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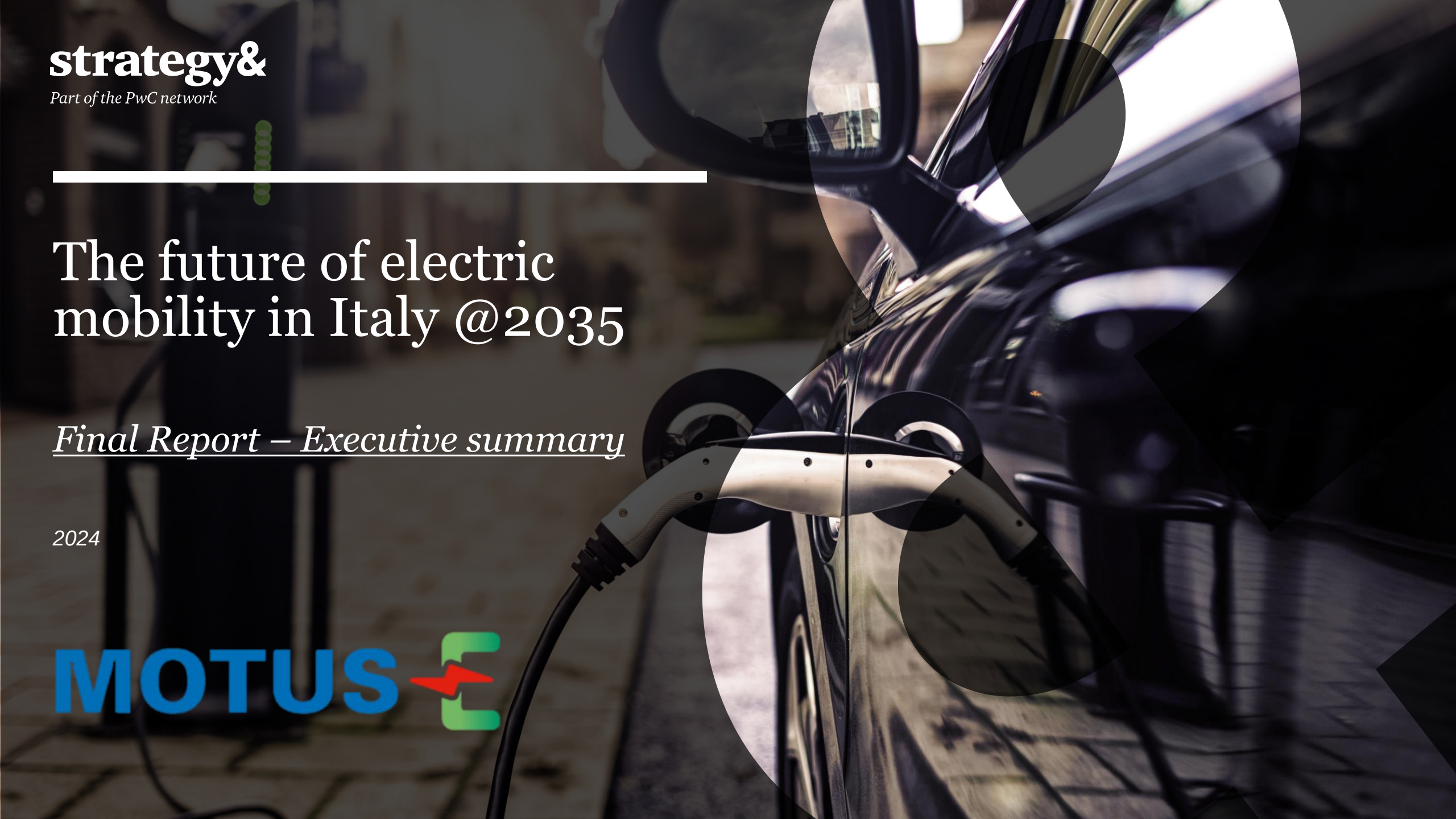
The future of electric mobility in Italy @2035

