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Dataset on Electric Road Mobility: Historical and Evolution Scenarios until 2050

Irvylle Cavalcante[1], Alberto Rodrigues da Silva[1,2], Matej Zajc[3], Igor Mendek[3], Lisa Calearo[4], Anna Malkova[4], Charalampos Ziras[4], Panagiotis Pediaditis[4,5], Konstantinos Michos[5], João Mateus[6], Samuel Matias[6], Miguel Brito[6], Alexis Lekidis[7,8], Cindy P. Guzman[1], Ana Rita Nunes[1] & Hugo Morais[1,2] ✉

An increasing adoption of electric vehicles (EVs) is expected in the coming decades mainly due to the need to achieve carbon neutrality until 2050. However, predicting electric mobility's future is challenging due to three main factors: technological advancements, regulatory policies, and consumer behaviour. The projections presented in this study are based on several scenarios driven mainly from reports published by public entities and consultants. It considers the evolution of electric road mobility by defined targets in the electrification of the transport sector. Therefore, the gathered data addresses different horizon times regarding EV penetration in the World, Europe, Portugal, Denmark, Greece, and Slovenia. Thus, an extensive literature review and estimating approach for EV forecast was conducted concerning EV markets, charging infrastructure, and electricity demand. Also, the dataset aims to provide a demand projection by 2050 and serving as a critical input to further work on EV mass deployment in the context of the project Electric Vehicles Management for carbon neutrality in Europe (EV4EU) and other works related to this field.

Background & Summary

Increased awareness of climate change is advancing toward several strategies, among them accelerating electric mobility. The transport sector contributes around 23% of the global greenhouse gas (GHG) emissions[1]. However, it has the lowest share of renewable energy[2] comparing with other sectors. To change this paradigm, adopting electric vehicles (EVs) is a key path. The global EV fleet is growing considerably thanks to incentive policies focused on GHG emissions standards, infrastructure development, and financial incentives. Several reports[3–5] projected an accelerated growth of electric mobility in the coming years, leading to a significant impact on mitigating GHG emissions. The projections also present an increase in electricity consumption and public charging points in the next decades. Nevertheless, a resilient power system is essential to support the increasing demand on network, avoiding peak loads, ensuring the electricity supply[6], and the industrial level capacity.

For instance, Europe is embracing the shift to zero-emission mobility. The 'fit for 55 packages' proposed by the European Green Deal aims to reduce at least 55% of GHG emissions by 2030 compared to 1990 levels[7]. One of the document that is part of 'fit for 55' is the Alternative Fuels Infrastructure Regulation (AFIR)[8] that is centred in the development of electric mobility. AFIR defines targets for minimum installed capacity in public charging stations that should be higher than 1.0 kW per per battery electric vehicle (BEV) and 0.66 KW per plug-in hybrid electric vehicle (PHEV). Considering the abovementioned, almost all internal combustion engine (ICE) vehicle sales are expected to be banned in Europe by 2035[9].

Considering the most recent data, Global EV sales more than doubled, driven by policy attention. It represents a global EV sales share of 8.57%, which accounts for 6.6 million units. Also, this stands current for over

[1]INESC-ID, Rua Alves Redol 9, Lisbon, 1000-029, Portugal. [2]Instituto Superior Tecnico, Av. Rovisco Pais 1, Lisbon, 1049-001, Portugal. [3]Faculty of Electrical Engineering, University of Ljubljana, 1000, Ljubljana, Slovenia. [4]Technical University of Denmark (DTU), Department of Wind and Energy Systems, Risø campus, Roskilde, Denmark. [5]School of Electrical and Computer Engineering, National Technical University of Athens, 15780, Zografou, Greece. [6]Centre for New Energy and Technologies, EDP NEW R& D, Lisbon, 2685-039, Portugal. [7]Public Power Corporation S.A., 10432, Athens, Greece. [8]Dpt. Energy Systems Gaiopolis Campus, University of Thessaly, Larissa, Greece. ✉e-mail: hugo.morais@tecnico.ulisboa.pt

