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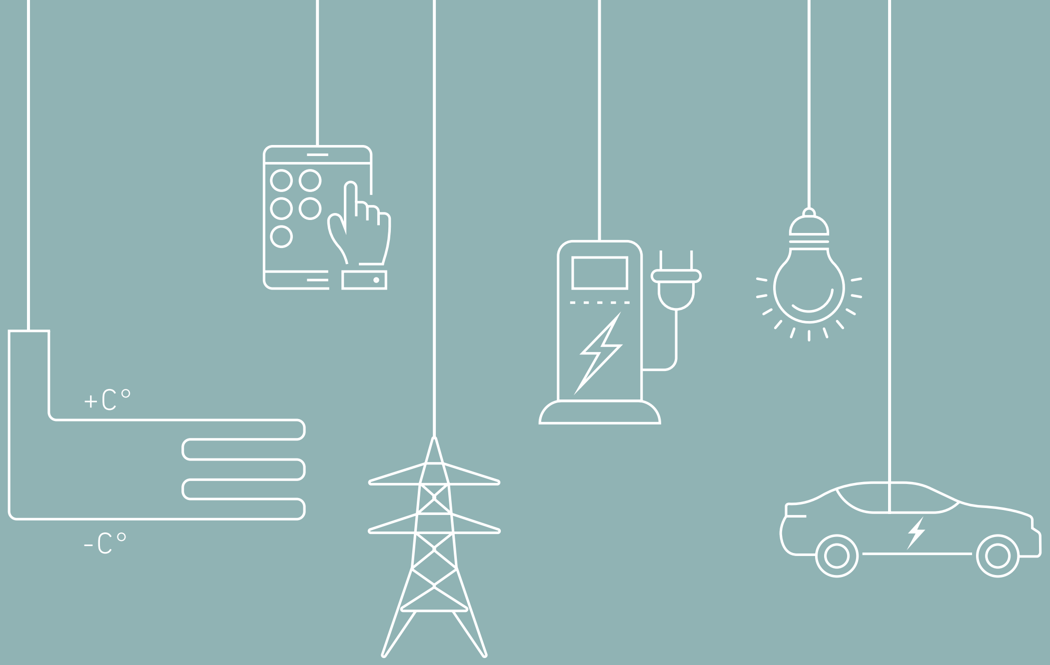
ELECTRICITY FOR EUROPE

A Bright Future for Europe

THE VALUE OF ELECTRICITY IN DECARBONISING THE EUROPEAN UNION



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FOREWORD

The immense value of electricity in our everyday lives is undeniable. When we think about how often we use electricity each and every day to satisfy our basic human needs, we begin to understand that electricity is, and will continue to be, indispensable to modern society.

With Europe pursuing an ambitious decarbonisation agenda, we must move towards a true valuation of electricity in achieving a competitive and decarbonised European economy. When I took over the Presidency of EURELECTRIC in 2015, I stated that it is our responsibility as the electricity industry to demonstrate this value to the outside world, and to put it into the right perspective in the context of the energy transition.

This discussion led to the need to reveal the value of electricity that can be realised already today, but also to increase efforts to show the vast potential value that still lies untapped in our industry.

This report makes it increasingly clear that electricity from carbon-neutral generation is the cleanest energy carrier, making electricity the main vector for a decarbonised energy future in Europe. This will be especially crucial in efforts to decarbonise the buildings and transport sectors. The value proposition of electricity in European societies today is magnified by the fact that these sectors can benefit from the electricity sector's clear commitment and trajectory towards carbon neutrality.

Electrification is the key vehicle for a decarbonised, competitive, and energy independent Europe. It is a winning strategy for Europe that will add value to the everyday lives of European citizens as it supports the pursuit of key EU decarbonisation objectives. Cost-effective decarbonisation is crucial if Europe is to remain competitive in the global market place.

Finally, I would like to congratulate the numerous companies and representatives who have contributed towards the development of this report, and for the sector's continued efforts to achieve carbon-neutrality by 2050. I am fully committed to supporting the pursuit of more ambitious efforts towards these objectives in the future.

António Mexia - President

Union of the Electricity Industry - EURELECTRIC

EXECUTIVE SUMMARY

ELECTRIFICATION: A WINNING STRATEGY FOR EUROPE

Electrification is a winning strategy for Europe. It adds value to the everyday lives of European citizens and the European economy, whilst driving the pursuit of the EU's decarbonisation ambitions and its commitments to the Paris Climate Agreement. The European electricity sector believes that cost-effective decarbonisation is crucial if Europe is to remain competitive in the global market place, and we are committed to leading this transition.

Back in 2009, sixty-one Chief Executive Officers of utilities from across Europe, then representing over 70% of total power generation, pledged to deliver a carbon-neutral power supply by 2050. The electricity sector remains fully committed and is demonstrating real achievements on the path towards decarbonisation with significant reductions in carbon intensity for electricity generation and huge investments in renewable energy.

Based on the value that electricity provides today, and that it can provide in the future, both to the individual and European societies as a whole, this report confirms the sectors commitment to decarbonisation, and reveals the benefits of electrification for the European transport and heating/cooling sectors on the path towards decarbonisation.