Final Report – Executive summary

2024

MOTUS-E



The report updates the development scenario of the Electric Vehicle (EV) charging infrastructure in Italy through 2035

Report objectives

Update the development scenarios of public and private EV charging infrastructure through 2035, presenting the dynamics of the evolution of the Italian market, with an extended view up to 2035 compared to the previous report

Understanding the EV customer today	• **Analysis of the Italian electric vehicle fleet** status, understanding the **evolution** in recent years and **the barriers to purchase** of an **Electric Vehicle** (EV) • **Overview** of the **current customer characteristics** and **charging habits**
The current infrastructure network	• **Analysis** and definition **of the current** public charging **infrastructure network** by **technology**, **geographic distribution,** and **destination**, also in comparison with European peers • **Comparison** of **EVSE capacity evolution** with the **charging power supported** by EVs
The development scenarios of electric mobility	• Definition of **two scenarios for the evolution of the EV fleet** by vehicle type (passenger cars, low and heavy-duty vehicles) • Review of the **main publications** regarding electric mobility development scenarios
The evolution of the Infrastructure network by 2035	• **Presentation** of the scenarios for the **evolution of the Italian of the charging infrastructure** through **2035** to meet growing **energy demand**, in private as well as in public contexts, with details of the different expected charging powers - considering the requirements of regulators, of the operators and customer needs
Regulations and other trends	• **Analysis of regulations** and other **trends** that will impact the electric mobility market in the **long term** (e.g. storage systems, photovoltaic panels, and off-grid charging stations)

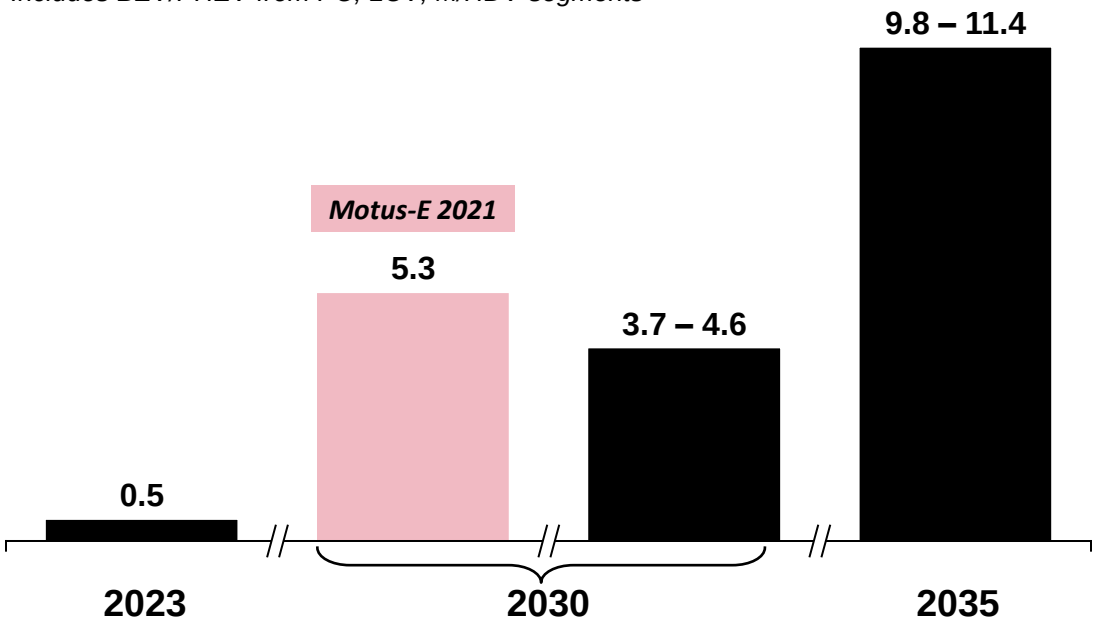
Source: Motus-E and Associates, Strategy& Analysis

