUR. [7]

[6] https://www.ise.fraunhofer.de/content/dam/ise/de/images/news/2022/Kreisdiagramm_2021.jpg
[7] Elektromobilität in Deutschland: Deloitte Studie

1.3.2. Challenges, barriers, opportunities and possible solutions for the integration of RES in EV charging

Originally, the German government had planned to reach the target of 10 million registered vehicles with alternative drives by 2030. The forecasts to date show that this target could already be missed by 4.3 million vehicles by May 2020 with the measures. With the new measures, the expected value rises to 6.35 million vehicles with alternative drives by 2030.

Thus, according to the current state of knowledge, the legal framework conditions and subsidies are not sufficient to achieve the self-imposed target but will accelerate the sales of alternatively powered vehicles in the long term.

German State: Short-term opportunities for accelerated transformation (prognose)

Based on the measures adopted in the economic stimulus package (after and during COVID 19), the state still has the potential to promote the transformation towards electromobility with an extended innovation premium as well as a staggered increase in the fuel price with an additional 0.4 million vehicles with alternative drive systems.

> **Innovation premium:** With an extension of the increased purchase premium until the end of 2023, another 150,000 vehicles with alternative drive systems would be newly registered according to our forecast.
>
> **Fuel price**: Based on a discussed increase in the fuel price (source: Federal Environment Agency) from 2021 to 2024, in this case by a total of 30 cents, a further 250,000 alternatively powered vehicles would be newly registered. [8]

[8] Elektromobilität in Deutschland: Deloitte Studie

Businesses and consumers: Longer-term opportunities

In the long term, however, necessary measures are required on the part of the companies in the automotive industry. They can drive the transformation with up to 1.4 million additional vehicles with alternative drive systems as the biggest lever - with the following influencing factors:

- **Battery technology:** building on the adopted measures, the extended optimization of the battery price to below 75€ in 2023 and below 50€ per kWh in 2026 will increase demand by an additional 320,000 vehicles. An additional reduction in electricity consumption to below 19 kWh/100km within the luxury class and 13 kWh/100km for subcompact cars by 2025 would create demand for an additional 140,000 vehicles.

- **Platform effect**: Intensive investments in platform building and the use of economies of scale reduce additional costs for manufacturing and materials. In addition, the costs of research and development are reduced - a further 640,000 vehicles with alternative drive systems are potentially in demand.

- **Infrastructure:** Innovative charging concepts in urban areas and a stronger focus on cooperation in the development of new charging concepts would increase the demand for vehicles with alternative drives by 300,000 units. [9]

Opportunities:

Due to the rising number of new registrations of e-vehicles (battery-electric vehicles and plug-in hybrid vehicles) in Germany, the need for charging infrastructure will continue to grow in the coming years, especially in the private sector. The new target of Germanys government to integrate 14 million e-vehicles by the year 2030 and the EU's more stringent fleet emission targets (i.e. the system of CO2 fleet limits for passenger cars and light commercial vehicles), the demand for charging infrastructure in Germany will continue to rise significantly in the coming years. In particular, *the successful grid integration of electromobility, i.e., the integration of charging facilities into the respective urban or rural local grids and the organization of the interaction between the grids and the connected charging infrastructure or electric vehicles, is both a challenge and an opportunity for sector coupling*[10].

[9] Elektromobilität in Deutschland: Deloitte Studie
[10] Wie gelingt die Netzintegration von Elektromobilität? › NATIONALE PLATTFORM ZUKUNFT DER MOBILITÄT (plattform-zukunft-mobilitaet.de)

1.4. Portugal (Azores)

1.4.1. Latest developments related to RES and EV charging

Nowadays, the Autonomous Region of the Azores has been serving as a living lab for the testing of several technologies. The Azorean entity responsible for energy related matters – the Regional Directorate for Energy – is part of five EU-funded projects, namely:

- Electric Vehicles Management for Carbon Neutrality in Europe (EV4EU), financed by Horizon Europe, for testing smart charging and V2X technology for mass EV deployment (GA 101056765).
- LIFE IP Climaz, co-financed by the LIFE programme, in order to analyse the safety of electric power supply and adaptation and mitigation of energy production and use/supply (Life19 IPC/PT/000004).
- Integrated Solutions for the Decarbonisation and Smartification of Islands (IANOS), financed by Horizon 2020, for the decarbonisation of electrically isolated islands (GA 957810).
- Increase of Energy Efficiency by Electric Mobility in the City (EMOBICITY), co-financed by Interreg Europe, seeking to improve low-carbon economy policies so as to facilitate the take up of electric mobility at a national and regional level.
- Supporting Energy Efficiency and Renewable Energy in European Islands and Remote Regions (RESOR), co-financed by Interreg Europe, aiming to promote the best practices that support energy efficiency and the use of renewable energy in corporations of the secondary and tertiary sector in European islands and other remote regions.

Additionally, the Azores is one of the islands all over Europe selected by the Clean Energy for EU Islands to accelerate their clean energy transition.

Also, as established in the Plan for Electric Mobility in the Azores (PMEA), Graciosa has been chosen as the Model Island for the promotion of innovative electric mobility solutions. The Graciólica project has allowed for over 60% of renewable energy integration. This private project consists of a hybrid production unit, relying on wind and solar power, together with an innovative energy storage system that can supply the island with over 24-hour consecutive periods of electric energy.

Furthermore, EDA – Eletricidade dos Açores, S.A. (Electricity of the Azores), the Azorean TSO and DSO has been deploying, in Terceira and São Miguel islands, a Battery Energy Storage Systems (BESS) for spinning reserve and frequency regulation purposes, in an

investment of around forty million euro. This will allow a further raise of the share of RES in the system. EDA plans to deploy similar systems in six more islands until 2026.

Also worth mentioning is that EDA Renováveis is expanding both their Geothermal Power Plants and their wind farms in order to maximise the RES energy production.

EDA Group has planned on investing more than 180 million euro in BESS and RES until 2026.

1.4.2. Challenges, barriers, opportunities and possible solutions for the integration of RES in EV charging

The Autonomous Region of the Azores is subject to regulation from the Regulatory Authority for Energy Services (ERSE). Given the fast development of technology over the last couple of years, Portuguese law has not managed to follow it as fast as recommended, thus creating some legal barriers to the deployment of technology. One can say that this is not exclusive to the Azorean/Portuguese market and that the EU should pressure all national Regulators for a faster response to the technological evolution.

The Azores have been studying the mass deployment of EVs and how smart charging and V2X technology could help integrate more RES.

It is believed that EVs have the capability to be fully deployed in Island environments, given the small distances driven. However, the initial costly investment in electric vehicles continues to be a challenge when implementing e-mobility, not only for individuals/families, but also for corporations, despite the incentive systems already in place. In addition, economic and social/cultural obstacles need to be tackled. Nevertheless, progress in order to promote electric mobility in the Azores is being made. The Azorean archipelago has been working on several initiatives, including financial support to the purchase of electric vehicles, awareness campaigns and expanding the public network of charging stations, in coordination with municipalities, public entities, corporations and organisations.

1.5. Portugal (mainland)

1.5.1. Latest developments related to RES and EV charging

In 2020, renewable energies accounted for 34% of gross final energy consumption, with Portugal being the 5th country in the EU-27 with the highest weight of energy from renewable energy sources, in its gross final energy consumption. This surpassed the

target of 31%, established in accordance with Directive 28/2009/EC, also included in the National Action Plan for Renewable Energies (PNAER). In the same year, the weight of renewable energy sources in electricity represented 58%, against 40,6% in 2010. For 2030 the National Plan for Energy and Climate (PNEC) established the target of 47% of energy from renewable sources in the gross final consumption, and 80% regarding the weight of renewable energy sources in electricity [1].