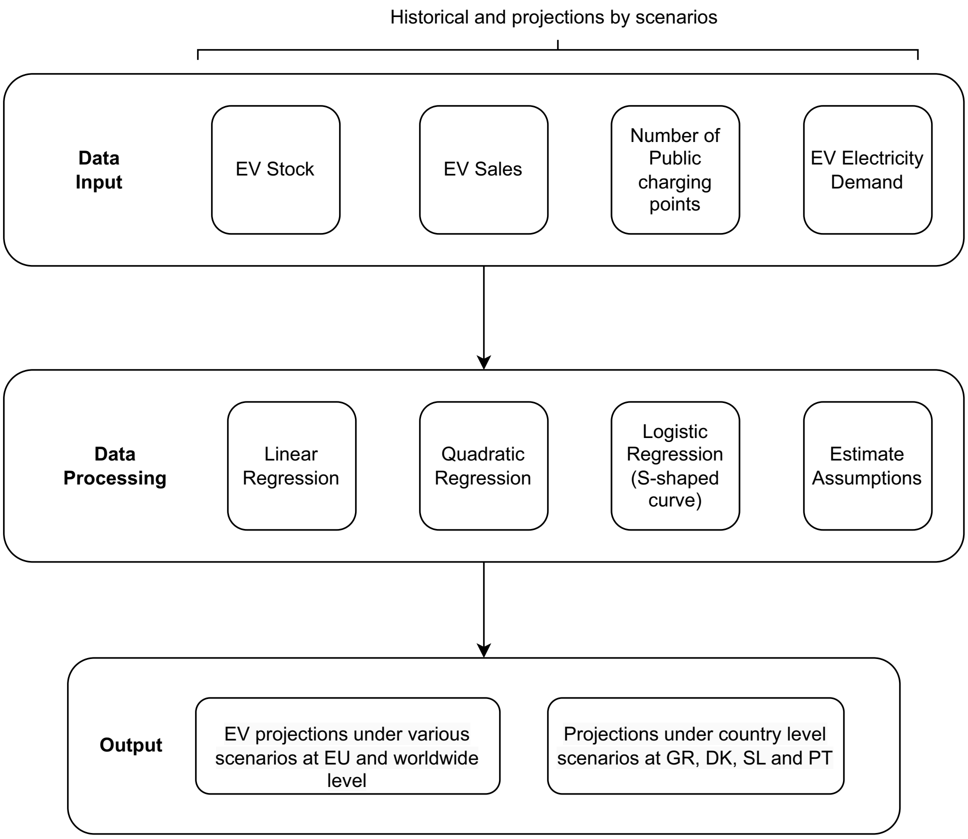


Fig. 1 Schematic method approach.

16.4 million of BEVs (68%) and PHEVs (32%) on the roads. China and Europe lead the EV market, accounting for 85% of the global fleet, followed by the United States[10].

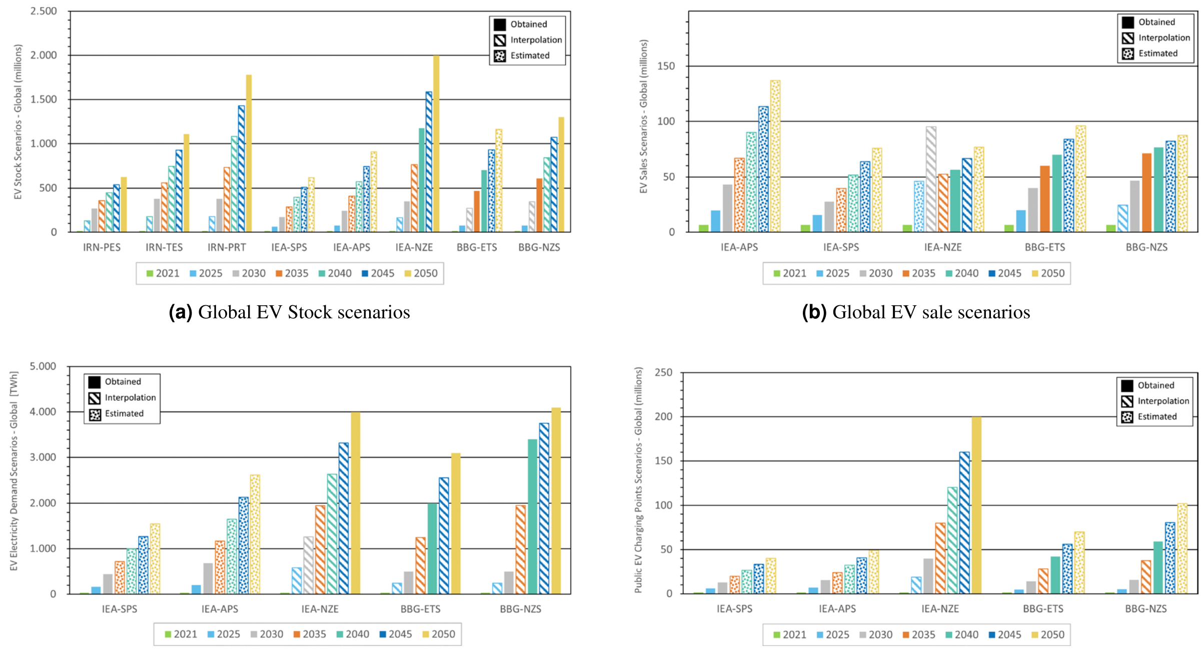
Despite barriers to EV adoption, such as high acquisition cost, limited battery capacity, and insufficient infrastructure[11], it has proven to be a promising solution for the energy transition. Therefore, estimating the evolution of electric mobility to prepare the future of the automotive industry, policymakers, and energy providers for EV mass deployment is crucial. Few papers approach the scenarios analysed in this study for the long-term due to gaps in publicly available data making it difficult to output straightforwardly. In this sense, this paper presents a dataset on electric road mobility based on historical and evolutionary scenarios until 2050. It was provided by public entities and consultants, addressing the targets from different assumptions, time horizons, and market behaviours at the international, national, and regional levels. However, it defines objectives but does not specify the path to achieve the targets. These projections will enable measuring the impact of the EV penetration that will be relevant to planning studies regarding energy systems and foster innovative business models for more sustainable mobility.

