E-MOBILITY REVOLUTION

Impacts on Italy and its industrial value chain: Italy's Agenda

Executive Summary

The European House Ambrosetti

enel

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Contents

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We would like to thank the following for their collaboration with The European House - Ambrosetti working group:
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We would also like to thank the following for their contributions and suggestions:
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The contents of this report refer exclusively to the analysis and research carried out by The European House–Ambrosetti and represent its opinion which may not coincide with the opinions and viewpoints of the individuals interviewed.

Preface

This study is entitled "e-Mobility Revolution". Revolution is a word that is very often used and abused, and yet in this case, it is particularly apt. The Latin word "*revolutio*" means return, to turn back; however, over the centuries, it has been used to indicate major political, social and economic changes that have shaped our history. In the case of electric mobility, we are experiencing both phenomena: the incredible technological progress will demolish the way in which we are used to getting around. Let's keep moving forward, therefore, at full speed.

At the same time, however, we also turn back, if we think of the electric car that was among the first types of automobile to be invented in the mid of nineteenth century, before being superseded by combustion engines.

So now, we are on the verge of a veritable revolution, sparked by the huge strides made by technology. If only a few years ago we were discussing electric mobility as an idea, we are now talking about the concrete actions that will turn it into a reality in an increasingly shorter time span. Thanks to this technological option, we will be in a position to tackle the major megatrends of the next few years (population growth, increasing urbanization, and atmospheric pollution), generating widespread benefits in terms of energy efficiency, environmental sustainability and safety. Not only the way in which we get around will change, but also the way in which we use our vehicles and how we experience and perceive our cities.

When it comes to the issue of electric mobility, Italy still has a lot of catching up to do when compared to other European countries, but it can quickly bridge the gaps. Enel is committed to providing a contribution to the development of e-Mobility, seeking to heal the infrastructural divide that separates us from those countries that are the best in class. Every player in the mobility ecosystem will end up playing their part: the automotive value chain that invests every year €3 billion in Research & Development; the new trends and models in mobility that accelerate demand; the policies for the sustainability and governance of access to the city.
To drive Italy's transition towards e-Mobility it is necessary to understand each individual the point of departure of each country's local area. From this point of view the study elaborated by The European House - Ambrosetti provides an innovative tool because it establishes an Electric Transport Index (ETI) that allows to gage performances on electric mobility in relative terms of Italy's 20 Regions and 14 Metropolitan Cities. This index will not only allow us to evaluate our current positioning in terms of the means of electric transport and infrastructures, but also to gage how quickly Italy will develop e-Mobility in the next few years.

The goal of the study, produced by The European House - Ambrosetti, that has involved numerous Italian and international experts, is to create a new awareness among policy makers and in the industrial sector with respect to the opportunities for economic development offered by electric mobility. It puts forward a convincing and comprehensive vision for Italy, offering innovative keys of understanding, that concern the creation of value that will benefit the entire industrial value chain, beyond those already widely discussed aspects on the environment and climate.

For each segment of the value chain, the existing and potential economic impacts are analyzed and the strong points and competitive gaps to be developed through various policy proposals are highlighted.

This study is therefore intended as a tool for private operators and public bodies, who are called upon to promote the cultural change that this revolution is in need of, in order to make our cities quieter and less polluted.

Our technological progress has provided us with some amazing tools: with the commitment of everyone, I am certain that the future will have some great surprises in store for us.

Francesco Starace
CEO and General Manager, Enel

"Just as energy is the basis of life itself,
and ideas the source of innovation,
so is innovation the vital spark of all human change,
improvement, and progress."

Theodore Levitt

Even outside of the specific sector, we are increasingly hearing references to e-Mobility. Electric mobility is an expanding phenomenon, in terms of both supply and demand. The top international car manufacturers have introduced electric models onto the market at increasingly competitive prices, and we are witnessing a growing presence of electric or hybrid electric plug-in vehicles in the fleets of companies and public entities, as well as in local public transport. As regards consumers, a growing number of individuals are showing interest in the benefits and economic advantages that could be offered by this new technology: between 2005 and 2016, the number of vehicles with an electric engine and plug-in hybrid electric vehicles in the world rose by an average of 94% in terms of stock (topping 2 million in 2016) and 72% in terms of new registrations.

Although the percentage of these vehicles remains limited (0.24% of cars and 1.1% of new registrations at global level), there are wide expectations for growth.

Italy is also part of this e-Mobility Revolution: even though the numbers relating to the stock of electric motor vehicles and new registrations show that there is still a long way to go towards Italy's transition to electric, the number of registrations of electric vehicles grew at a compound annual average rate of 41% between 2005 and 2016, and there was also significant growth in the number of vehicles in circulation, with 9,820 electric vehicles in 2016 (+60% compared to the previous year). To a much larger extent than in the past, the transport sector has the potential to contribute to a significant reduction in greenhouse gas emissions, in line with the commitment undertaken with the Paris agreement on climate change, and with the 2030 Agenda for more sustainable development adopted by the General Assembly of the United Nations on 25 September 2015. This is especially true of Italy, which has more vehicles per capita than any other country in Europe (610 cars per 1,000 inhabitants, compared to 548 in Germany and 484 in France), and where 14% of cars on the road are over 20 years old, placing Italy near the bottom of the table in Europe, with serious consequences for environmental and urban sustainability.

Placing greater importance on sustainable mobility could also have positive effects in a large number of related fields in synergy with it, deploying resources and skills, reinforcing the ability to innovate and encouraging the creation of new directly and indirectly linked industrial manufacturing and service chains. All too often, there is a tendency to associate e-Mobility simply with the environment and fuel saving; no attention has been paid to the industrial significance of the whole technological supply chain it generates, which – all the more so in a country such as Italy with an intensive manufacturing industry – could be a significant driver for growth.

The level of development of electricity storage and engine technologies, the spread of renewable energy sources and smart distribution networks and the objectives posed by the climate challenge all give the electric mobility option a pivotal role in a new sustainable development model.
All the main governments have now set out a clear medium/long-term vision and identified the targets to aim at, with reference both to the market and to the industrial supply chain, as well as the underlying infrastructure network. In this report, you will find a detailed analysis of the most interesting international case studies.

In order to assess the dimensions of the phenomenon and the impact it could have on the industrial value chain of e-Mobility in Italy, The European House - Ambrosetti has set out a number of scenarios for the development of electric motor vehicles and the infrastructure network for recharging them. Taking into account the electric motor vehicle market alone and the turnover that can be generated at each stage of the pertinent value chain (motor vehicles, electric charging infrastructures, ICT services, recycling and second life), our consultants estimate that in the different development scenarios hypothesized, an aggregate turnover of between €24 and €100 billion could be generated by 2025, and between €68 and €303 billion by 2030.

This is a significant impact, which had never been quantified until now, and one from which Italy could capture a significant share in the component, bodywork and interiors sectors, as well as in the area of electric charging equipment, not to mention those that develop predominantly nationwide, that is to say the electricity grid, recycling and second life of vehicles. The European House - Ambrosetti estimates that an aggregate value of between €14 and €59 billion could be generated in Italy by 2025, and between €41 and €180 billion by 2030.

To guide Italy's transition towards e-Mobility, it is important to understand the point the country starts out from. This is what prompted our consultants to develop an innovative monitoring tool, the Electric Transport Index (ETI), which makes it possible to measure electric mobility performance, in relative terms, of Italy's 20 Regions and 14 Metropolitan Cities. The ranking, featured in this report, shows very significant differences between the various areas of the country: with the exception of Apulia, all the Regions in Southern Italy occupy the lower positions; this indicates ample potential for the development of e-Mobility in these areas, also as a strategic driver in support of improvement in sustainability regarding the environment and local transport systems.

I would like to make it clear that this ambitious report would not have been possible without the strong commitment by the Top Management of Enel, starting from Francesco Starace and Francesco Venturini, along with the Enel working group, to explore a front-line issue in the current debate, or without the invaluable contribution of the project's advisors – Maria Chiara Carrozza (Professor of Industrial Bioengineering, Scuola Superiore Sant'Anna; Member of the Italian Parliament; former Italian Minister of Education, University and Research), Massimo Nordio (CEO and Director General, Volkswagen Group Italia) and Carlo Ratti (Professor and Director of the MIT Senseable City Laboratory) – to whom I am profoundly grateful.

Lastly, heartfelt thanks go to the colleagues of The European House - Ambrosetti Working Group, comprised of Lorenzo Tavazzi, Paolo Borzatta, Pio Parma, Benedetta Brioschi, Arianna Landi, Fabiola Gnocchi and Ines Lundra.

Valerio De Molli
Managing Partner and CEO,
The European House - Ambrosetti

Contributions from the Advisors

Are we experiencing a real industrial revolution? We don't really know the answer to this question, but it feels like we are living in a world that until now we had only read about in science fiction: robots and artificial intelligence are pouring out of our factories, our manufacturing industries, and will gradually take over the service sector, entering our homes and streets, changing the relationship between capital and labor.

The symbol of this change is, of course, the self-driving car: an innovation that comes from dynamic sectors of the economy to disrupt the slow, conservative automotive world, and that will have the power to alter technological paradigms and business models that have been in place for many decades. The world of mobility is confronted with a revolution: in this respect, we only need to consider that the driver of our public and private transportation, considered a central figure until a few years ago, is gradually becoming marginal, and is destined, if not to disappear altogether, to be physically and cognitively assisted by intelligent systems in the name of the safety and efficiency of the transportation of goods and people. The very concept of ownership of the vehicle is changing into a service of use for the necessary time, in the context of the sharing economy. All this is happening while we grow more and more aware that among the many problems afflicting our society, climate change is already causing vast migratory phenomena and geopolitical upheaval. Respect of the Paris agreements and European commitments imposes an orientation of economic growth in a direction that is more sustainable from the standpoint of environmental concerns and public health, and that, in the last analysis, has as its goal a radical change in our lifestyles in which the question of mobility is crucial. At the same time, the economic conditions in emerging countries are encouraging the concentration of the populations in gigantic urban agglomerates, and the unstoppable growth of these megalopolises poses unavoidable challenges in terms of social coexistence, urban development and sustainability to which science, technology and innovation must find answers.

We have mentioned just a few of the macro-trends on the agenda in all international discussions: the revolution of robotics and self-driving vehicles, sustainability and agreements for the reduction of emissions, urban development and safety. These social issues concern the mobility of people and goods and affect the entire automotive sector.
Electrical propulsion is one of the key aspects of this change, because it is closely linked to the main elements of technological innovation and the requisite of sustainability, and not only because mobile robots are prevalently powered by electric motors, for which the controls are extremely sophisticated and reliable in interaction with the environment and with people.

This is an aspect in which the report of The European House - Ambrosetti plays a significant role, based as it is on precise methods of qualitative and quantitative analysis: it provides an indispensable tool to the political, industrial and economic decision-makers to understand the state of the art of the Italian position and the growth opportunities within the reach of our system. The contents of the report, and in particular the last chapter, offer a proposal for a national policy with concrete actions on the subject of e-Mobility. It is important to stress that the final recommendations are expressed at the end of a detailed description of the international situation, the conditions of the Italian regions and municipalities, with the intention of promoting the enormous industrial and cultural capital represented by the Italian automotive industry.

If we are not to be merely passive recipients of the technological innovations imposed by others, now more than ever before we must understand change and take the leadership in it, seizing the opportunities offered by a discontinuity that is more social and industrial than technological, for which electrical propulsion is the foundation on which we can build and relaunch a revitalized Italian manufacturing industry. As has already been indicated in the recommendations, Italy has the skills, the human and cultural resources, on which to erect the necessary infrastructures for the take-off of e-Mobility and the development of a sustainable value chain of the automobile industry that also includes services of innovative mobility and an extremely modern circular economy. To achieve this, the development of national policies with a strategic national vision is urgent. We must push toward the future, encouraging the many positive ventures that already exist, coordinating territorial experiences, filling the gaps and creating the fundamental infrastructures so that the chain of e-Mobility can develop into a national industry that also flourishes in the services offered to the administrations and citizens.