The charging infrastructure study is based on more conservative EV penetration forecasts compared to previous ones

Report highlights (1/3)

Motus-E estimate on EV circulating fleet *(M vehicles)*

Includes BEV/PHEV from PC, LCV, M/HDV segments[1]



	2023	2030		2035
EVs on circulating fleet	***1%***	***12%***	***8 - 10%***	***22 - 26%***

1. **As of 2023, only 1% of the Italian circulating fleet is electric,** with a significantly slower growth compared to other European countries

2. The new Motus-E estimate predicts between **3,7** and **4.6 million EVs on the road by 2030** (down from the 5.3 million estimated in the 2021 study) and up to **11.4 million by 2035**

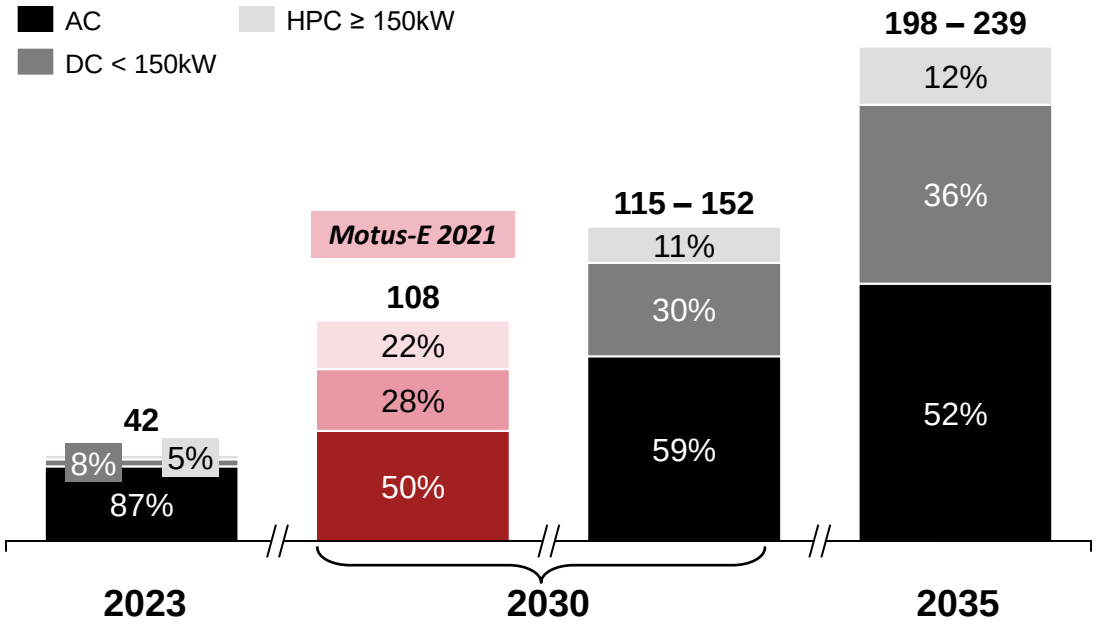
   These estimates assume the **continuation of incentive policies** in the early years of the forecast horizon (e.g., purchase incentives and favorable tax treatment for company fleets)

Note: 1) Includes: PC: Passenger Car – cars; LCV: Light Commercial Vehicles – light commercial vehicles from ≤3.5t; M/HDV: Medium and Heavy Duty Vehicles - medium and heavy commercial vehicles over > 3.5t; BEV: Battery Electric Vehicle – full electric vehicle; PHEV: Plug-In Electric Vehicle; Source: Motus-E and Associates, Strategy& Analysis

Despite the lower penetration of EVs, we foresee an increasingly widespread public infrastructure

Report highlights (2/3)

Evolution of public charging network *(k Charging Points)*



1. In the new scenario, a **more widespread network is expected through 2030** (115-152k public CPs vs. less than 110k estimated in 2021) growing to **239k CPs by 2035**