Some scenarios in the literature cover different approaches to predict the future of electric mobility and sometimes consider hurdle factors like consumer behaviour in the trajectory. These range from machine-learning tools and diffusion models, which can be subdivided into stochastic and population models[12]. While the stochastic models are based on consumers' preferences considering the purchase decision, the population models consider the market diffusion curve or different growth rate scenarios. Nevertheless, both are less accurate for long-term predictions than the statistical model[13,14].

Furthermore, the datasets described in this study include an EV forecast concerning the stock, sales, electricity demand, and the number of public charging points in the World, Europe, Portugal, Denmark, Greece, and Slovenia. The analysis is performed by growth scenarios on a five-year increment to 2050. Further, the scenarios presented in this study, if not obtained from available sources, the values for some years have been applied to the regression model, and estimated assumptions are used. Figure 1 illustrates the main steps approached for EV demand projections.

Methods

EV Forecast is based on existing production forecasts mainly from reports by public entities and consultants, which considers market and policy targets aiming to achieve carbon neutrality for different time horizons in the context of EV4EU member countries (Portugal, Denmark, Greece and Slovenia) and worldwide. In terms of analysis, these countries are interesting due to the cultural differences, relative position in Europe and the stage of adoption of electric vehicles.



(a) Global EV Stock scenarios

(b) Global EV sale scenarios

(c) Global EV electricity demand scenarios

(d) Global EV charging point scenarios

Fig. 2 Global EV evolution Scenarios. (**a**) Global EV Stock scenarios. (**b**) Global EV sale scenarios. (**c**) Global EV electricity demand scenarios. (**d**) Global EV charging point scenarios.

Input data processing: In addition to the data gathered from the open source, we use the interpolation and S-shaped curve to estimate the unavailable data from five-year increments until 2050 and applied some assumptions. The interpolation as been performed using the Eq. (1) where the values of y represent the number of vehicles and the values of x the years. The indexes '1' and '2' represent the known values and the variables without indexes the values to be calculated.

$$y = y_1 + \frac{y_2 - y_1}{x_2 - x_1}(x - x_1) \tag{1}$$

The S-shaped curve is presented in Eq. (2) where L presented the maximum value of the curve, e the natural logarithm base (or Euler's number), x_0 the x-value of the sigmoid's midpoint (year in the present case), and k the steepness of the curve or the logistic growth rate.

$$f(x) = \frac{L}{1 - e^{-k(x - x_0)}} \tag{2}$$

Several reports have presented projections regarding the evolution of EVs, considering diverse aspects as follows. The input data and sources used are publicly available and described in Table 4. the data have been collected, organized and computed based on existing references. Values not available in the references have been computed using Eqs. (1) and (2).

Worldwide. The input data sourced from the available literature is descrived in the following paragraphs. The missing values regarding EV evolution scenarios were obtained by interpolation function for different time horizons. Figure 2 shows one EV scenario built in the case of worldwide.

- IEA[3] addresses three scenarios until 2030: (i) Announced pledge Scenario (IEA-APS) based on climate policy pledges up to 2030 and driven by the economic and technological development in the coming years impacting the EV market. (ii) Staded Policies Scenario (IEA-SPS) embraces current policy plans up to 2030. (iii) Net Zero Emissions by 2050 Scenario (IEA-NZE) considering the main energy-related targets of the united nations' sustainable development goals (SDGs).
- Bloomberg[4] assesses three scenarios by 2050: (i) Economic Transition Scenario (BBG-ETS) driven by the economic and technological development in the coming years impacting the EV market; (ii) Net Zero Scenario (BBG-NZS) analyses the main path to zero-emission in the transport sector and considers the economy a decisive factor for achieving carbon neutrality by 2050.
- IRENA[5,15] presents three scenarios: (i) 1.5°C scenario (IRN-PRT) pathway to reach the 1.5°C targets of the Paris Agreement through six technological avenues comprising electrification of the sectors, increasing renewable energy generation and improvements in energy efficiency in the context of the energy transition.