Maria Chiara Carrozza
Member of the 3rd "Foreign and European Affairs" Committee,
the Italian Chamber of Deputies; Professor of Industrial Bioengineering
and former Rector, Scuola Superiore Sant'Anna of Pisa; former
Minister of Education, Universities and Research of the Italian Government

Despite the fact that, in recent years, the development and production of electric vehicles by car manufacturers is making great strides, there remains the primary and unquestionable need for a strategic coordination between players.

Specific policies should be defined by the Institutions. The renewal of vehicles in circulation, the definition of a plan aimed at the gradual introduction of electric vehicles (vehicle fleets for Public Administration, taxis and vehicle sharing), transparent tax breaks that are simple for citizens to understand, the coordination - at a national (not local) level - of traffic management, a widespread distribution of rapid charging stations on roads and motorways, a fast and decisive swing towards non-monetary incentives (free circulation, access to limited traffic zones, preferential lanes, free parking), would most certainly favor the spread of electric mobility in a realistic and definitive way.
Nowadays, electric vehicles still have certain limitations - reduced range, long recharging times and high purchase price - but over the next few years, with the arrival of the new generation of vehicles that will be free from the aforementioned problems, their presence in the Italian market is expected to grow.

It will therefore become necessary to ensure that public opinion has a greater understanding of the practical opportunities offered by electric mobility and, as previously stated, provide incentives for the system's structural and coordinated growth.

It is essential, therefore, that mobility producers (car manufacturers and suppliers of components, rental, car sharing and on-demand companies), energy and service companies as well as institutions and local bodies, have clear and common goals, adapting their own activities and cooperate to support e-Mobility in order to ensure its complete success.

This transformation undoubtedly represents an important opportunity for the technological- manufacturing value chain, which can benefit from a noticeable boost given by the strategic focus on electric mobility of almost all automotive cases. Italy's outstanding components' sector could reap the advantages and benefit from a major impulse for development and growth.

What is essential is a coordinated approach when it comes to open business models based on international standards that will accompany clients and users towards a continuous and long-lasting transition, in the direction of a mobility that is finally more mature and knowledgeable.

Massimo Nordio
CEO and Director General, Volkswagen Group Italia;
former President, UNRAE - Association of foreign
car makers operating in Italy

The relationship between cars and the city is complicated. Today, as afflicted as we are by traffic and pollution, we are increasingly led to viewing them as incompatible. Nevertheless, over the entire course of the twentieth century, the automobile has left an indelible mark on our cities, influencing many urban planning choices. As Le Corbusier wrote in 1925 "*the car... has totally revolutionized our old ideas about urban planning*".
Almost a century later, we find ourselves at a similar turning point. According to estimates, the demand for urban transport should more than double by 2050, a fact that will require our roads to double in capacity, just to keep pace with current levels of congestion (often already unsustainable). What is more, thanks to the rapid convergence of IT and communication technologies, of robotics and artificial intelligence, our transport systems are heading in the direction of a massive transformation that will also radically alter our urban landscape.
Among the factors that will contribute to paving the way towards change, there are electric vehicles (EVs) and autonomous vehicles (AVs) that we will hereinafter group together under one heading, EVAVs. In recent years cars have gone from being the mechanical systems produced by Henry Ford to veritable computers on wheels. They are now equipped with sensors that gather data that make the drive more efficient and safe. Companies like Waymo (that originated from Google), Cruise (acquired by General Motors), Otto (purchased by Uber), Zoox and nuTonomy, for example, are experimenting with new sensors that will allow a car to "see" as we do with our own eyes. Autonomous cars will reduce the amount of time we spend every day driving and they will make our roads safer. What is more, AVs will probably be electric vehicles, reducing in this way the impact on the environment.
As we hypothesized in a recent MIT study, a correct regulation and an increase in car sharing could reduce the number of vehicles on our roads to just 20 to 30% of what it is today. Try to imagine how our cities' roads could be reconfigured if they were not clogged up by parked cars and traffic congestion. Imagine room for trees, wide pavements and bike paths, green spaces or homes without car parks at reasonable prices. Nevertheless, in order to achieve such a scenario, cities and governments must now draw up clear policies that are linked to EVAVs.
The EVAV revolution will bring with it sensational transformations in the area of urban planning, precisely because it will allow a further increase in the dynamic of sharing. At present, when someone wants to use a Car2Go, Enjoy or Zipcar car-sharing vehicle, they have to go and look for it. In the future, it will come and look for them when they book it using an application. A driverless car can give us a lift to work in the morning and then, instead of standing idle in a car park, it will take our children or our neighbors' to school or give a ride to anyone else in the neighborhood or town. Combining these two aspects, i.e. car sharing and ride sharing, it is possible to imagine a city that operates with far fewer cars than we have today, something that will also lead to fading away the distinction between public and private transport. The difference would be significant, with a more efficient use of resources and the conversion of many spaces that are currently filled by car parks, transforming them into open public or green spaces.
In addition to an alternative use for car parks, EVAVs could also result in the disappearance of another common element on our roads, namely the traffic light - a technology that is now 150 years old that was originally designed as a tool for preventing collisions between horse drawn carriages. It is inevitable that, with the prospect of these new mobility scenarios, even the mainstays of our road infrastructures will undergo changes. We can imagine a future in which, thanks to the widespread uses of autonomous mobility, traffic lights will be replaced by a space allocation system, where attention will shift from road traffic to the vehicle. In this way a vehicle will arrive at a crossroads at precisely the moment when there is a space available, thus avoiding the creation of road congestion. This will considerably reduce waiting times, as well as fuel consumption, and will contribute to lower emissions helping to fight climate change.
In conclusion, EVAVs could decidedly improve urban transport. However, if the transition is not managed wisely, it could also result in negative outcomes. We could find ourselves in a scenario with no more parking charges, or speeding fines, or license fees or tolls, amid a growing number of shared journeys in common vehicles with intelligent methods of taxation, based on the type of fuel, the weight of the vehicle, congestion and distances traveled. If we don't take control of the changes immediately, however, we could end up being catapulted into that nightmare scenario prophesied by Robin Chase, entrepreneur and founder of ZipCar. We risk having cities that are even more congested as a result of "zombie" EVAVs that clog up our roads because driving them around will cost less than keeping them parked up. We would lose the funding base for transport infrastructures, not to mention the impact of job losses, lower market consumption and reduced tax revenues as a result of the new numbers of unemployed. A hellish but plausible scenario. For the majority of those who live in a city, a seat on an EVAV would be cheaper, easier and more convenient than owning their own car.
Fortunately, there is still time for us to knowledgeably manage this transition. If we enter into an open debate about the subject, involving all of our cities' social players, autonomous vehicles could lead us to a more sustainable, safe and pleasurable urban experience. And paving the way towards this dialog is precisely the contribution made by this report, prepared by the European House – Ambrosetti.

Carlo Ratti
Professor and Director of the MIT Senseable City Laboratory,
Massachusetts Institute of Technology

10 key points of the study

1. e-Mobility represents a key paradigm shift in line with standards of greater sustainability, safety and modernity

The electrification of mobility is not solely confined to the motor vehicle sector, but it also involves other forms of transport on four wheels (buses, vans, commercial vehicles, quadricycles) and two (motorcycles and bicycles). The spread of these makes it possible to **revolutionize the system of passenger and freight mobility as a whole**, in line with criteria of greater energy efficiency, environmental and urban sustainability, safety, accessibility, connectivity and multimodality. From an environmental perspective, electric mobility ensures greater benefits, when one considers the entire cycle of production and use (well-to-wheel). For all combustible fuels, the contribution of the "well-to-tank" phase is significant, but it is even more so for electric and plug-in hybrid electric vehicles. Moreover, whereas a thermal engine has an efficiency of 17 - 19%, an electric one can reach **36%** overall (a level that is liable to increase still further through the integration of the electricity produced from renewable sources).

2. Around the world, the electrification of mobility is expanding and during the next 10 years this technology is expected to become fully established on the market

All over the world, electric mobility is experiencing a substantial period of growth. Between 2005 and 2016 the number of electric and plug-in hybrid electric vehicles grew at an average annual rate of **94%** in terms of stock (surpassing 2 million units) and **72%** in terms of new registrations. While the relative incidence is still contained (0.24% of the vehicle fleet and 1.1% of new registrations on a global level), there are broader expectations for development: it is estimated, in fact, that by 2040 electric vehicles will account for more than 50% of all new sales. In 2016 even the global stock of electric buses doubled, compared to the previous year, reaching 345,000 units. The incidence of electric mobility is also growing for other forms of road transport, that is to say commercial vehicles, mopeds and scooters. A key development driver for e-Mobility comes from European and Italian policies for decarbonization, in favor of a more sustainable development.

3. Electric mobility is a "game changer", because it responds effectively to the remarkable megatrends that will map out the near future

Electric propulsion will allow to generate widespread benefits in several areas:

- Urbanization and local mobility. The characteristics of electric cars enables to optimize the benefits arising out of their use (zero emissions, reducing noise pollution, etc). Moreover, government policies for urban mobility and access to the city (preferential access to limited traffic zones, reserved lanes, etc.) are pushing towards the adoption of electric propulsion.
- Smart city logistics: light commercial vehicles, those of the so-called 'last mile', have a particular significance for mobility in town centers and they are expected to increase in coming years, supporting the development of e-commerce. The replacement of conventionally powered vehicles with lightweight electrically-driven vans would make it possible to reduce noise pollution in historic town centers and to contain polluting emissions, given that these vehicles are best suited for short to medium range journeys in an urban setting.
- Sharing economy: the use as "second car" that characterizes car sharing vehicles with journeys that are mainly urban, makes the electric motor vehicle the perfect means of transport for the distribution of shared transport services.
- Connectivity and autonomous driving: even if the driving is autonomous it is not tied to the adoption of electric propulsion, 100% electric autonomous vehicles produce better performances thanks to the on board installation of electronic systems and ICT solutions.
- Aging society: in a global scenario of an aging population, the installation of connectivity solutions on electric vehicles for transporting passengers promotes a better use and running of the motor vehicle. By integrating with the new info mobility and traffic management solutions, these new technologies make an electric vehicle a source for gathering and exchanging information concerning a vehicle's performance and the style of driving, whilst, at the same time, facilitating its use, even by the more senior members of our community.
- Circular economy: the development of electric mobility can activate new supply chains, beginning with the recycling of batteries.

4. Italy is involved in the e-Mobility Revolution, but from the outset it is in a situation of backwardness, compared to more advanced countries

Even if the numbers related to the stock of electric vehicles and new registrations show that there is still a long way to go towards Italy's transition to electric, the number of registrations of electric vehicles grew at a compound annual average rate of **41%** between 2005 and 2016, and the growth of the number of vehicles in circulation was also relevant, with **9,820 electric vehicles in 2016** (+60% compared to the previous year). In Italy too, electrification is gradually involving more forms of mobility. For example, models of **electric buses** have been circulating in some Italian cities for almost twenty years. Even the two-wheeled sector recorded positive results in 2016, above all in the **electric bicycle** segment (124,400 units sold, that's **+120%** compared to 2015, with a 2.6% drop in the sale of conventional bicycles). During the first five months of 2017, registrations of mopeds and motorcycles doubled (+96%).

5. The Electric Transport Index reveals wide variations between Italy's Regions and Metropolitan Cities, with a significant north-south divide in the country

The Electric Transport (ETI) is an innovative tool that enables to gage performances in relative terms of the 20 Italian Regions (ETI^R) and the 14 Metropolitan Cities (ETI^M).

Among the Italian Regions, **Tuscany** records the highest score of **6.5** out of a maximum value of 10. With the exception of Apulia, all the regions in Southern Italy are in the lower half of the ETI^R 2017 rankings, highlighting the great potential that exists in these areas for the development of e-Mobility. The best performance in the ETI^M 2017 rankings for electric transport was delivered by the **Metropolitan City of Florence**, with a total score of **8.1**. It is followed by the metropolitan areas of Milan (6.4 points out of a maximum of 10) and Rome (6.0 points).