2. We anticipate a stonger penetration of **AC public CPs,** thanks to urban investments aimed at compensating for the **scarcity of domestic options**

3. The **DC/HPC segment** will cover approximately 40% of the charging points by 2030 and 50% by 2035, with significant growth but slightly delayed compared to previous estimates

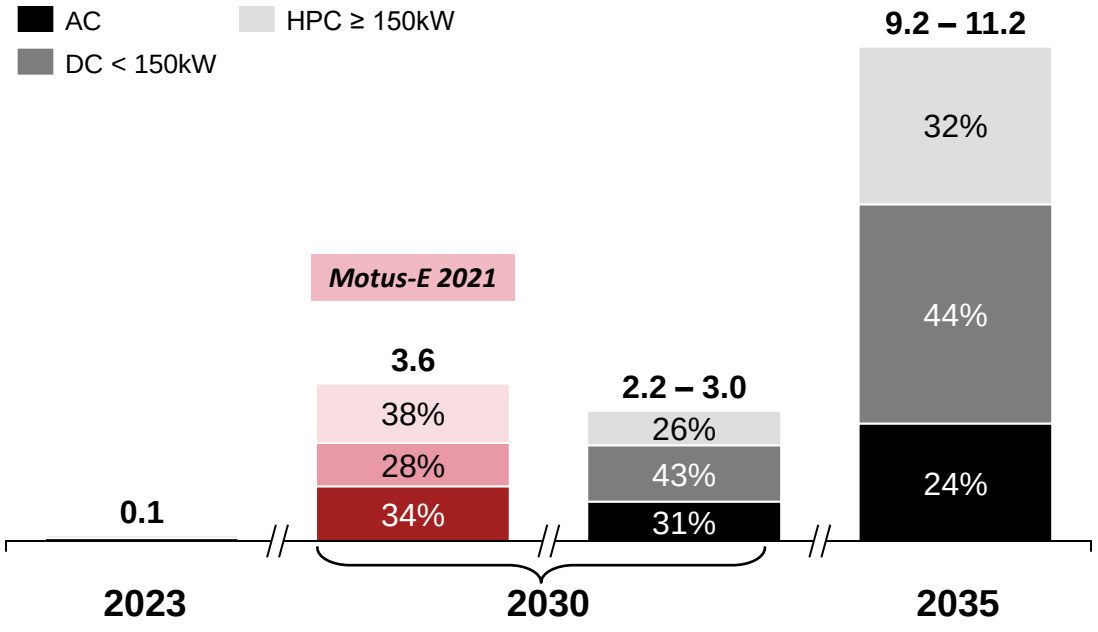
4. Based on the projections, up to **3-4 billion euros of additional investments are expected in the installation of charging infrastructure** over the next decade

Strategy& Source: Motus-E and Associates, Strategy& Analysis

Public charging will absorb 9-11 TWh of electricity by 2035 (out of a total of 23-28 TWh including private charging)

Report highlights (3/3)

Evolution of energy demand delivered at public CPs[1] *(TWh)*



Total energy demand[2] *(TWh)*	***0.7***	***10.4***	***7.1 – 9,6***	***22.7 – 28.1***

1. The **energy** delivered on the public charging infrastructure will reach **9-11 TWh by 2035** (**23-28 TWh** also considering private charging)

2. Despite **fewer charging points**, by 2035 over **75% of public charging energy** will be delivered by **DC and HPC charging infrastructures** (~70% already by 2030)

3. In particular, **HPC charging infrastructures** will cover 26% **of energy needs** by **2030** (over 30% by 2035 with 12% of charging points)

Notes: 1) Charging Points; 2) Includes public, home, and workplace charging
Source: Motus-E and Associates, Strategy& Analysis

Executive Summary (1/5)

Understanding the EV customer today

Reduced penetration of electric mobility in Italy (1% of the circulating fleet)