The greater use of Portuguese endogenous and renewable resources, to produce electricity, has changed the composition of the electricity production mix in Portugal. Between January and April 2022, 14.677 GWh of electricity were generated in mainland Portugal, of which 59,4% were from renewable sources (hydro, wind, bioenergy and solar). In April 2022 alone, the renewable incorporation in electricity generation was 62,1%. In turn, fossil thermal power plants accounted for 31,4% [2].

The electric production evolution per source, between April 2020 and April 2022, can be seen on Figure 2 below.

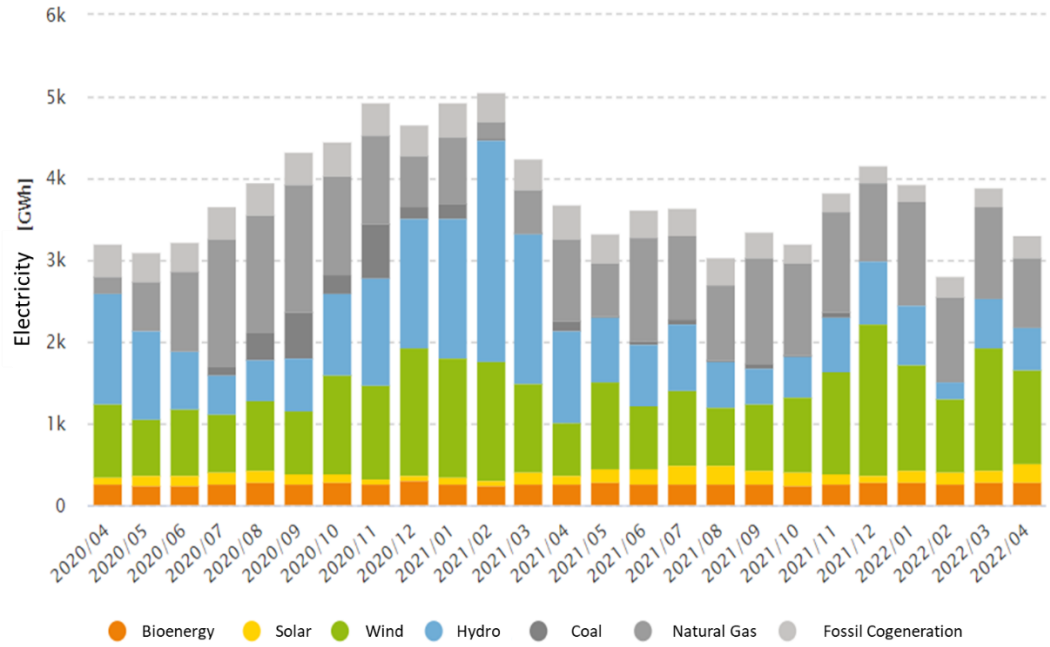


Figure 2 – Electric Production Evolution per Source – Portugal Mainland. Source: APREN, 2022 (data from REN).

EVs play an important role in boosting the use of RES, as they can act as batteries capable of charging excess energy during peak generation, stabilizing the grid. Occasionally, the energy produced from RES, namely solar and wind, cannot be fully used, particularly at times of lower consumption. As such, the network becomes "saturated", forcing the production to be limited – which is to be avoided, as the aim is to maximize the use of these energy sources. The generalization of EVs use can help to solve this either locally,

using smart solutions to accelerate the EV chargers consumption (during peak renewable production), or globally, since EVs often charge during night, that is, when there is less overall consumption and more wind energy available (thus, avoiding the waste of RES).

Furthermore, there are EV chargers like the ones developed by MAGNUM CAP [3] ("Fast Solar Charging"), that use the energy generated by a photovoltaic panels system, allowing the vehicles' to perform a fast charging through intermediate energy storage, using second life batteries of EVs. These systems allow:

- Charging the EV with 100% renewable energy
- The energy produced by the solar panels is used to charge the vehicle at any time
- Significant reduction in greenhouse gas emissions.
- Promotion and respect for the principles of a circular economy, using energy storage solutions with recycled lithium batteries
- EVs operate as renewable energy storage actors
- Off-grid solution (e.g., parking lots, service stations, remote locations)
- Reduction of energy dependence

This solution is integrated with a web-based remote access system, capable of providing important measurements and metrics on solar energy, battery energy storage and charging session reporting. This allows the control of the charging process in real time, and continuous efficient management of the energy available.