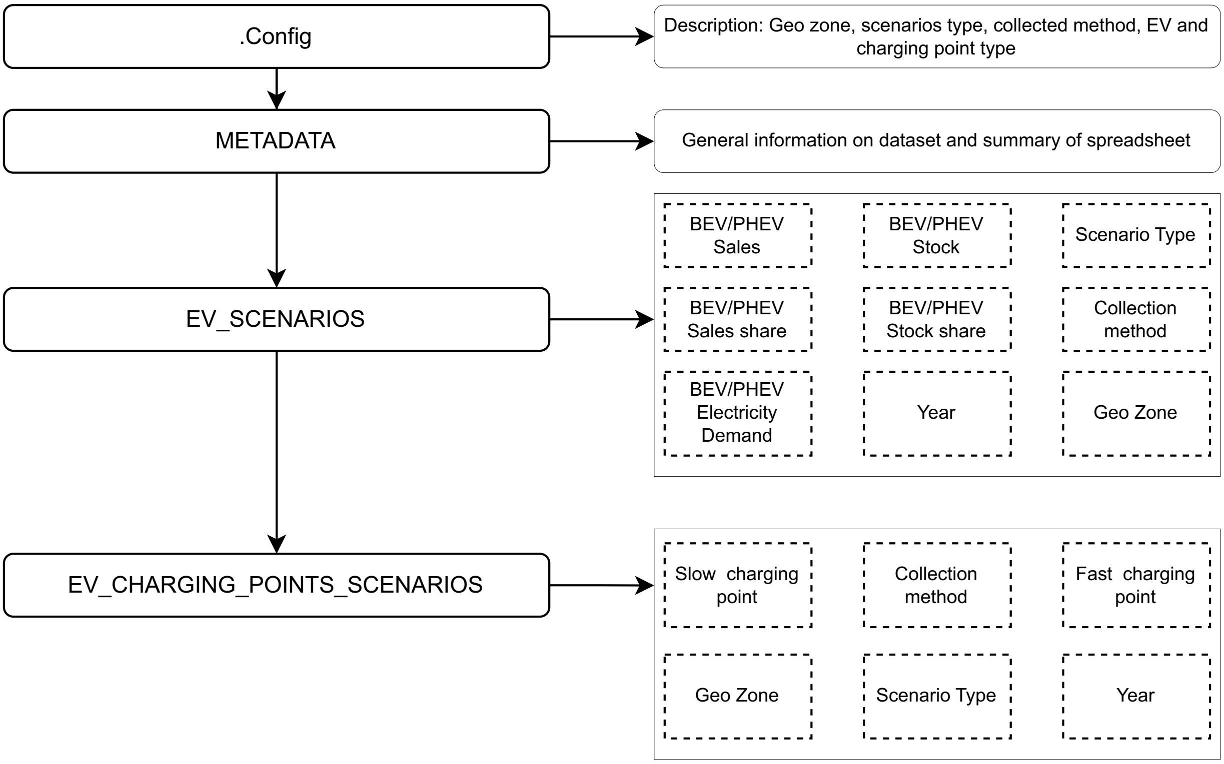


Fig. 3 Dataset scheme.

(ii) Planned Energy Scenario (IRN-PES) is based on the energy plans established by governments besides other policy targets in this field. (iii) Transforming Energy Scenario (TES) proposes an ambitious scenario considering renewable source penetration and energy efficiency improvements.

Europe. Different assumptions were considered, and interpolation was applied for missing values in some years. The results were adjusted for each geo-zone of Europe in order to obtain a fair comparison between projections. Furthermore, constant car stock(333.3 million) and new car registrations (14.5 million/year) are assumed for values obtained from percentage sales until 2050.