6. The electric mobility value chain involves multiple industrial and service value chains, with significant potential in terms of value added and employment

In order to assess the potential impacts on Italian industry associated with the development of electric mobility, the **extended e-Mobility value chain** has been reconstructed, taking into account both the direct and associated chains: Research & Development, manufacturing, distribution and sales of vehicles, IT and energy platforms, use and aftermarket, recycling and second life. The area of analysis on which attention was focused considers the different types of vehicle involved in the road electric mobility - automobiles, motorcycles, buses and commercial vehicles - in the full electric and plug-in hybrid versions. Overall, this consists of approximately **160,000 companies, 823,000 employees** and an annual turnover of almost **€390 billion**.

7. Italy has numerous manufacturing and technological competencies that are or can be linked to e-Mobility, and from these it can activate an important driver for growth

Taking into account the electric motor vehicle market alone and the turnover that can be generated in each stage of the value chain, it has been estimated that in the different development scenarios hypothesized, an overall turnover **of between €24 and €100 billion by 2025 and between €68 and €303 billion by 2030** could be activated.

This is a significant impact, of which Italy could capture a relevant share in the component, bodywork and interiors sectors, as well as in the area of electric charging equipment, in addition to those that develop predominantly nationwide, that is the electricity grid, recycling and second life. It would be possible, therefore, to generate, in Italy, a value **of between €14 and €59 billion by 2025 and between €41 and €180 billion by 2030**.

8. Around the world the major economies have defined a coherent and integrated set of measures for accompanying the transition towards electric mobility and enhancing it, even in light of opportunities of industrial development

Although timescales and methods may differ, to this date the governments of the countries analyzed have defined a **medium to long-term vision and identified targets to be achieved**. For example, Germany has set itself the goal of one million electric cars in circulation by 2020. The target set by France and the United Kingdom is that as from 2040 all new vehicles registered will be low emission. India, on the other hand, is aiming to decarbonize the country's entire car fleet by 2030. Having clearly defined the point-of-arrival, Governments and relevant bodies have been able to establish specific measure to be put in place in order to achieve it.

In those countries that have a significant automotive manufacturing base (such as France, Germany, the UK, Japan and China) there is strong state support and the active involvement of industry in plans for developing electric mobility, through **funding of R&D projects on the frontiers of innovation** (for example, technologies for autonomous driving and those for balancing the network, such as Vehicle-to-Grid) and with **public-private partnerships**.

9. To this date Italy does not have a clear programmatic line for the development of e-Mobility and this represents an obstacle to benefiting in full from the opportunities of modernisation and growth related to it

There have recently been some system initiatives (such as the "Tiscar Round Table" document and the joint resolution of the Public Works and Environment Committees of the Senate of the Italian Republic on sustainable mobility). Nevertheless, there are still **a number of impeding elements requiring intervention**. These include:

- Consumer information that is still scarce, in a relatively new market, regarding the benefits and performances of an electric vehicle.
- The purchase price, that is still not competitive, compared to models with thermal engines, also because of the lack of incentive schemes.
- The anxiety range of drivers.
- The absence of subsidized and uniform tariffs for charging points provision.
- The need to adapt the regulatory framework and to include national guidelines aimed at establishing minimum technical-operational requirements for charging infrastructures and a uniform and simplified approach to completing the administrative procedures for the installation of electric charging infrastructures.
- Poor collaboration, in a systematic manner, between the stakeholders in mobility.

10. To enhance the opportunity for e-Mobility and derive the maximum benefits from it, it is necessary a countrywide strategy integrated on six building blocks

1. Formulate, at the level of the Italian national economy, an incisive, all-round **vision for the national development** of e-Mobility (vehicles - private and public, two and four wheeled and "slow mobility"), through the commitment of the Government - even with the establishment of a platform that will act as a national control room - to share with key industrial players and stakeholders, and subsequently formalize medium to long-term targets and launch, in a dedicated plan, the measures for supporting the development of the demand, the supply and the charging infrastructure network.
2. Establish a **leadership role for Italy in the area of Research and Development** through: the launch of programs of research at a national level; the creation of a national cluster on e-Mobility that will enhance the scientific competencies and know-how throughout the entire extended electric mobility value chain; an awareness raising initiative to create a patenting culture.
3. Promote **policies based on incentives of a non-economic nature** in order to accelerate the spread, on a vast scale, of electric mobility, in the short-term, with particular reference to urban settings.
4. Promote **pilot supply chain projects** involving companies, universities and research centers, aimed at defined system goals (the spread of electric car sharing, the development of electric public transport, the integration of urban and suburban transport system, etc) and/or developing innovative solutions (new service for city logistics, ICT applications, etc.).
5. Accelerate the **infrastructure process of electric charging points network**, by: simplifying administrative procedures; defining a regulatory framework for standardizing tariffs for supplying electricity to charging points; introducing tax incentives for the purchase and installation of charging equipment; promoting agreements and contracts for the installation of private charging points for public use.
6. Promote, under government guidance, and with the involvement of the industry, a **nationwide awareness and information strategy** on e-Mobility, targeting public opinion and the industrial players.

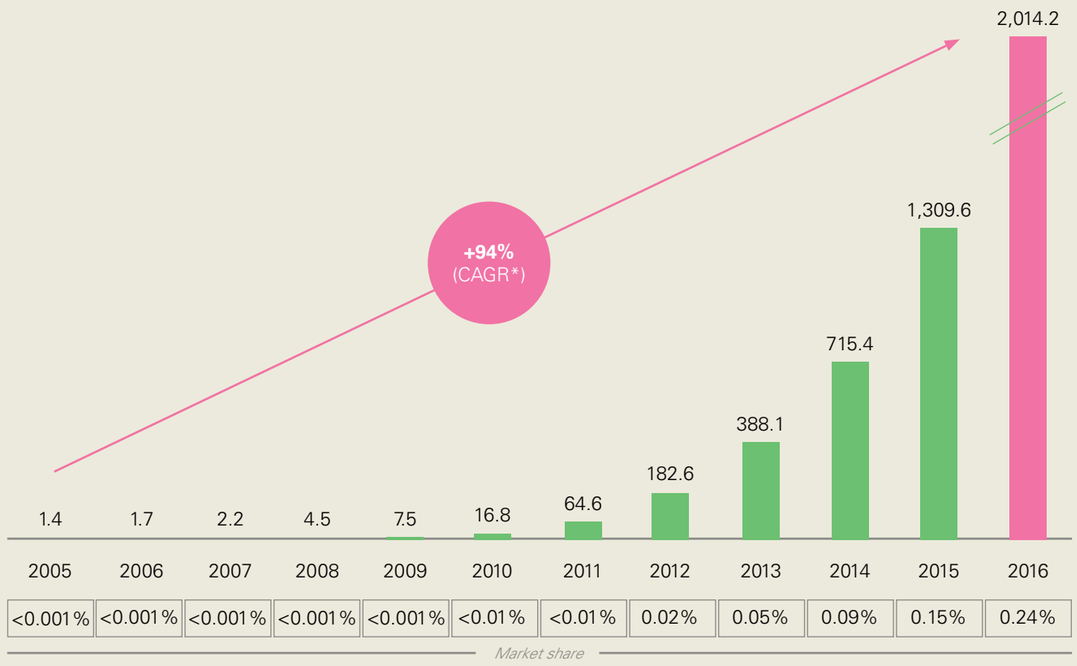
Executive Summary

Bring e-Mobility to Italy's economic system and its industry

1. On a global level, e-Mobility is experiencing a period of significant growth. In fact, the benefits associated with this new form of transport—in terms of enhanced environmental sustainability (especially in urban areas), energy efficiency, technological content, accessibility and connectivity—are increasingly galvanizing the attention and interest of the various players involved (government, industry and individuals). The gradual electrification of the vehicle fleet makes it possible to "revolutionize" the transport system as a whole because it involves not only **passenger and freight transport**, but also the **public and private side**, given its application to a range of means of transport—from 4-wheel vehicles (cars, buses, vans, commercial vehicles and quadricycles) to those on two wheels (motorcycles and bicycles).
2. Globally, in terms of motor vehicles alone, between 2005 and 2016, the number of full-electric (BEV) and hybrid plug-in (PHEV) vehicles increased on average by 94% in terms of stocks (exceeding 2 million vehicles) and 72% in terms of new registrations. Although the impact of electric motor vehicles remains low (0.24% of the total car fleet and 1.1% of new registrations), there are significant prospects for development. In fact, it is estimated that **by 2040**, electric vehicles will comprise **more than 50% of all new cars sold**.

Figure 1

Stock and market share of electric motor vehicles worldwide (BEVs and PHEVs, in thousands and percentage share of car fleet), 2005-2016.
Source: The European House-Ambrosetti elaboration of International Energy Agency (IEA) data, 2017