- By the end of 2023, **electric mobility** in **Italy** represents only **1% of the circulating vehicle fleet**, lagging behind in comparison to other main European countries
- However, the market is experiencing very **rapid growth**, (CAGR 2021-23 of 42%), **despite some issues** related to the full utilization of **incentives** (e.g., around 300 million euros of incentives not utilized in 2023), partly due to the limitations on the maximum spending cap allowed to access the incentive

3 main barriers to purchasing an EV:

i. **range**
ii. **charging time**
iii. **purchase cost**

- Among the reasons for the still limited penetration of electric vehicles, we find **three main barriers to the purchase of an Electric Vehicle (EV),** which new technologies may mitigate: **range, charging time** and **initial purchase cost**
  - **Range is increasing** compared to the first models on the market (from 320km in 2020 to 350km in 2023) and the latest models announced by OEMs for new vehicles expected in the coming two years see a further increase (about 400-450km)
  - The **charging time will benefit from a greater spread of DC and High Power Charging infrastructure** (also thanks to PNRR funds) and from the **increase in the maximum «acceptable» power** from the internal charging system of EVs.
  - **The electric car offerings** are still concentrated in **relatively high price ranges**. 84% of the electric vehicles offered on the market cost between €20,000-80,000, while the price range < €20,000, which for ICE vehicles represents the segment with the best-selling cars, is not currently fully covered by the offerings (1% of models). **However, compared to 2019, the average purchase price of an EV has decreased by 12%[1]**
- Additionally, the progressive **understanding of the different paradigm** of using an electric car compared to an ICE (e.g., an overnight charging mode) will lead to a more informed comparison on certain parameters (e.g., range and charging time)

5 EV sales channels – Long-Term Rental is the most used to reduce the initial purchase cost

- Electric mobility includes **various types of vehicles**: **cars** (Passenger Cars) **full electric** (BEV) and **plug-in hybrid** (PHEV), **light commercial vehicles** (LCV) **full electric** and **medium/heavy commercial vehicles** (M/HDV)[2] **full electric**
- **From the point of view of sales channels**, five segments have been identified : Private individuals, Fleets, Long-Term Rental, Short-Term Rental, Dealers. As noted in the 2020 report, the segmentation of registrations across sales channels highlights a **high proportion of EVs registered through Long-Term Rental**, indicating a **greater propensity for customers to choose purchase models that allow for reduced initial costs**

Note: 1) Arithmetic mean, not weighted by the number of registrations; considering the 7 best-selling BEV models in 2019 (i.e. 1 segment A, 4 seg. B, 1 seg. C, 1 seg. D) and the 9 best-selling BEV models in 2023 (i.e. 4 seg. A, 1 seg. B, 2 seg. C, 2 seg. D - excluding Audi Q4 e-Tron for segment comparison); 1) included additionally compared to the 2020 report for their potential impact on public and depot charging

Executive Summary (2/5)