- Virta[16] analyses two scenarios, "Low estimates" (VRTLOW) and "High estimates" (VRT-HGH). Both differ from each other mainly by the deployment of "EVs romaning around Europe" (EU-28).
- Fraunhofer[17] proposes a scenario (FRH-SCN) from EV sales that could reach 100% share in (EU-28+NO+IS+CH) and sales growth fitting the S-shaped diffusion curve adjusted on the baseline of Norwegian EV sales.
- Eureletric[18] in association with EY analyses the increasing penetration of EVs in Europe (EU-28+NO+CH) based on the charging infrastructure considering the impact on the electricity grid. It also considers the key participation of industry leaders in the evolution of EVs from market experience.
- European Alternative Fuels Observatory (EAFO)[19] Following three scenarios for 2050 in (EU-28): (i) ZEV Base Case (EFO-ZBV) considers a medium adoption of zero-emission vehicles (ZEV); (ii) PHEV Bridging (EFO-PHV) assumes a significant increase in the market share of PHEVs around 2030. (iii) ZEV leader (EFO-ZLD) is based on the high adoption of ZEV.
- Strategy&[20] reports the (SPC-SCN) scenario based on the declining global car stock of over 11% driven by car-sharing adoption in (EU-27+NO+GBR+CH).
- Strategy& in partnership with European Association of Automotive Suppliers[21] (CLEPA) presents three scenarios for 2040 in (EU-28 + EFTA): (i) "Mixed-technology scenario" (CLP-MTS) based on the government recovery post-COVID, consider a 50% reduction of CO_2 emissions from 2020 to 2030.; (ii) "EV-only scenario" (CLP-EVS) addresses the projections by STEP in IEA[10], fit for 55 package[7] and incentives for EV adoption and charging infrastructure development.; (iii) "Radical scenario" (CLP-RAD) takes into account a total 100% reduction in CO_2 emissions by 2030.
- ElementEnergy[22] covers two scenarios for 2050 that consider price parity a critical factor for EV adoption in (EU-28 + EFTA). (i) "Baseline" (ELM-BAS) assumes price parity will be reached in 2030 only for passenger cars; (ii) "2028 Purchase price parity" (ELM-PPP) goes further and considers price parity to be achieved in 2030 for all segments.
- ChargeUp[23] presents three scenarios following different shares of charging infrastructure deployment in (EU-27). Further, it takes into account the EV adoption based on current policies and EV strategies of the

EV type	EV charging point type	Collected Method
		Interpolation
BEV	Fast	Extrapolation
PHEV	Slow	Reported
		Estimated

Table 1. Data type classification.

Geo Zones	Scenarios types
EU	EFO-ZBV, EFO-PHV, EFO-ZLD
EU-27	CHU-MIN, CHU-ACS, CHU-HPS, TeE-SCN
EU-27+NO+GBR+CH	EUR-SCN, SPC-SCN
EU-28	VRT-LOW, VRT-HGH
EU-28+NO+ IS+CH	FRH-SCN
EU-28 + EFTA	CLP-MTS, CLP-EVS, CLP-RAD, ELM-BAS, ELM-PPP
World	REAL, IEA-SPS, IEA-APS, IEA-NZE, BBG-ETS, BBG-NZS, IRN-PES, IRN-TES, IRN-PRT
DK	REAL, Pessimistic, Intermediate, Optimistic
SL	REAL, Pessimistic, Optimistic. Actual projection
PT	REAL, Disruptive, Progressive, Conservative
GR	REAL, NECP, 2030 ban, C-curve, S-curve

Table 2. Data attributes.

leading European automotive industries, production forecasts of market intelligence companies and some assumptions: (i) ChargeUP-minimum (CHU-MIN) set a minimum number of charging point stations; (ii) ChargeUP-AC station (CHU-ACS) assumes a high share of AC charging points; (iii) ChargeUP-higher share (CHU-HPS) also considers a high share (45% instead of 35% in the CHU-MIN scenario).

- Transport & Environment[24] discusses the scenario (TeE-SCN) in (EU-27), emphasising the impact on the development of charging infrastructure in Europe with increasing EV stock to reach the European target of 100% ZEV registration for passenger cars and vans until 2035.
- International Council on Clean Transportation (ICCT)[25] analyses the evolution of EV stock by the scenario (ICT-SCN) in (EU-27) until 2030 based on the goal of reaching 100% ZEV sales by 2030 through the roadmap model[26].

Greece. Regarding the EV evolution scenarios in Greece are based on four uptake scenarios covering market and policy decisions on projections as described:

- NECP uptake[27] scenario uses the targets set by the Greek authorities' National Energy and Climate Plan (NECP) as a constant.
- 2030 ban uptake[28] scenario is based on a recent decision by the Greek authorities that bans all new internal combustion engine (ICE) car (non-PHEVs) sales by 2030.
- C-curve uptake scenario is determined based on the corresponding mathematical model and uses fitting on past data (from 2015 to 2021) to project the likely uptake of new BEVs and PHEVs.
- S-curve uptake scenario splits the adoption timeline into 4 phases: Emerging (early adopters), Growth, Maturity, and Saturation. Furthermore, similarly to the C-curve, data from 2015 to 2021 are used for the initial fitting. Concerning the infrastructure demand analysis, assumptions about the typical annual mileage and the likely number of vehicles from different specifications have been used to estimate the total charging needs. These data, combined with the duration of charging that depends on the power of the charging point and the proportion of public charging needs, further define the number of projected charging points per type. These numbers are adjusted based on[29] and accessibility factors, regionalisation and creating targets. The projected numbers for public charging points following considerations: (i) 2025 projections: the NECP numbers are driven by population, and the 2030 ban numbers are driven by EU regulations of power per vehicle; (ii) 2030 projections: Both numbers (NECP & 2030 ban) are driven by the EU target of 1 charging point per 10 vehicles.