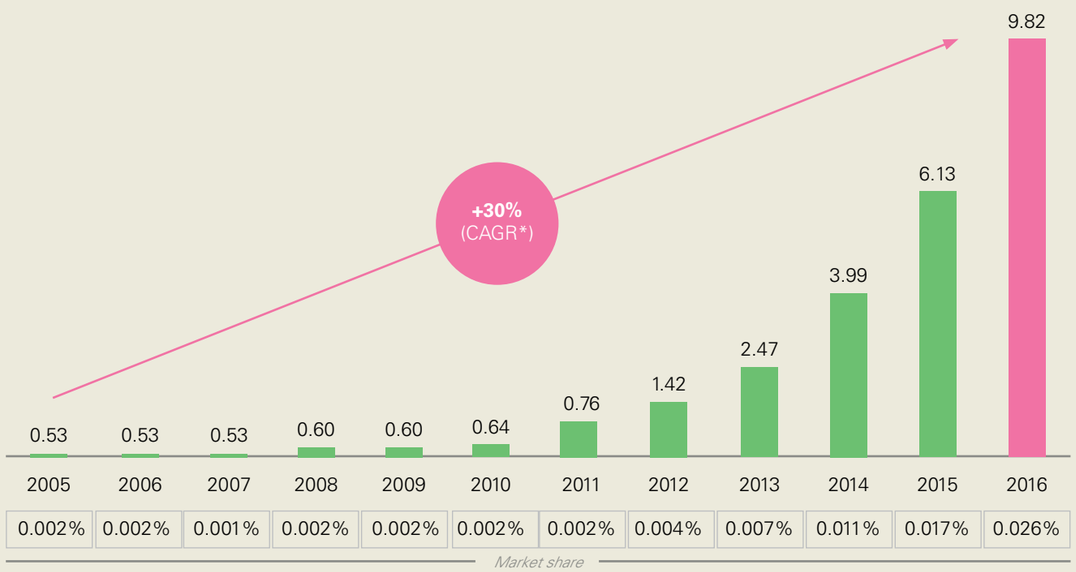


(*) Compound annual growth rate

3. The spread of e-Mobility on a global scale reveals a diversified situation: with almost 649,000 electric motor vehicles in 2016, China is the #1 country in the world in terms of stocks (and it is also #1 in terms of 2-wheel vehicles in circulation, more than 200 million in 2016), while Norway is the leader in terms of electric cars in circulation (5.11%) and market share of registrations in 2016 (28.76%).
4. Italy must bridge the gap with countries that are more advanced in terms of e-Mobility. As of end-2016, stocks of electric cars were **less than 10,000 vehicles** and the share of autos in circulation was **0.026%**. The transition towards e-Mobility could aid in the management of a number of social-environmental critical areas on a national level that are connected, first and foremost, to the combination of a high level of motorization (the highest in Europe, with 610 cars per 1,000 inhabitants, compared with 548 in Germany and 484 in France) and a car fleet that is one of the most obsolete in the EU (nearly 14% of the fleet in circulation is over 20 years old). Within this context, there are positive signs of growth in the car sector:
• Between 2005 and 2016, registrations of electric motor vehicles grew at an average compound annual rate of **41%**, from a few tens of vehicles sold to 2,200 new vehicles in 2016 (0.12% of new registrations).
• The stock of BEV and PHEV motor vehicles grew at an average rate of **30%** during the same period.
The growth trend in electric technology is gradually involving other forms of mobility. For example, models of electric buses have been in circulation in some Italian cities for nearly twenty years, while in the electric bicycle segment, in 2016 sales increased by +120% (124,400 bicycles sold) compared with a decrease of 2.6% in the sales of traditional bikes. And, over the first five months of 2017, registrations of electric motorcycles and mopeds in Italy doubled (+96%).
5. The electrification of mobility will be a **game changer for the future** because it is the technological option that will make it possible to meet and manage efficiently (and international and European policies are also moving in this direction) some of the main megatrends that will characterize the coming decades, including:
• Sustainability of short haul transport, last mile logistics and reduction of the external negative factors of mobility, starting with urban factors, thanks to decreased bulk and/or greater available space, reduced (or zero) emissions and the development of management and city access policies which see electric vehicles as a particularly suitable means.
• Sharing economy: the use of car-sharing services on urban routes makes electric motor vehicles an ideal means for providing shared transport services. These involve small-size means—generally quadricycles—approved to carry two people with local emissions and engine noise levels of zero and equipped with batteries guaranteed to provide 100 km of running on a full-charge (i.e., ideal for urban mobility).
• Connectivity and autonomous self-driving: within a scenario of accelerated development of new computer solutions and connectivity in the passenger and freight transport sector (even if self-driving, they must not necessarily be electrically-powered), 100% electric autonomous vehicles have the best performance levels thanks to the on-board integration of ICT and integrated electronic systems.
• Ageing society: in the face of the gradual ageing of the population, introduction of connectivity solutions on electric motor vehicles for passenger transport fosters enhanced fruition and management of the car, even by more senior users, in addition to vehicles that are easier to drive.
• Circular economy: the development of e-Mobility could activate new industrial value chains, starting with the re-use of car materials and recycling (second life) of electric batteries which can be regenerated for use in energy storage solutions for stationary use or the re-installation of new vehicles.
6. The impact of e-Mobility is significant from the standpoint of environmental compatibility (pollution, noise, etc.) and energy efficiency. If the entire **production and use cycle** ("well-to-wheel") is taken into consideration, the contribution of the "well-to-tank" phase (energy costs connected with the elaboration of the primary source—extraction, processing and transport) is significant for all fossil fuels, while for electrical energy this cost is lower, especially if production of electrical energy from renewable sources is considered. In addition, electric motors have an overall efficiency of over **36%** compared with 17-19% for heat engines, allowing for further maximization of this efficiency when electricity produced by renewable sources is used, thanks to technologies that allow for the balancing of the grid, such as Vehicle-to-Grid (V2G). Additional important benefits can be obtained in terms of integration and better use of the energy produced by renewable sources and positive impacts on the **stability of the energy grid** through Smart Charging and Vehicle-to-Grid (V2G) technology. When individual vehicles or public or private fleets of vehicles are inactive, their batteries can be recharged flexibly or, in the case of V2G, utilized to feed energy into the grid, thus guaranteeing better management of peak demand of electrical energy and enhanced integration of energy produced by renewable sources.
7. The spread of e-Mobility can allow both new development as well as the reinforcement of **multiple product and service value chains**, representing significant potential in terms of value added and employment. In this study, the **extended e-Mobility value chain** has been reconstructed (seen as the totality of industrial sectors and services involved to various degrees in the development of e-Mobility), while taking into consideration both the direct and related value chains, as well as the various types of road e-Mobility: motor vehicles, motorcycles, buses and commercial vehicles.
8. The mapping of the value chain consists of a matrix structure, based on two macro-areas (on one hand vehicles, and on the other the infrastructure and energy grid) onto which the components of ICT Services that can be activated with e-Mobility can be inserted across-the-board. The detailed assessment of the e-Mobility value chain—performed using granular analysis of the products and services that already exist or could be activated[1]—focused on a number of both **up- and downstream phases**:
• R&D, which concentrates on a number of specific areas, including energy efficiency and innovative systems for smart vehicle charging; solutions to improve the performance, management and reuse of storage systems; vehicle redesign; and development of software and self-driving systems.
• Manufacturing, which includes: manufacturing parts and accessories for vehicles and their motors and assembly; energy production; telecommunications; building charging stations; networks of service stations; and ICT solutions.
• Distribution and Sales (of vehicles, IT platforms and energy).
• Use and Aftermarket, seen as the totality of maintenance and repair activities of electric vehicles and their components; sales of vehicles, finished and spare parts; smart services; management of the infrastructure and electrical grid; and customer service.
• Recycling and "second life" (of vehicle components and charging infrastructure).
Considering Italy and the overall perimeter of e-Mobility (motor vehicles, motorcycles, buses and commercial vehicles), the value chain involved represents a **very significant range of activity**, with 160,000 businesses, a workforce of over 820,000 individuals and annual revenues of nearly 390 billion euros.

Figure 2

Stock and market share of electric motor vehicles in Italy (BEVs and PHEVs, in thousands and percentage share of car fleet), 2005-2016.
Source: The European House-Ambrosetti elaboration of International Energy Agency (IEA) data, 2017



(*) Compound annual growth rate

1 Use was made of a range of information channels and sources: survey of the main technical studies and scientific literature in this area; interviews in the field with industry representatives across the value chain; and expert reviews of the technological profile with CEFRIEL - Milan Polytechnic and the Istituto Motori–CNR of Naples, whose experts validated the structure and individual activities/outputs of the extended e-Mobility supply chain.

Figure 3

The extended e-Mobility value chain (Battery Electric Vehicles & Plug-in Hybrid Electric Vehicles).
Source: The European House–Ambrosetti data elaboration, 2017

Exclusive inputs/outputs for electric vehicle
Energy supply chain
ICT services

R&D (areas of research)

Vehicle

- Fossil fuels°
- Sources of renewable energy
- Alternative fuels (e.g. biodiesel, hydrogen, methane°, etc.)
- Energy efficiency (e.g. cutting edge materials for energy storage, soundproofing, bodywork and components, etc.)
- Vehicle-to-Home
- Autonomous Vehicle
- Battery Management System (BMS)
- Electronic differential
- On-board energy flow management strategies
- Redesigning vehicle and its bodywork
- Design and engineering
- Software development
- Vehicle-to-Vehicle
- ...

Infrastructural and energy network

- Energy efficiency
- Sources of renewable energy
- Energy transmission/deployment network
- Development of software for electrical energy flows
- Second-life for electric batteries
- Vehicle-to-Grid
- Smart charging
- ...

Manufacturing

Electrical systems
- Wires and wiring sets
- Windscreen wipers, heated rear windows and electrical anti-fogging devices for automobiles
- Starter motors°
- Aerial
- Conductive and inductive charging systems (static and dynamic)

Mechanical components
- Brakes and components (disk, pedal and calipers)
- Clutches
- Manual/automatic gear box°
- Front/rear differential
- Rims and wheels
- Pads
- Gas spring/absorbers
- Chassis
- Axles
- Suspension shock absorbers
- Radiators
- Silencers°
- Steering and columns
- Tank°
- Passenger access platform*
- Easel**
- Pedal**
- Fairing**

Audible systems
- Horn
- Loudspeakers
- Soundproofing°
- Audible indicator

After Treatment System
- Catalysts°
- Intakes°

Air Conditioning

Electronic systems of power
- Electronic capacitors
- Electronic resistors
- Electronic valves
- Spark plugs°
- Wiring for ignition systems°
- Ignition coils°
- Dodes

Electronic systems of control
- Dashboard
- Telematic systems
- Electric panel (electronic crystals, components for monitors, cathode tubes)
- Micro-processors
- Connectors
- Inducers
- Boards and printed circuits
- Electrical systems for windows and doors
- Panel instruments
- Voltage regulator
- Control units
- Diagnostics
- Vehicle Management System (VMS)

Lighting
- Headlights/LEDs
- Interior lighting
- DRL adaptive lights

Bodywork
- Cab
- Bumpers
- Spraying and painting
- Front grill
- Doors
- Lining of trunk

Interior trims
- Windshields and windows
- Mirrors and steering wheel
- Handrails and buttons for stop request*
- Handlebar**
- Seats
- Saddle**
- Safety kit (fire extinguisher, first aid)
- Ticket punch*
- Safety belts and airbags
- Interior gadgets

Electrochemical storage systems
- Battery pack
- Battery charger
- Super-capacitors
- Accessories
- Battery Management System (BMS)

Software for vehicles
- Sensors
- Diagnostics systems
- Start&Stop Systems
- Safety Systems
- Navigation systems
- Tracking devices
- Integrated systems (ABS, EDS,...)
- Alarm system

Powertrain (electric and thermal motor)
- Thermal engine°
- Power generators
- Alternators°
- Engine generator sets (excluding turbine generating sets)
- Rotor and stator coils
- Generator sets°
- Cooling systems (water and air)
- Electronic power converters
- Permanent magnets
- Coupling system between thermal and electric engine°

Energy
- Electricity production, transmission and distribution grid and related infrastructures
- Installation of new energy transmission plants for more widely distributed grids
- Public electricity grid
- Domestic grid
- Storage systems
- Smart grids
- Transformers (of electricity distribution, of fluorescent current, etc.)
- Substations of transformers for electricity distribution
- Transmission and distribution regulators

Telecommunications network
- Systems for connecting to Internet
- Vehicle-to-Vehicle
- Smart phones
- Telecommunication/transmission infrastructures (4G, 5G, etc.)

Software for charging points
- Integrated systems
- Sensors
- Diagnostic systems
- Navigation systems
- Tracking devices
- Payment/transaction systems for charging
- Software for vehicle interaction/recognition

Electrical charging points
- Exterior panels
- Displays
- Electrical cables
- Transformer
- Power converter
- Connectors for slow and fast charge
- Handle
- Energy/power gauge
- Protection and control device
- Hardware communication module
- Integrated storage systems
- Electrical safety check in residential setting

Distribution/Sales

Distribution
- Logistics
- Vehicle park

Sales
- Customer support services
- Financing services
- Training/technical updating services

Software
- Online Platforms for orders/sales management
- Integrated systems
- Integrated systems for transport
- ITS integrated systems
- Upgrading systems
- Management systems of electric car fleet
- Big Data analytics (electric battery status monitoring software)

Service stations
- Fuel service stations and related infrastructures (gasoline pumps, etc.)°
- Charging stations (alternate current and fast direct current) and related infrastructures
- Service areas (catering, etc.)
- Parking for stops
- Electrification system along the motorway network
- Wireless charging pads and dynamic charging systems
- Solar panels

Energy
- Transmission
- Distribution
- Energy Community

Use and after market

Maintenance
- Maintenance/overhaul of vehicle and components
- Battery replacement and installation
- Conversion and retrofitting kits°
- Roadside assistance

Smart services
- Vehicle-to-Vehicle
- Vehicle-to-Home
- Vehicle-to-Grid
- Bidding/geolocation services, etc.
- Driving and parking assistance
- Wearable device/ IoT
- Mobile App

Operating services
- Car sharing services
- Management of electric car fleet
- Ancillary services (geomarketing, ecc.)
- Integrated mobility services

New forms of vehicle use
- Car sharing
- Ride sharing
- Car pooling

Operating services
- Maintenance
- Replacement and installation
- Monitoring
- Energy demand management systems
- Vehicle-to-Grid for energy flows management in electricity grid
- Smart charging

Customer service
- Maintenance services
- Car sharing services
- Parking
- Wireless network communication

Recycling and Second life

Vehicle
- Recycling of conventional vehicle components (electronics, bodywork, glass,etc.)
- Recycling of electric vehicle components

Battery
- Recycling of components (copper, iron, etc.)
- Regeneration of battery for domestic/industrial use
- Storage of batteries for electric storage

Infrastructure
- Recycling/reuse of charging stations component parts
- Conversion of service area

N.B.: the supply chain outlined refers to the electric vehicle as a whole and does not include other indirect/external supply chains

(*) Typical components for bus (**) Typical components for motorcycles (°) Output/services at risk in case of a total decarbonization of car fleet (100% BEV)

Figure 4

Mapping of Italy's areas of expertise along the e-Mobility value chain in an international comparison.
Source: The European House - Ambrosetti data elaboration, 2017

Livello di competenze

- High
- Middle
- To be built

- **Output**
- **Supply chain phases**
- Italy's excellences in the industrial supply chain for electric cars

(*) COBAT (70 collection points and 26 specialist treatment and recycling plants) treats 51% of industrial and vehicle accumulators placed on the market for consumption.