1.5.2. Challenges, barriers, opportunities and possible solutions for the integration of RES in EV charging

The importance of the transport sector decarbonization has given a fundamental impetus to electric mobility, while cities are geared towards energy production and are preparing to be the stage for the green transition. Compliance with the Paris Agreement implies that the transport sector should abandon fossil fuels and start using cleaner alternatives. Thus, electricity from renewable sources is probably the most valid option, as it reflects the energy transition itself.

It is in this scenario that Renewable Energy Communities (CER) are created, regulated by Decree-Law 162/2019. These are presented as one of the essential vectors of the PNEC, aiming at increasing energy consumption from renewable sources in the 2021 - 2030 horizon. This diploma, in addition to establishing the legal regime for CERs, is also applicable to self-consumption of renewable energy. The Decree-Law establishes that

the CER is a legal person, based on an open and voluntary membership, who may be natural or legal persons, namely small and medium-sized companies, or local authorities, that is autonomous from its members or partners.

In this context, electric mobility can play an interesting role, as EVs can be used as energy storage batteries, promoting grid stability, and boosting energy flows. Thus, it is possible to integrate in a CER, charging points for EV, bike sharing, storage batteries, among other solutions.

1.6. Romania

1.6.1. Latest developments related to RES and EV charging

The only relevant update is the launch of the National Resilience and Recovery Program ("Componenta 10 – Fondul Local") that will fund the installation of 13208 charging points (target) al over Romania. Additionally, the urban rehabilitation axis ("Componenta 5 - Valul Renovarii") (public buildings and collective housing units) also includes installation of EV charging stations into the eligible project activities. This is a huge boost for collective housing units where the possibilities to charge your EV at home is verry limited. Also, there are discussions about a possible financing of SME's for installation of solar panels as part of technologization projects. It is however still unclear if there will be a link between these solar panels and EV charging stations.

The launch of the Dacia Spring, an EV sold for 10.400 (if you apply for the national EV voucher) meant a strong boost for the national EV market. In the first two months of 2022 there have been more EV (BEV and PHEV) registered than diesel cars. Just in those two months 315 Dacia Spring vehicles have been registered.

1.6.2. Challenges, barriers, opportunities and possible solutions for the integration of RES in EV charging

Regulatory framework and administrative hassles are limiting the possibility of private households to send the surplus of energy generated (from solar panels for example). So vehicle to grid energy transfer is not really applicable in Romania at the moment.

Most EV-charging stations are directly connected to the grid while the energy provided is sourced according to the national energy mix (27,9% Hidro, 19,15% Nuclear, 18.5% Hydrocarbs, 17,2% Coal, 15,1% Wind and others).

Lack of interest in the seeking energy independence at household level, linked with the still high acquisition and installation costs for EVs and RES have been an important

impediment in the integration of RES in EV charging station. However, due the war in Ukraine gas prices have skyrocketed, even forcing the government to implement a 0.5 lei / litre subsidy for gas (half of this “subsidy” has to be covered by the gas stations). This increase in price, bundled with the low acquisition price of a Dacia Spring is convincing more and more Romanians to change their mind regarding the acquisition of an EV, but also regarding local energy production, mostly solar panels on roofs.

References

[1] *Observatório da Energia, DGEG and ADENE (2022). Energia em Números - Edição 2022: https://www.observatoriodaenergia.pt/pt/comunicar-energia/post/9981/energia-em-numeros-edicao-2022/*

[2] APREN – Associação Portuguesa de Energias Renováveis (Portuguese Association of Renewable Energies): https://www.apren.pt/pt/energias-renovaveis/producao

[3] MAGNUM CAP: https://magnumcap.com/pt-pt/linha-profissional/solar-fast-charger/