Portugal. Portugal approaches a population model by a logistic growth (S-shaped curve), which allows the comparison between early- and late-adopters. In this sense, the logistic growth models increase slowly at the beginning, depicting early adopters, and then more rapidly until the inflection point. Thus, the innovation share starts to decrease and achieve a saturation limit. Therefore the model is built from three scenarios extrapolated based on national guidelines and policies, motorization ratio, renewable fleet rates, and the average age of the

Column Header	Description
Geo zone	Geographical area under analysis
Year	Reference year of analysis
Scenario type	Scenario under analysis
Collection methods	Type of data gathering method
BEV sales	Total number of BEV sales
BEV sales share	Percentage of the total number of BEV sales
BEV stock	Total number of BEV
BEV stock share	Percentage of the total number of BEV
BEV electricity demand	Total electricity consumed by BEV
PHEV sales	Total number of PHEV sales
PHEV sales share	Percentage of the total number of PHEV sales
PHEV stock	Total number of PHEV
PHEV stock share	Percentage of the total number of PHEV
PHEV electricity demand	Total electricity consumed by PHEV
BEV & PHEV sales	Total number of BEV and PHEV sales
BEV & PHEV sales share	Percentage of the total number of BEV and PHEV sales
BEV & PHEV stock	Total number of BEV and PHEV
BEV & PHEV stock share	Percentage of the total number of BEV and PHEV
BEV & PHEV electricity demand	Total electricity consumed by BEV and PHEV
Slow charging point	Total number of slow charging points
Fast charging point	Total number of fast charging points
Slow & Fast charging point	Total number of slow and fast charging points

Table 3. Description of data headers.

vehicles by 2050: (i) Conservative is based on conservative scenario in RMSA[30] and "off-track" scenario in RNC 2050[31] and takes into account a reduction of 10% in car ownership[32,33]; (ii) Progressive addresses ambitions goals considering PNEC 2030[34], RMSA[30] and RNC 2050[31], besides a 10% in the motorization rate of the country; (iii) Disruptive considers a high adoption of EVs by the population and public transport. The motorization rate will remain constant until 2050 and will experience rapid PHEV growth. It is based on the "yellow jersey" scenario in RNC 2050[31].

Slovenia. Two scenarios were developed (pessimistic and optimistic) until 2050. The pessimistic scenario uses a linear function to estimate the EVs' evolution, and the optimistic scenario considers the quadratic function. The functions were adjusted after the strategy[35] was adopted for the data from 2018 to 2021. Also, the electricity consumption[36] was estimated following the pessimistic and optimistic scenarios approach. These values were calculated considering the number of EVs in the fleet, the average energy efficiency and the average travelled distance per vehicle. Also, a gradual improvement to 15 kWh/100 km in 2050 was assumed, and an average mileage of 10 000 kilometres per year was considered. Since there is no centralized authority concerning the number of charging stations[37,38], it was estimated the number of charging sites assumed a ratio of 40 EVs per charging point(pessimistic) and 10 EVs per charging point by 2050 (optimistic).

Denmark. An acceleration in EV adoption is expected from 2025 onwards based on the Danish government's climate neutrality targets until 2050. Besides the scenarios taken from the indicated resources[39–44], three scenarios are also built to project EV fleet size and electricity demand from the study started in[45]. Also, the scenarios projected considering different EV stock share for 2030 (optimistic 43%, intermediate 33% and pessimistic 17%) and 2050 (optimistic 100%, intermediate 100% and pessimistic 90%). Further, data on electricity consumption related to EV charging in Denmark is not directly available. Therefore, an estimate of electricity demand due to BEVs and PHEVs was based on the number of vehicles, the average driven kilometres (45 Km/day) and energy consumption (5 km/kWh).

Data Records

The dataset arose from deliverable D1.1-Electric Road Mobility Evolution Scenarios from the Horizon Europe Project EV4EU - Electric Vehicles Management for carbon neutrality in Europe. The data records with the respective projection results have been stored and are available on Zenodo for download at https://doi.org/10.5281/zenodo.10443418[46]. Figure 3 illustrates the dataset's file arrangement.