	Storage systems (batteries)	Electric and hybrid engines	Inverters	Components	Bodywork and interiors	Electric charging infrastructures	ICT Systems	Energy grid	Mobility services
R&D, Design/ Engineering	R&D to date in Italy is under-developed	Excellences in the manufacture of components for engines, but R&D is lacking, with the exception of Magneti Marelli (leader in the Powertrain segment in Italy); excellences in the motorcycle sector (Energetica)	R&D driven above all by the development of technological solutions applied to the renewables sector and for industrial automation	The presence in Italy of numerous medium to large-sized players active in the design of mechanical components and systems in plastic and composite materials	Italian tradition (e.g. Pininfarina's agreement with Iran Khodro and Hybrid Kinetic; Zagato; Pininfarina); university courses and European-level Masters in automotive design	Japan and USA's specialization in R&D on infrastructures and standard (AC) and fast (DC) charging systems; experimentation on inductive charging in northern Europe and pilot projects in the Netherlands	Launch, in 2015, of the German ICT for Electric Mobility II plan for developing ICT solutions for e-Mobility; investments in the United Kingdom on R&D on driverless vehicles	Cutting edge R&D (e.g. agreement between Enel and Rossetti, Russian operator for the development of innovative smart grids , June 2017); experimentation on storage systems for integration into the electricity grid (Terna)	R&D for digital services and broadband solutions (Vetrya has developed an e-car with info-mobility and ITS services – driven by an on-board tablet which operates as a multimedia dashboard giving information about the vehicle status, rewarded by the London Stock Exchange among the 1,000 EU most innovative companies)
Manufacturing	Segment that is still under-developed (among the majors are Fiamm and Midac) when compared with China, Japan, South Korea, Germany and France, but in 2020 the market for battery energy storage from the energy and industrial sectors will hit €1.35 billion in Italy	The leading car manufacturer for the production of electric engines is Nissan, followed by Mitsubishi and GM	The presence of medium to large manufacturers of inverters for the photovoltaic and automotive (e.g. Elettronica Santerno) sectors that is dominated by the Chinese, Germans, Japanese and South Koreans	Italy is the 2° country in the world for trade balance of electric conductors with voltages greater than 80 V and 3° country in the world for trade balance of gears and gearing. Magneti Marelli is among the top 100 OEMs (30th in the world and 13th in Europe in 2016)	Extensive experience in the design of vehicle interiors and the production of bodywork, also in the bicycle and motorcycle sectors	Italy has excellences in the production of charging infrastructures (e.g. Enel, Bitron, Ducati Energia, Energy Resources, etc.)	STM among the world-leading companies for electronic circuits, batteries and (semi) autonomous driving systems. Other EU countries have integration solutions between charging stations and domestic communications (es. Devolo – Germany); growing telematic segment (e.g. Octo Telematics)	Italy was the first country in the world to launch in 2001 a national plan of massive installation of electronic counters, which are the basis of smart grid; opportunities of services for managing the network	Relocation of bicycle and motorcycle production from China to Italy with Five, the first ultra green start-up dedicated to the electric mobility in Italy
Use and aftermarket	Aftermarket is still under-developed in Italy; experiences of the battery pack leasing service by some automotive operators, with its own scheduled replacement with new battery packs and or updated technology	Aftermarket services (maintenance, support, etc.) of electric engines are still not very widespread in Italy when compared to other European countries (e.g. Germany) that are among the major manufacturers of such engines	Basic support services guaranteed by medium to large manufacturers and distributors of inverters	2,000 companies active in the component sector in Italy, with a turnover of €38.8 billion and ~€20 billion in exports (19% towards Germany); 71% of operators active in the aftermarket segment	Expertise in the aftermarket services is widespread for bodywork and interior components of thermal engine vehicles	Imminent boosting of the charging network infrastructure on a domestic level and associated opportunities	Development of value added ICT and software services associated with the creation of a network of infrastructures (Big Data, geolocation services of charging points via mobile networks, bidding services, etc.)	Possibility of offering services associated with Vehicle-to-Grid; the need to draft regulation on the offer and related pricing and uniform communication standards	The Italian app, Andale, is the only one in the world that enables to subscribe at different car sharing and bike sharing services with a unique registration
Recycling and second life	COBAT's know how in the disposal of accumulators* (collaboration with CNR - National Research Council - on the recovery of lithium batteries); central-southern European countries at the forefront (e.g. in Germany, a pilot project for spent batteries in Smart ForTwos, for supplying renewable energy to the domestic grid)	COBAT expertise in the disposal of component parts in engines	Recovery projects for inverter electrical component parts (e.g. collaboration between COBAT and manufacturers)	Collaboration between steelworks, national demolition operators and SMEs: production of ~1.8 million tonnes per annum of ferrous scrap broken up in Italy; initiatives for the recovery/disposal of windscreen and side window glasses and plastic materials coming from the automotive sector		Italy aligned with other countries; possibility of creating a network for the recovery of main, quality materials (e.g. iron and copper plates)	Italy aligned with other countries; possibility of creating a network for the recovery of component parts in copper, silicon and rare earth elements in the face of significant investments		

9. In order to understand the development potential associated with e-Mobility, an **assessment of the competencies and competitiveness level** of Italian industry across the various phases of the extended e-Mobility value chain was developed in terms of the main international competitors and with special focus on a number of key areas: storage systems (batteries); electric and hybrid motors; inverters; components; bodywork and interiors; charging equipment; ICT systems; electrical grid; and mobility services.
For each of these areas, in conjunction with the "matrical" development of the extended e-Mobility value chain, the different phases up- and downstream were considered: research and development, manufacturing, use and aftermarket, recycling and second life.

10. **Italy boasts numerous, major competencies** that can be usefully capitalized on in a nationwide project of industrial development of e-Mobility, particularly in the areas connected with:

- **Bodywork and interiors**: within R&D, there is a solid and prestigious tradition with engineering and design companies, as well as in bodywork manufacture and the design of interiors.
- **Electronic components**: Italy is the #2 country in the world in terms of trade balance of electrical conductors for voltages above 80V.
- **Charging equipment**: Italy excels in the engineering, industrial design and manufacture of electrical charging equipment—with companies such as Enel, Bitron, Ducati Energia, Scame and ABB—that would permit the launching in the short-term of a plan to develop a grid infrastructure on a national level.
- **Electrical grid**: Italy is in the vanguard in this area (having launched, back in 2001, the first nationwide plan for the massive installation of electronic meters—that represent the basis of the smart grid—on an international level) and is developing projects and international collaboration in the development of Smart Grids, Smart Charging and Vehicle-to-Grid technologies, including on a world level.
- **Mobility services**: Italy has a long-standing tradition in the production of light electrical vehicles, electric bicycles and motorcycles, and a framework is emerging of innovative companies specialized in the development of software, applications and technological solutions for managing mobility, including intermodal.

Conversely, the battery and electric motor sectors are less-covered than their foreign competitors, where production is primarily in the hands of China, Japan, South Korea and Germany. However, in both sectors, there are interesting development opportunities for Italy (in particular in the battery energy storage market), where Italian know-how in inverter production for industrial automation and energy generation from renewable sources could serve as a driver, and could be transferred and adapted to the e-Mobility sector.

11. To evaluate the industrial impact that could be activated within the e-Mobility industrial value chain in Italy, a number of **development scenarios** were devised for electric motor vehicles and related charging grid, based on two temporal milestones:

- The year **2025** emerged from interviews with those active in the market and with experts, and from a critical analysis of sector literature, as the "watershed" year for launching electric cars and **prospective technological parity** between electric and heat engine propulsion.
- The year **2030**, indicated as the reference time frame for attaining **mass production** that would also see costs brought into line for the end-user between electric cars and other propulsion methods.

For each of these two time frames, four levels of development were taken into consideration: low, medium, high and accelerated, plus an "inertial" one (calculated on the basis of forecasts for the compound annual growth rate in Italy for the period 2005-2016). The scenarios were developed using as their basis estimates from a number of organiza-

Figure 5

Hypothetical scenarios of the spread of electric motor vehicles (BEVs and PHEVs) in the Italian car fleet as of 2025 and 2030 (absolute number and as a percentage of stock). *Source: The European House - Ambrosetti data elaboration, 2017*

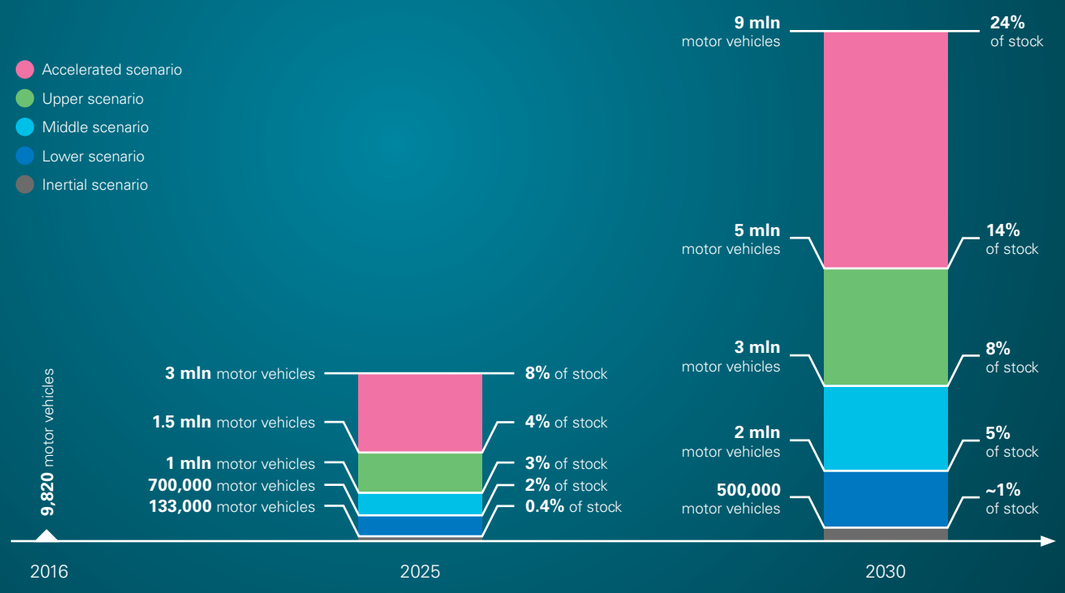
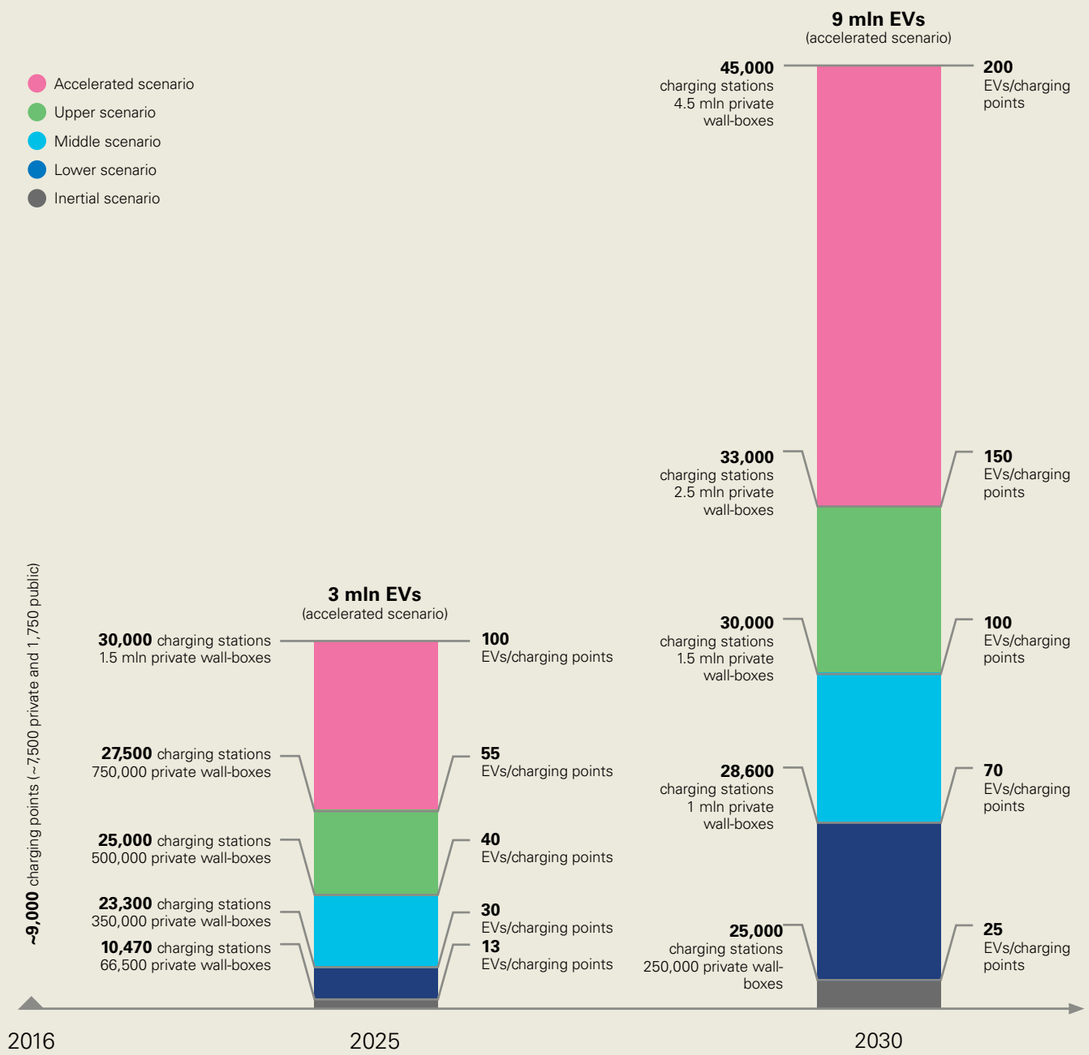