The current Charging Infrastructure network	**In Italy ~27,000 charging infrastructures[1] installed with 51,000 charging points[1], 85% in AC**	• At the end of 2023, Italy counts **~27,000 Electric Vehicle Supply Equipment (EVSE) installed with ~51,000 Charging Points (CP)**, of which 42,000 are active • **85%** of **public CPs are in AC** (95% in 2020) and concentrated on power ranges of 7.4-22 kW, while the remaining **15% are composed of DC CPs**, which are divided into **DC with power from 43-149kW** (10% of total public charging points), and **High Power Chargers ≥ 150kW (5%)**. The presence of **HPC** is still limited in highway and suburban areas, but **it is growing rapidly**, as in 2020 they accounted for only 0.2% of total public charging points
	Prevalence of charging points in Northern Italy (58%)	• The distribution of public access charging infrastructure is concentrated **in Northern Italy (58%).** This infrastructure is mostly installed **on public land (68%),** but **public access private land** (e.g., in commercial facilities, gas stations, and 'private' parking lots) **is growing rapidly (32%** vs. 20% in 2020)
	Increased public coverage – 99% of the territory with 1 charging point every 20km	• 99% **of Italian territory has at least one charging point within a 20 km radius** and 86% within a radius of only 10 km • As of today, **there is 1 CP every 8 km of highway** and **1 CP every 15 km of rural roads**. Compared to 2020, the density of the **public infrastructure on highways has increased by ~10 times** (from 88 to 932 charging points by the end of 2023) • The number of **municipalities without CPs has decreased from 59% in 2022 to 47% in 2023** (3,691 municipalities)
	Only part of the EV models are enabled for high-power charging – 36% of the models can charge in DC at 150kW	• Although **most models allow for DC charging (99%)**, **only a portion** reaches **high charging power** (e.g., 32% of the models on the market can charge in AC up to 22kW and 36% in DC at 150kW – considering higher powers, only 2% of the models can charge at 300+kW). The current BEV offering does not exploit the maximum nominal power of the charging points, **reducing the incentive for CPOs** to **install high-power (HPC) infrastructures** which require significant investments • However, **OEMs aim for increasing compatibility of EVs with high charging powers,** reaching an average **maximum power of 210 kW by 2035** (up from 135 kW today) for BEV cars
	Italy stands out in terms CPs/BEV (21), though limited absolute #CPs	• In the European **landscape**, **Italy** ranks among the **best countries in terms of public-use CPs installed per BEV** (21) – however, **the total number of public CPs** in Italy (51k) is **still limited** compared to the spread of public infrastructure installed in **countries** with a similar population (e.g., France and Germany, respectively 119k and 121k CPs). The **penetration of DC/HPC in Italy is average**, with 15% of high-power charging points.

Strategy& Note: 1) EVSE: Electric Vehicle Suppy Equipment, i.e. charging infrastructure; PdR: Charging Points

Executive Summary (3/5)

The development scenarios of electric mobility

The NECP[1] scenario estimates 6.6 million EVs by 2030

- To date, there are **several scenarios for the development of electric mobility**, all projecting figures up to 2030.
- The **Italian NECP** (National Energy and Climate Plan) estimates **6.6 million EVs by 2030** (4.3 million BEVs and 2.3 million PHEVs), **other sources** (e.g., Politecnico di Milano) also shows **more aggressive scenarios** (up to 7.8 million EVs by 2030)

Motus-e sees two scenarios for EV penetration by 2035: *i.* Accelerated: 11.4 million *ii.* Conservative: 9.8 million

- **Motus-e sees two different scenarios** for the penetration of Evs, **including cars (BEV + PHEV), LCVs and HDVs:**
  - **Accelerated Scenario (4.6 million EVs by 2030, 11.4 million by 2035):** limited increase in EV penetration in the short term, reaching a 56% share of registered BEV PC + LCV in 2030 and 100% in 2035. PHEVs are a transitional technology, reaching maximum penetration in 2026 (9%)
  - **Conservative Scenario (3.7 Mln EV by 2030, 9.8 M by 2035):** slow growth in BEV PC + LCV registration in the coming years (39% of total registration by 2030), reaching 100% by 2035 as per EU regulations. PHEVs have a greater impact in the early years, with 11% by 2026

The evolution of the infrastructure network by 2035

28 TWh of energy demand by 2035 according to the Accelerated scenario and 23 TWh according to the Conservative one

- The scenario for the **evolution of the infrastructure network** sees an **overall 2035 charging energy demand of ~28TWh** in the **Accelerated scenario** and **~23TWh in the Conservative scenario**
- **Both scenarios**, though differing in the number of circulating EVs (and resulting energy demand), take into account **the same needs of customers, operators, and regulators** – by providing a widespread network of private and public charging points capable of ensuring a return on investment for CPOs – and follow the **same logics and assumptions** for the **development of charging infrastructure** (e.g., reduction of domestic charging; progressive increase in the capillarity of public charging points, increase in power per charging point, and the charging power of EV batteries)