Description of features. The dataset contains a total of 22 features available in Open XML spreadsheet (XLSX) format and divided into metadata, detailed header description, and scenario projection for EV and charging points. The results are tabulated by technology (BEV and PHEV), type of charging point (slow and fast) for each scenario and geo zone considered in five-year increments until 2050. Further, the column headers in the file are summarized according to Table 3.

Source	Electric Vehicles - Historical					Electric Vehicles - Projections				
	Stock	Sales	Charging Points	Market Share	Electricity Demand	Stock	Sales	Charging Points	Market Share	Electricity Demand
International Energy Agency[10]	x	x	x	x	x	x	x	x	x	x
Bloomberg[4]								x		x
International Renewable Energy Agency[5,15]						x				
Virta[16]				x		x		x		
European Environment Agency[49]				x						
Fraunhofer[17]						x				
European Alternative Fuels Observatory[19]						x				
Strategy&[20]						x				
European Association of Automotive Suppliers[21]						x				
ElementEnergy[22]						x				
Transport & Environment[24]						x		x		
International Council on Clean Transportation[25]						x				
Eurelectric[18]						x		x		
ChargeUp[23]								x		
Republic of Slovenia Statistical Office[50]	x	x		x	x					
Rebublika Slovenija Ministrstvo Za Infrastrukturo[38]						x		x		
Associação de Utilizadores de Veículos Elétricos[51]		x		x						
Associação Automóvel de Portugal[52]	x			x						
Plano Nacional Energia e Clima 2030[34]						x		x		x
Roteiro para a Neutralidade Carbónica 2050[31]						x		x		x
Relatório de Monitorização da Segurança de Abastecimento do Sistema Eléctrico Nacional 2022-2040[30]						x		x		x
Denmark Statisk[40]		x						x		
Danmmarks StatistikDanske Bilimportører[39]				x						
Smart Energy[45]						x			x	
Danmarks Tekniske Universitet & Danks Elbil Alliance[41]	x									
Electricity Distribution System Operator[53]			x							
Vlada Rebublike Slovenija[37]								x		
Danmarks StatiskKommissionen for grøn omstilling af personbiler[29]								x		
Republika Slovenija (Računsko sodišče)[36]										x
Mobi.E Network[54]					x					
Energistyrelsen[43]										x

Table 4. Input data sources.

Breadth and coverage. The breadth and coverage encompass current and future information on electric road mobility collected from scenario data released by public entities and consultants in five-year increments from 2021 to 2050. In addition to the data obtained directly from the source, the data from the interpolation was also included. The dataset has a total of 1405 records. Table 1 shows the classification of the data sample according to the type of EV technology (BEV or PHEV), EV charging point type (slow or fast) and collection method (interpolation, extrapolation, reported or estimated). Table 2 also shows the data classification based on the type of geographical area covered by each scenario. Further, the data allows for comparison with the main EV policy targets. The file path is the year and scenario reference following the chronological growth projections listed as follows:

1. Metadata: Provide clarification instructions on spreadsheets containing datasets. The data relates to historical and future (evolution scenarios) EV markets, including EV sales and stocks, electricity demand and public charging points worldwide, in Europe and the countries of the EV4EU project members (Denmark, Greece, Portugal and Slovenia). The evolution scenarios presented are based on the European Commission's target for zero emissions by 2050.

Source	Region	Category	Key Policy target
COP 26[55]	Global	LDV	100% share in new sales of ZEV by 2035 for leading markets and by 2040 globally
EU Green Deal[56]	EU	LDV	13 million passengers ZEV and LEV stock expected on European roads by 2025
			15% share of car sales by 2025 and 35% by 2030
EU Commission[57]	EU	Multiple vehicle category	At least 30 million passenger ZEV stock by 2030
			Almost all electric passenger LDV and heavy commercial vehicle stock by 2050
EU Commission[58] AFIR[59]	EU	Charging infrastructure	At least 1 million public charging stations by 2025 and 3 million by 2030
			Charging stations should increase proportionally to the number of cars registered each year
			Power output of publicly charger at least 1 kW per BEV and 0.66 kW per PHEV
RNC 2050[31]	PT	LDV	More than 30% share of LDV EV sales by 2030 and 100% by 2050
Danish government[60–62]	DK	LDV	1 million passenger ZEVs in LDV stock by 2030
		M/HDV	Phase out sales of ICE by 2030
Greek government	GR	LDV	30% share in sales of ZEV passenger LDV by 2030
Slovenian republic[35]	SL	LDV	Phase out new sales of passenger LDV with CO_2 emissions above 50g CO_2 /Km by 2030

Table 5. key policies cross-comparison with projections.