Figure 6

Hypothetical scenarios of the spread of electric charging points (public charging stations and private wall-boxes) and the ratio of electric motor vehicles (EVs) and charging points in Italy as of 2025 and 2030. N.B.: the histograms refer to hypothetical growth in the number of electric motor vehicles (BEVs and PHEVs) on a national level in the various development scenarios for the years 2025 and 2030 (respectively 3 and 9 million electric motor vehicles in the accelerated scenario). *Source: The European House - Ambrosetti elaboration based on Enel estimates, 2017*



tions that are points-of-reference for e-Mobility – including ANFIA and the draft of the "*Strategia Energetica Nazionale—SEN 2017*" (National Energy Strategy) currently being debated – and the expectations and declarations of major market operators[2]. On the basis of these assumptions, the following can be hypothesized for Italy:

- A share of electric motor vehicles of the car fleet in circulation of between 2% and 8% in 2025 and 5% and 24% in 2030.
- Infrastructure grid coverage of 30-100 electric motor vehicles for each individual charging point in 2025, and 70-200 electric motor vehicles in 2030.

12. To quantify the revenues that could potentially be generated by the years 2025 and 2030, the calculation methodology involved:

- Estimate of the **revenue by unit** of electric motor vehicles (considering an average value between the cost of a "small BEV" and a "medium-large BEV") and the charging equipment (public stations and private wall-boxes), through comparison of the unit costs with the study scenarios of their penetration in Italy as of 2025 and 2030.
- Estimate of the potential impact of the ICT services market on the basis of **parametric factors** deriving from the international experiences offered and relevant literature, and their application to Italy. The revenues expected from this market were re-parameterized on the basis of the current share of the fleet of Italian cars in circulation compared to the total worldwide (3.9%) and measured on the basis of the share of electric cars circulating in Italy as of 2025 and 2030 on a by-unit basis according to the hypothesized scenarios (in fact, the assumption is that these services will develop independently of the spread of electric motor vehicles).
- The estimate of the **unit value** of the revenues connected to recycling material per individual car and the regeneration costs and reuse of batteries utilized in electric vehicles, applied to the number of electric cars to be scrapped by 2025 and 2030 in Italy, and depleted electric batteries to be regenerated for energy storage applications for stationary use or to be reinstalled in new motor vehicles (assuming a battery life of 8 years).

13. Overall—and on the basis of the above hypothesis—the revenues activatable in Italy along the electric motor vehicle value chain (at current values) are between:

- **24 and 100 billion euros** as of 2025;
- **68 and 303 billion euros** as of 2030.

Given the currently limited development of e-Mobility in Italy, the spin-offs activatable along the value chain for the year 2025 are relatively low. Nonetheless, already from the 2025-2030 horizon, a trend can be observed with a multiplicative effect in the growth of revenues activatable as a result of the greater penetration of electric cars in the fleet of cars circulating in Italy. This is especially true for the sub-value chain of ICT services and recycling of electric motor vehicles and second life of batteries.

14. Using these values, and on the basis of exchange with sector operators and technical experts, the **"Italian-ness" quota** was also estimated, that is, the revenues Italian business is likely to capture on the basis of its current production and competencies, which amounts to between:

- **14 and 59 billion euros** as of 2025;
- **41 and 180 billion euros** as of 2030.

2 On a methodological level, to estimate the penetration level over the mid-term periods (2016-2025 and 2025-2030), a technological evolution curve was applied based on information from the market operators interviewed and calculated on the percentage of electric motor vehicles out of total new registrations for each year, in order to obtain the level of stocks for the two years examined. In terms of overall volumes, reference was made to the current Italian car fleet (37 million motor vehicles as of 2016).

Figure 7

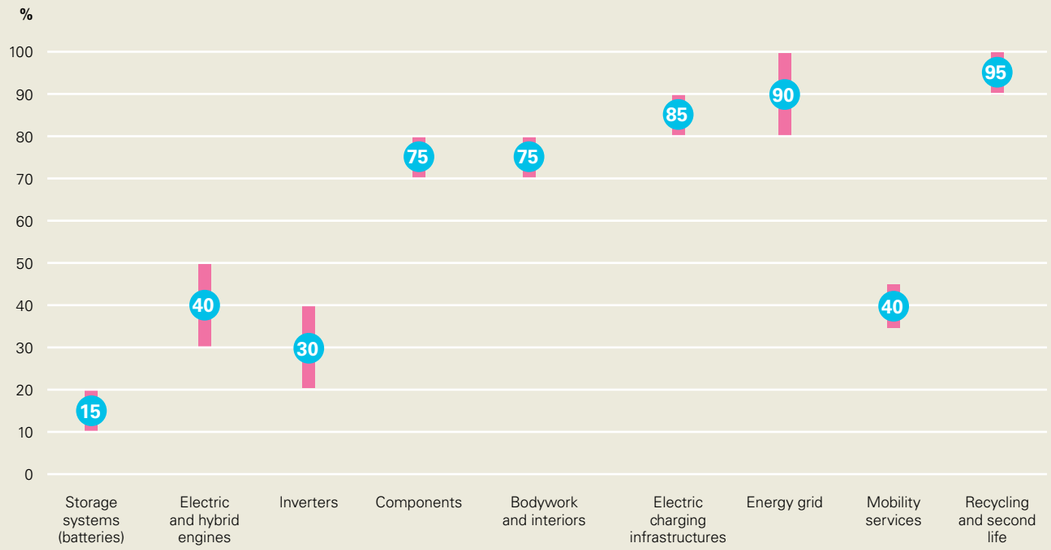
Estimate of the cumulative revenues activatable along the electric car value chain as of 2025 and 2030 (absolute value in billions of euros), 2017. *Source: The European House - Ambrosetti data elaboration, 2017*

	Motor vehicle		Electric charging infrastructures		ICT services		Recycling and second life		Total activable turnover*	
	2025	2030	2025	2030	2025	2030	2025	2030	2025	2030
Lower scenario	21	61	2	4	0.4	3	0.05	1	24	68
Middle scenario	31	92	2	5	0.5	4	0.05	1	33	102
Upper scenario	46	153	3	7	0.8	7	0.1	2	50	169
Accelerated scenario	92	276	5	13	1.8	11	0.1	3	100	303

(*) Figure rounded up to the nearest whole number above

Figure 8

The "Italian-ness" quota across the electric car value chain (percentages and maximum, minimum and average range), 2017. *Source: The European House - Ambrosetti data elaboration, 2017*



The current status of the transition to e-Mobility throughout Italy

15. To have a clearer idea of the current status of e-Mobility across Italy, The European House - Ambrosetti developed the **Electric Transport Index (ETI)** which makes it possible to compare in relative terms the performance of Italy's 20 Regions (ETI^R) and 14 Metropolitan Cities (ETI^M). The creation of the two synthetic indicators, ETI^R and ETI^M, are based on the identification and selection of a series of Key Performance Indicators (KPIs) aimed at measuring the current level of development locally in Italy of road electric transport (motor vehicles, commercial vehicles, motorcycles and quadricycles) on the basis of two aspects:

- The extent of electric transport vehicles and the status of local infrastructure (stocks), measured using a Positioning Index (PI).
- Variation over time of vehicle and infrastructure stocks in the short-term (three-year reference period[3]), measured using a Dynamism Index (DI).

This information was combined with the Sustainability Index (SI) which provides a qualitative/quantitative indication of the extent to which a given area is sustainable both environmentally and in terms of its transport system.

16. For each sub-index (PI, DI and SI) the KPIs selected were grouped into macro-areas. Specifically:

- The Positioning Index is comprised of 14 KPIs for Italy's Regions and 12 KPIs for its Metropolitan Cities, which are sub-divided into two macro-areas "Electric vehicles" and "Charging infrastructural grid". The former provides a picture of electric vehicles in local areas, measured both in absolute terms and relatively in terms of the overall fleet of motor vehicles, (light and heavy) commercial vehicles, buses, motorcycles and quadricycles in circulation, while the latter refers to electric charging points in the area and number of charging stations for electric motor vehicles in circulation.
- The Sustainability Index is comprised of 7 KPIs for the regions and 6 KPIs for the Metropolitan Cities, sub-divided into the macro-areas of "Environment and Local Area" which monitors a number of negative external influences on the environment linked to transport (level of air, noise and water pollution) and "Transport System" which examines the primary risks connected to an inefficient road transport system with low sustainability (level of motorization, average age of vehicles in circulation, level of pollution of motor vehicles in circulation and risks from road transport).

While the Positioning Index (PI) is given a **numeric score** in relative terms (on a rising scale from 1 to 10), the Dynamism and Sustainability Indices (ID and IS) are expressed in an overall range of the area's positioning ("high", "medium-high", "medium-low" or "low").

17. The Electric Transport Index reflects a highly-diversified situation within Italy, with a significant gap between the north and south of the country. Among Italian regions, **Tuscany** has the highest e-Mobility score in the Positioning Index (6.5 out of a maximum of 10), showing a high level of dynamism in the short-term and in the sustainability of its regional transport and environmental system. In second and third place are **Lombardy** and **Emilia-Romagna** with specific strong points in, respectively, the spread and level of electric cars and commercial vehicles. With the exception of Apulia, all the Regions in the south of Italy are positioned in the lower part of the ITE^R 2017 ranking, thus indicating **ample potential for development** of e-Mobility in these areas, including as a strategic driver in support of improvement in sustainability regarding the environment and local transport system.

3 Given the most recent year for which individual KPIs are available, the time frame utilized included the years 2013-2015.