Decrease in privately charged energy – 27% by 2035 vs. 64% in 2023

- **It is estimated** that **27% of the energy will be charged at home** (vs. **64% in 2023**), while **in the workplace** the **demand will grow** up to **34% of the total energy**. The **remaining 39%** is expected to be covered **by public infrastructure**, split between **highways (6%), extra-urban roads (12%) and urban roads (21%)**

Note: National Energy and Climate Plan

Executive Summary (4/5)

The evolution of the infrastructure network by 2035

4-5 million charging points in domestic settings by 2035

- The domestic **charging infrastructure** will grow to **5 million CPs by 2035** in the **Accelerated scenario** and **4 Million CPs** in the **Conservative scenario**, with about **45% of EVs having a domestic charging point available**

450,000-550,000 charging points in workplace settings by 2035

- The infrastructure in **the workplace** will **2035** reach **550k charging points** in the **Accelerated scenario** and **450k charging points** in the **Conservative scenario**. In the coming years, **an increase in EVs with availability of a workplace charging point is expected** (**~40% by 2035** vs. ~15% by 2023) and **a scaling effect** (**~10 EVs per charging point**), while in the **depots** the spread of **high-power charging points is expected** (both DC and HPC) mainly intended for **M/HDV and PC/LCV fleets**. AC charging remains the dominant technology**, with the** 62% of total charging points **in the workplace, allowing** employees to charge during working hours **without the need for fast charging**

Estimate of the evolution of public charging infrastructure to 239,000 charging points by 2035 according to the Accelerated scenario and 198,000 charging points according to the Conservative scenario distributed among AC, DC, and HPC

- **The public charging infrastructure, on the other hand, is projected to grow to 239k charging points by 2035** (152k charging points in 2030) in the **Accelerated scenario** and **198k charging points in the Conservative scenario** (115k charging points in 2030)
  - **Public AC** charging points complement domestic charging, with **124k charging points in the Accelerated scenario** and 104k charging points in the Conservative scenario at 2035 (respectively, 100k and 68k charging points in 2030)
  - A **progressive expansion of DC CPs**, both on **high-speed roads and in urban areas**, to ensure fast charging service for short stops, emergencies, and top-ups with **86k charging points in the Accelerated scenario** and 71k charging points in the Conservative scenario by 2035 (respectively, 45k and 34k charging points in 2030)
  - The **HPC** network is **expected to be extensive and widespread by 2035**, ensuring **coverage of highways and extra-urban roads** for both cars and commercial vehicles (light and heavy) as well as the development of urban hubs for fast charging, with **28k charging points in the Accelerated scenario** and 23k charging points in the Conservative scenario by 2035 (respectively, 17k and 13k charging points in 2030)

Executive Summary (5/5)

Regulations and other trends

Motus-E forecasts in line with NRRP and AFIR regulations

- The proposed scenarios represent **Motus-e's expectations on the growth of the EV fleet**, which influences the need for charging infrastructure. This document is a continuation of the report published in 2020 and aims to update the current views and projections. However, **the 2035 situation is not the endpoint for the evolution of electric mobility** (consider that the scenario foresees 11 million EVs, while the total circulating fleet is about 44 million vehicles)
- The **forecasts take into account the regulations of the NRRP**, which provides for the installation of 21k charging points by 2026 (operational by the following year) **and AFIR**, which foresees a gradual increase in high-power infrastructure density in the TEN-T network and the installation of public charging points equal to 1.3kW per new BEV registration and 0.8kW per new PHEV registration

Future trends: off-grid stations, energy storage systems, and PV panels

- **Moreover, new technologies can have a significant impact on public charging in the long term:**
  - Off-grid charging stations **can provide an alternative form of charging (e.g. mobile charging, wireless, BSS)**
  - Energy storage systems **can provide high-power connections even in areas not served by the grid, ensuring savings**
  - Photovoltaic panels **can offer considerable savings for charging hubs**

Note: NRRP – National Resilience and Recovery Plan

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