2. EV scenarios: Historical data and scenarios for BEV and PHEV related sales, stock, market share, and electricity demand in World, Europe (EU), Denmark (DK), Slovenia (SL) and Greece (GR).
3. Charging points scenario: Historical data and scenarios for public charging point (fast and slow chargers) distribution in World, Europe, Denmark, Slovenia and Greece.
4. Config: Description of the scenarios, geo zone, and variables used in the dataset.The evolution scenarios presented are based on the European Commission's target for zero emissions by 2050. The data comprises historical and forecasting, including EV sales and stocks, electricity demand and public charging points worldwide, Europe and the EV4EU project members (Denmark, Greece, Portugal and Slovenia). The projection data is categorised according to the geographical area in which the projections are analysed and the type of forecast scenario. The type of EV technology (BEV or PHEV) and charging point (slow or fast) are also considered. In addition, the method for obtaining the data (Interpolation, extrapolation, reported or estimated) is specified.

Technical Validation

The scenarios regarding the evolution of EV markets, charging infrastructure, and electricity demand considers different market behaviours and targets at the international, national, and regional levels. The data gathered is validated from peer review by entities and consultants. Furthermore, our projections were compared in some scenarios with the Norwegian BEV fleet evolution, which presents a higher maturity of EV market adoption. Afterwards, a comparison of the forecast obtained is performed according to a political perspective and proved to be aligned favourably against EV key policy targets as summarised in Table 5.

Overview on data quality. *Cross-comparison.* The entities and consultants that submit its methodology for peer reviewing validate the dataset. Also, it is compared our results (https://doi.org/10.5281/zenodo.10443418) with the key policies for EV and zero-emission vehicles (ZEVs) deployment, including goals for light-duty vehicles (LDV) and charging infrastructure. These policies are structured across published government targets and incorporated in legislation fulfilling the Paris climate agreement, EU, or nationally announced climate plans. The policy scope presents targets on Global, European, Danish, Portuguese, Slovenian, and Greek EV markets, including EV sales and stock, charging infrastructures, and electricity demand. Besides, It was possible to compare the data with the Norwegian BEV fleet benchmark.

In Denmark, based on our projections, we estimate in the optimistic scenario an EV stock of 1.3 million (43% share) and 3.2 million (100% share) by 2050. It follows the trend of phasing out ICE sales and aligns with the EV stock targets set by the Danish government above. Also, regarding the evolution of EV stock in Slovenia, the values obtained for the optimistic scenario could represent about 100% of the total vehicles. This means it will reach the target of phasing out the sale of passenger LDV above 50g CO_2/Km by 2030, as proposed by the government of Slovenia.

Further, for the Greek evolution scenario, an average of 53% percentage of new BEVs is expected for the four scenarios (NECP,2030 ban, C-curve, S-curve) towards 2030, which represents more than 30% of the target share in new sales for ZEV passenger LDV until 2030 presented by the Greek government. Also the projections were compared with an uptake curve for Norway[47] included in[48]. In the case of the Portuguese EV evolution scenario, besides the RNC 2050[31] targets, also considered the goals for PNEC 2030[34] and RMSA[30] in the analyse for the respective scenarios (conservative, progressive and disruptive), which show from the projections, an average share of 57% for light-duty EVs until 2040. Furthermore, a comparison of BEV fleet share evolution based on the Norwegian BEV fleet with a 6-year shift is performed in the study[48].

At the European level, the scenarios present an average of 30 million vehicles by 2025 and, for the most optimistic ones, foresee an EV stock of around 330 million by 2050. In addition, following the ambitious scenarios for the other countries analysed in our projections, about 3.2 million in Denmark (100% share), 6.3 million in

Portugal, 1.5 million in Slovenia and less than 50% of EV stock share in Greece until 2050. Furthermore, an average of about 3 million public charging points in Europe by 2030 is estimated from the scenarios. Also, the ratio between the number of EVs and the number of CPs(charging points) is around 26 EVs/CPs.This demonstrates that the scenarios between the methodologies addressed are on track towards European EV adoption and carbon neutrality targets.

From this, it is estimated that over 1800 million EVs worldwide (90% of the global fleet) instead of the 1.4%[10] currently, representing about 40 million EVs/year until 2030 and 95 million EVs/year between 2030 and 2050. Following the trend of the scenarios, achieving the EV share sales target in the leading markets and globally will be possible.

Usage Notes

The format of the results is Office Open XML spreadsheet (XLSX). All the results are available on the Zenodo Open-Access repository (https://doi.org/10.5281/zenodo.10443418).

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Author contributions

Must include all authors, identified by initials, for example: A.A. conceived the experiment(s), A.A. and B.A. conducted the experiment(s), C.A. and D.A. analysed the results. All authors reviewed the manuscript.

Competing interests

The authors declare no competing interests.

Additional information

Correspondence and requests for materials should be addressed to H.M.