Figure 9

Structure of the Electric Transport Index (ETI) and the Sustainability Index (SI): macro-areas and sub-indicators. *Source: The European House - Ambrosetti data elaboration, 2017*

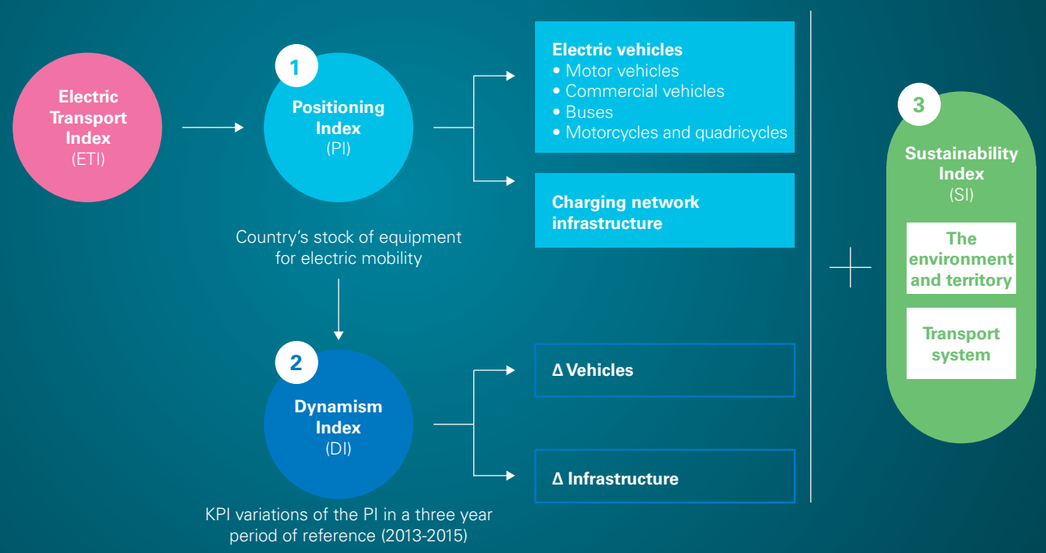


Figure 10

Italian Regions and the Electric Transport Index: overview. *Source: The European House - Ambrosetti data elaboration, 2017*

REGIONS	PI (score)	ID	IS
Tuscany	6.5		
Lombardy	5.1		
Emilia Rom.	5.0		
Lazio	4.2		
Umbria	4.0		
Trentino A.A.	3.5		
Apulia	2.7		
Valle d'Aosta	2.4		
Veneto	2.4		
Liguria	2.2		

REGIONS	PI (score)	ID	IS
Friuli V.G.	2.1		
Piedmont	2.0		
Basilicata	1.8		
Sicily	1.6		
Marches	1.6		
Campania	1.5		
Abruzzo	1.5		
Sardinia	1.5		
Calabria	1.2		
Molise	1.0		

High · Medium-High · Medium-Low · Low

18. In the ETI[M] 2017 ranking, the best performance in electric transport was the Metropolitan City of Florence with an overall score of 8.1 in the Positioning Index (PI), thanks to its first place in the charging grid infrastructure macro-area and a high level of dynamism. It was followed by the metropolitan areas of **Milan** (6.4 points out of a maximum of 10) and **Rome** (6.0 points), both of which placed medium-high in the Dynamism Index (DI) and Sustainability Index (SI).

Figure 11

Italian Metropolitan Cities and the Electric Transport Index: overview. *Source: The European House - Ambrosetti data elaboration, 2017*

Metropolitan Cities	PI (score)	ID	IS
Florence	8.1	High	High
Milan	6.4	Medium-High	Medium-High
Rome	6.0	Medium-High	Medium-High
Bologna	4.0	Medium-Low	Medium-High
Bari	3.4	Medium-Low	High
Genova	2.8	High	High
Turin	2.2	High	Medium-Low

Metropolitan Cities	PI (score)	ID	IS
Catania	2.0	Medium-Low	Low
Venice	1.9	Medium-High	Medium-High
Naples	1.6	Medium-High	High
Cagliari	1.3	Low	Medium-Low
Palermo	1.2	Medium-Low	Medium-Low
Reggio Calabria	1.2	Low	Low
Messina	1.0	Low	Low

High Medium-High Medium-Low Low

International experiences of reference in e-Mobility development

19. To understand the strategies implemented by the most advanced countries to promote e-Mobility, an international-level benchmark analysis was developed. All the major European (France, Germany, the United Kingdom, Denmark, The Netherlands, Norway and Sweden) and non-European (the United States, China, Japan and India) economies analyzed have drawn up a **coherent and integrated series of measures** to accompany the transition towards electric-powered mobility and to also take advantage of it as an opportunity for industrial development.

20. Despite the varying time frames and modalities, to-date, all the governments of the countries analyzed have developed **a medium- to long-term perspective** and identified **binding goals to be met** in terms of volume. For example, Germany has set itself the goal of one million electric cars in circulation by 2020 (today the number is 73,000), France and the United Kingdom are focused on having all newly-registered cars with low emissions starting in 2040, and India's goal is to decarbonize the entire national car fleet by 2030.

21. The economies analyzed, especially the mature ones, began a number of years ago to implement policies in support of e-Mobility, with pioneering measures in Norway and California as early as the 1990s. **As of 2009, all the European countries examined already had a strategic document regarding this**. Within this context, although China only recently entered the competitive arena of electric motor vehicles, within a short time it has succeeded in becoming the #1 market for electric cars in the world, as well as the top producer of lithium batteries as a result of public investments totaling over 8.2 billion euros (of which 1.1 billion in R&D alone).

22. Defining a medium- to long-term perspective and the point-of-arrival was the precondition for governments and the entities involved in establishing the specific policy measures to be implemented year-by-year in terms of **demand** (market) and **supply** (industry) and the **grid infrastructure** to meet these goals.

Figure 12

e-Mobility reference case studies examined in the international benchmark analysis. *Source: The European House - Ambrosetti data elaboration, 2017*

Figure 13

e-Mobility policies: overview. *Source: The European House - Ambrosetti data elaboration, 2017*

POLICIES FOR ELECTRIC MOBILITY

Market (demand)

ECONOMIC INCENTIVES
- Subsidies for the purchase of passenger and commercial vehicles
- Incentives for scrapping of polluting cars
- Discounts on insurance premiums and preferential interest rates on bank loans
- Reduced electricity tariffs
- Free access to charging points
- Subsidies for renewing LPT fleets

TAX INCENTIVES
- Ownership tax exemption/reduction
- Registration tax exemption/reduction
- VAT exemption
- Deductions for charging stations in private and public buildings (installation)

OTHER MEASURES
- Deductions on pro-e-Mobility investments
- Taxation on polluting vehicles(environmental penalty)
- Restrictions on registration of polluting cars (electric cars exempted)
- Free parking
- Preferential/reserved lanes
- Free access to limited traffic zones
- Motorway tolls reduction/exemption
- Communication/awareness campaigns (public opinion and schools)
- Support for car sharing (preferential rates, etc.)

Infrastructure

- Funding for industrial R&D
- Incentive systems for charging infrastructures
- Incentives and public/private partnerships for the electrification of road networks and charging infrastructures
- Launch of pilot projects

Industry (supply)

- Direct subsidies for manufacturing companies and production facilities
- Public procurement initiatives
- Launch of pilot projects
- Tax on electric car imports

23. The initiatives to stimulate demand make use of **economic incentives** (bonuses or discounts applied to the purchase price), **tax breaks** (exemptions or tax cuts for ownership, registration or VAT) and **non-economic measures** (traffic management facilities, such as free and/or reserved parking, preferential lanes and limited traffic zones). These measures are often combined with **bonus-malus mechanisms** (for example in France, Sweden, Norway and Japan) that are aimed at encouraging the purchase low-emission vehicles and discouraging the purchase of polluting vehicles.

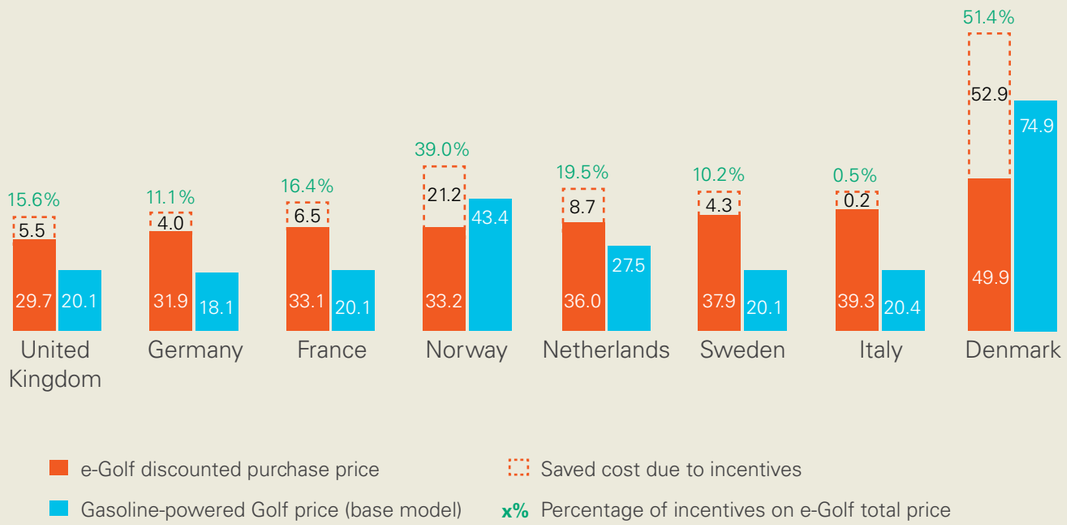
24. In those countries with a significant automotive industry (e.g., France, Germany, the United Kingdom, Japan and China) we can see the active role played by the central government in the active involvement of industry in the **development plans of the e-Mobility value chain**. Within this context, the countries analyzed have implemented a number of different strategies. For example:

- China, in line with its strategies to develop national manufacturing, imposes restraints on the importation of vehicles produced abroad and provides direct financing for industrial production and R&D.
- In Germany and Japan, initiatives were launched that call for the involvement of government and institutions, research centers and producers as part of a public-private partnership.
- The United Kingdom chose to earmark a significant part of state funding for innovation and R&D connected with the frontiers of mobility, such as ultra low emission vehicles, self-driving technologies and Vehicle-to-Grid (V2G).

25. In all the experiences analyzed, **support for creating electric charging grid infrastructure** was an essential condition for significant development in e-Mobility within the domestic market. France's goal, for example, is to have 7 million charging stations by 2030, a goal it is pursuing through major investment (1.5 billion euros). In addition to the public charging grid, in the majority of foreign case studies examined, there has also been support for **private charging infrastructure** such as in the United Kingdom (private investment into infrastructure covered up to 75%) and in California (low-interest loans to install charging stations in residential buildings).

Figure 14

Thermometer of incentives (direct economic and tax) to boost demand in support of the purchase of electric motor vehicles in the European countries analyzed: Golf case study (comparison between the electric and gasoline-powered models, thousands of euros and percentage impact of incentives on purchase price), 2017.
Source: The European House - Ambrosetti elaboration based on a number of sources, 2017



How to concretize the electric transition and reap the benefits: the Agenda for Italy

26. Currently, Italy does not have a **shared vision** and **systemic and integrated action strategy on a national level**, unlike the foreign benchmarks examined.

27. This situation makes it difficult for Italy to reap the full benefits of the opportunities connected with e-Mobility, even if in recent months there have been a number of centralized initiatives, including the activities of the "Tiscar Round Table" and the joint resolution regarding sustainable mobility from the Public Works and Environment Committees of the Senate of the Italian Republic.

28. The main hurdles to e-Mobility involve:

- **Low information for the consumer** regarding the advantages and performance levels of electric vehicles in a market that is still relatively new in Italy. This leads to the belief within the general public (with the due exceptions), that some aspects normally sought when evaluating cars—such as comfort, design and performance levels—do not pertain to electric vehicles.
- Lack of awareness about the impact of individual choices on the well-being of society as a whole and on **environmental sustainability**, aspects which are fostered by the low environmental impact of electric vehicles
- The price tag of electric cars which are still not competitive with heat engine models, also as a result of the **lack of measures to boost demand** (tax breaks and other types of incentives) to promote the use of electric motor vehicles, as well as the installation of charging infrastructure as is done in other countries.
- The **"range anxiety" of drivers** due to the need to expand charging grid infrastructure on the ground throughout the country, giving precedence to ultra-fast charging points found primarily in service stations in non-urban areas, fast charging points in public areas in the city and wall-boxes in private homes. Added to this is the lack of low-cost, uniform pricing at charging points.
- The need to **update the Italian legal framework** to accommodate the circulation of 4- and 2-wheel electric vehicles (classification standards, driver requirements, etc.) and to provide **national guidelines** to establish uniform and simpler administrative procedures for the installation of electric charging infrastructure (discrepancies on a local level).

29. Also included in this context is the difficulty of **collaboration among public and private stakeholders** involved in e-Mobility:

- On one hand, some institutional players have implemented a number of single initiatives to promote e-Mobility that have proven to be weak in the face of the development requirements for Italy. In addition, the assignment of different responsibilities and powers to a range of entities (under Article V of the Italian Constitution) has led to **slow-downs and inefficiency** in procedures and decision-making.
- On the other hand, there is a lack of collaboration and capacity for "teamwork", even among industrial stakeholders, that could guarantee greater competitive clout for Italian businesses, which are primarily SMEs.

30. **Italy, today, is facing a historic opportunity**, not just in terms of the evolution itself of the mobility system in the country and the impacts it entails, but also to take advantage of the potential to develop the current Italian industrial and manufacturing value chain in this direction by making use of the strong points it already possesses in the traditional automotive sector. However **integrated action** is needed in key areas that represent the building blocks of effective action to accompany the country in its transition towards the electrification of the transport system and reap the full benefits as an opportunity for growth and modernization.

31. **Six lines of action** have been identified and in each one the **government has a key, pro-active role** in terms of active leadership and coordination and balancing of the needs of all stakeholders.

Figure 15

Vision and programmatic guidelines for e-Mobility in the countries analyzed as part of the international case studies, 2013-2017. *Source: The European House - Ambrosetti elaboration based on official government sources, 2017*

2013

«*Denmark's strategy is to achieve the target of* ***200,000 EV on the road by 2020***» (source: statement by Lærke Flader, CEO of the Danish Electric Vehicle Alliance, 2013)

2014

«*The governmnt has the abitious vision of a* ***fossil fuel free transport fleet*** *by 2030*» (source: Swedish Government, «Integrated climate and energy policy», 2014)

«*The government aims to capture* ***50 to 70% of nex-generation vehicles, of which 20-30% EV****, to total new car sales by 2030*» (source: Ministry of Economics, «Japan Revitalization Strategy», 2014)

2015

«*Support green economic growth, througt the promotion of electric and hybrid vehicle and the istallation of* ***7 milion*** *charging station*» (source: Ministry of the Environment, «Energy Transition Law», 2015)

«***One million electric vehicles*** *on the road by 2020 - that is the bold aim of Germany's "National Electromobility Development Paln"* » (source: Ministry of Economic Development, «National Electromobility Plan», 2015)

«*Our ambition is reduce* CO_2 *emission improve energy-efficiency, and make us less dependent on fossil fuels with* ***200,000*** *EV by 2020 and* ***1 million*** *by 2025* (source: statement by the NL Agency, Ministry of Economic Affairs, 2015)

2016

«*Reach* ***1 million*** *Zero Emission Vehicles by 2020 and 1.5 million ZEVs by 2025 on California' s roadways*» (source: State of California, «ZEV Action Plan 2016»)

«*India can become the first country of its size which will run* ***100%*** *of electric vehicles by 2030*» (source: statement by Piyush Goyal, India's Minister for Energy, 2016)

«*Our ambition is for nearly all new cars and vans to be zero emission by 2040 and we are taking real steps to achieve this in the Modern Transport Bill*» (source: UK Department for Transport, 2016)

«*The government will include a ban on new gasoline-powered car sales as soon as 2025*» (source: statement by Chris Grayling, UK Secretary of State for Transport, 2016)

2017

«*Sales of new energy vehicles should reach* ***2 million by 2020*** *and account for* ***more than 20%*** *of total vehicle production and sales* ***by 2025***» (source: Ministry of Industry and Information and Technology, 2017)

Figure 16

Building blocks of the "e-Mobility revolution" to maximize the opportunities offered by electric mobility in Italy. *Source: The European House - Ambrosetti data elaboration, 2017*

1. **National strategic vision for the e-Mobility Revolution and roadmap**
2. **Research and Development**
3. **Accelerating factors for e-Mobility Revolution in an urban context**
4. **Pilot projects for the e-Mobility Revolution**
5. **Charging network infrastructure**
6. **Campaign to boost awareness of the general public and businesses**

LINE OF ACTION 1. National strategic vision for the e-Mobility Revolution and roadmap

32. Thanks to technological evolution, e-Mobility will assume an increasingly important role in responding to ever-more stringent national and international goals regarding sustainability, quality of life and health and energy efficiency.
33. Within this scenario, for Italy to play a role of leader (and not follower) among international competitors, what is required—as a prerequisite—is the formulation of an **incisive, 360° national perspective for e-Mobility** (public and private, 2- and 4-wheel vehicles and "slow mobility") that includes the entire country and its economy, through the commitment of the government to:

• Share with industrial players and stakeholders and subsequently formalize **challenging quantitative targets** for e-Mobility development over the medium- to long-term.
• Launch, in a specially-developed plan that is coherent with the e-Mobility perspective, **measures that support the development of demand, supply and the charging infrastructural grid** and which must be developed in the short-term to fix the medium- to long-term objectives. Within this context, initiatives must be rationalized and systematized, including in relation to other programs regarding diverse propulsion and sustainable mobility technologies.
• Create a governance platform, which could also be in the form of an Agency, that would function as a centralized steering committee to preside over the development of e-Mobility in Italy, and which would have the responsibility to act as an operational tool by also coordinating activities involving the development of the infrastructural grid and defining the basic rules of operation for the technological solutions to be adopted by the various stakeholders involved.

LINE OF ACTION 2. Research and Development

34. In a sector such as e-Mobility with ample margins for evolution, R&D is a strategic issue because it allows, on one hand, for the emergence of technologies to be used as inputs for launching new types of manufactured products and, on the other, for the identification of innovative solutions to meet sustainability goals regarding efficiency, transport security and the safeguarding of public health.
35. Italy must aim at a position of **leadership in a number of the technology areas selected** which represent breakthroughs for the future, through:

• Launching specific research programs on a national level from a pre-competitive approach with subsequent industrial development, with public/private collaboration and partnership models in selected areas of scientific and technological specialization[4], in order to bridge the gap with Italy's major competitors who are already investing significantly in e-Mobility hardware and software technologies.
• The creation of a national e-Mobility cluster supported by close collaboration between the public and private sectors, which works synergistically with the 12 districts already created by MIUR[5]. This cluster should have the role of capitalizing on the scientific expertise and industrial know-how found on a regional and local level throughout the value chain, while working in synergy with other strategic clusters and promoting projects for the internationalization of research through scientific collaboration and technological exchange with partners which have competencies that complement Italy's.
• A concerted awareness campaign to create a patent culture in Italian companies to guarantee the protection of competitive and technological advantages. In fact, R&D policy involving e-Mobility must see patents as an important tool. Because the sector is not yet fully consolidated, thanks to new products or solutions protected by patents, individual countries can make exponential strides (for example, the new generation of electric batteries or driverless technologies).

4 In particular, battery life and storage systems (including recycling and second life); systems for the management of energy flows through Smart Charging, Vehicle-to-Grid (V2G) and Vehicle-to-Home (V2H) technologies—for example, for managing and foreseeing demand peaks and regulating the grid; development of software and algorithm systems for public and private fleet management; and the planning of services connected with the development of shared vehicles that are digitally connected or self-driving.
5 To provide incentive for public/private collaboration and promote the creation of research networks and national supply chains, in 2012, 12 areas of smart specialization were identified, each with its own technological cluster or, in other words, networks comprised of the main public and private players operating in Italy in industrial research.

LINE OF ACTION 3. Accelerating factors for e-Mobility Revolution in an urban context

36. Electrification of transport systems guarantees a series of significant benefits and advantages, including environmental sustainability, performance, ease of use and safety, which find their **natural habitat in urban settings**. Italy can, therefore, benefit from the development of e-Mobility to resolve, on one hand, a number of problematic areas in the urban transport and mobility system and, at the same time, stimulate its national industrial supply chains.
37. Towards this end, policies must be promoted within Italy that are based on **non-economic incentives**, as is done in the more developed countries, to accelerate the spread on a vast scale of e-Mobility in Italy in the short-term. These include a mix of measures, such as:

• free access to LTZs and preferential lanes in urban centers;
• reduction or exemption from paid parking;
• freedom to circulate in closed traffic areas;
• reduced tolls for highways and expressways;
• incentives for efficient use of public charging grids (for example, occupying the station only for the time required to charge);
• target goals for electric vehicles in public transport fleets (including taking advantage of funds available on a national level);
• promotion of vehicle sharing systems (car, motorcycle, bicycle) which would tend to have the effect of reducing vehicles in circulation;
• introduction of measures to discourage vehicles with polluting emissions, such as the adoption of road pricing and congestion charges for access to urban centers.

LINE OF ACTION 4. Pilot projects for the e-Mobility Revolution

38. Examination of international case studies highlighted the key role of the launching of pilot projects designed to implement concrete e-Mobility solutions that would make it possible to try out development models, collaboration between companies and other partners (for example, universities) and experience "first-hand" the benefits for the public and users.
39. Italy must make use of this tool and **promote value chain-oriented pilot projects on e-Mobility** through a pro-active role with regions and municipalities to take part in European calls for proposals and smart specialization in local areas[6].
The pilot projects should also include companies ("lead companies" and networks of SMEs), universities and research centers, in order to meet the defined system goals (e.g., spread of electric car sharing, integration of urban and suburban transport systems, etc.), as well as develop innovative solutions (new services for city logistics, ICT applications, etc.).

LINE OF ACTION 5. Charging network infrastructure

40. All the major countries which are currently in the vanguard of the spread of electric vehicles have drawn up a regulatory framework and incentive schemes to support the process of creating the charging grid infrastructure on a national scale—a basic enabling element.
41. Italy is behind the international benchmarks, both in terms of the number of electric charging stations (approximately 9,000 of which 1,750 are for public use) as well as the measures to accompany the process of constructing grid infrastructure. The process of creating (public and private) electric charging grid infrastructure must be accelerated through:

• **Streamlining bureaucratic red-tape**, through the setting of a maximum time frame in which permits are to be granted, and standards and regulations which are the same throughout the country for the installation of charging stations.
• Defining regulatory measures to **standardize** and promote **electrical rates** at charging stations, at least in the initial phases of launching and development in Italy, where there is currently a disparity in electrical energy costs depending on the type of charging station.
• Introducing **tax breaks** for the purchase and installation of electric charging equipment for home and business, to

6 In support of regional "smart specialization", for the period 2014-2020, over 67 billion euros have been allocated through EU investment and structural funds and national and regional funds, including 6.7 billion euros in Italy through EU and national funding for research and innovation.

be extended to existing and new construction, and work to improve energy efficiency of existing housing and industrial stock.

• Promoting **agreements and accords** for the installation of private charging stations for public use in the service sector in order to improve the service offered to the general public, customers, foreign tourists, etc., with a return for those who made this service available.

LINE OF ACTION 6. Campaign to boost awareness of the general public and businesses

42. In Italy, also as a result of the lack of advertising or information campaigns, electric technologies are still unfamiliar, not only to the general public, but also the majority of the business community. The major case studies involving the development of e-Mobility abroad show, on the other hand, how **integrated and coordinated efforts** to raise awareness and provide information are an integral part of promoting acceptance of electric vehicles in order to boost demand and, at the same time, create awareness about the industrial opportunities related to them.

43. Creating a broad-based culture around e-Mobility in Italy is a priority, through a national strategy of awareness-raising and information about e-Mobility under the guidance of the central government, aimed at:

• Public opinion, through an **advertising campaign** (for example, public service announcements) on traditional media outlets and social network channels, and the launching of **flagship initiatives** with high media visibility and public mobilization, for example, entry of Italy into the calendar of FIA "Formula E" races dedicated to electric vehicles.

• Industrial players, through targeted communications initiatives such as **local roadshows and sector- and theme-related workshops** to "accompany" businessmen in the supply chain, especially SMEs, so that they can fully comprehend this market which is growing rapidly and requires a new approach to innovation-oriented production, with the opportunity to develop new business models and new products and services.

Concept design and realization
You&Web - Gruppo HDRÀ

Printing
Primaprint

Print run: 600 copies

Published in August 2017

Paper/weight inside pages
GardaMatt Art 135 g/m²

Paper/weight cover
GardaMatt Art 250 g/m²

This publication is printed on 100% certified FSC® paper

Publication not for sale

Enel
Società per azioni
Registered office 00198 Rome – Italy
Viale Regina Margherita, 137
Stock capital
Euro 10,166,679,946
(at April 1st, 2016) fully paid-in
Companies Register of Rome
and Tax I.D. 00811720580
R.E.A. of Rome 756032
VAT Code 00934061003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