Electricity has allowed European economies to develop and make available the comforts of a modern lifestyle which all European citizens enjoy today. With a commitment to the electrification of the European transport and heating/cooling sectors, EU citizens can expect a fundamental improvement of their living standards in the future.

In this report, the European electricity sector proposes the progressive electrification of final energy demand in Europe by 2050. The value proposition of electricity in European societies today is magnified by the fact that other sectors can benefit from the European electricity sector's trajectory towards carbon neutrality.

The report finds that electrifying the transport and heating/cooling sectors will provide a viable response to the challenge of decarbonising the European economy and will allow for maximum value to be realised from the electricity system. Given the European electricity sector's continued commitment and action to reduce greenhouse gas emissions, there is a significant opportunity to allow other sectors to benefit from these efforts.

Highlighting multiple opportunities for electrification, the report shows that avoiding the lock-in of conventional, more carbon-intensive technologies will be crucial. To move towards the best possible results for decarbonisation of the European energy system, to keep costs low for energy consumers, and to retain the competitiveness of European economies, barriers to electrification in the transport and heating/cooling sectors must be addressed as soon as possible. The failure to deliver a suitable framework may significantly increase the cost of decarbonisation and potentially hamper efforts to achieve the 2050 goals.

A Framework for the Future

In this report, EURELECTRIC presents five key proposals that aim to facilitate the electricity sectors' ability to be the key energy carrier for a decarbonised and competitive Europe, unlocking the vision of a sustainable, electricity-driven economy:

1. Bringing down policy support costs in the electricity bill to reduce the pressure on electricity consumers who currently carry the bulk of decarbonisation costs. Instead, decarbonisation investment should be driven by market-based mechanisms such as the EU ETS. Sectors currently outside the EU ETS, such as buildings and transport, and energy carriers other than electricity should also make equitable financial contributions to decarbonisation.

2. Strengthening the EU ETS by increasing the Linear Reduction Factor for the period post-2020 to at least 2.4%, increasing the intake rate of the Market Stability Reserve (MSR) to 24% per year from 2019 until at least 2023, and offering a mechanism to future-proof the MSR by lowering the applicable thresholds. At the same time, EURELECTRIC sees the necessity to mitigate increased costs for Member States with high carbon intensities and low GDP per capita ratios.

3. Advocating an energy efficiency policy at EU level which promotes innovation, allows the consumer to have active and positive involvement, and ensures savings come from carbon intensive sources.

4. Developing measures to capture energy carriers currently outside of the EU ETS so these also contribute to financing decarbonisation. At the same time, market distortions from policy support schemes should be minimised.

5. Ensuring the market effectively values energy, flexibility and capacity. Market integration must be achieved and cross-border capacity must be used efficiently to fully integrate increased shares of renewables.

For transport

1. Implementing strict and coherently tested emission standards for light duty vehicles and heavy duty vehicles, as well as separate targets for the take up of zero emission vehicles. As road transport emissions must fall sharply to achieve the EU's decarbonisation objectives, we need ambitious CO_2 emission targets, backed by sound testing methodologies.

2. Ensuring that sufficient charging infrastructure for electric vehicles is in place across Europe. By encouraging Member States to facilitate the roll-out of public charging points (via the Alternative Fuels Infrastructure Directive) as well as making it as easy as possible for private parties to install their charging point (through the revised Energy Performance of Buildings Directive).

3. Tapping into the potential of smart charging. This technology offers significant benefits both to the electricity system as well as to the final customers. DSOs should receive appropriate incentives to procure and use such localised system management options.

For heating/cooling

1. Updating the methodology for calculating the Primary Energy Factor (PEF) to recognise that electricity is increasingly coming from renewables and low carbon sources. Specifically, factors of 0 are needed for non-combustible RES and 1 for nuclear sources.

2. Allowing for flexible ways through which EU Member States can reduce their energy demand. Various tools in existing legislation allow each Member State to tailor its approach to individual circumstances. It is important to strengthen this toolset in the reviews of both the Energy Efficiency Directive and Energy Performance of Buildings Directive.

3. Closing the energy efficiency financing gap by encouraging private investment in enabling technologies (such as heat pumps etc.). We are convinced that non-economic barriers in financing need to be addressed at the EU level. In this regard, there is a clear need to revise the way in which investments in energy efficiency are being promoted. We advocate a much stronger development of innovative financing tools such as Energy Performance Contracts and the standardisation of processes in public financing in order to attract more interest and lower the burden for potential investors.

INTRODUCTION

Electricity is the foundation for prosperity in modern society. Since the early 1990s, European policy initiatives have recognised that safeguarding prosperity of the European Union means active involvement of both electricity producers and consumers. As part of this approach, the European electricity sector has continued to provide a valuable contribution towards the reduction of greenhouse gas (GHG) emissions in the EU. In 2009, sixty-one Chief Executive Officers of utilities from across Europe, then representing over 70% of total power generation, pledged to deliver a carbon-neutral power supply by 2050. The electricity sector is demonstrating real achievements with this commitment towards decarbonisation; since 1990 carbon dioxide (CO_2) emissions per kilowatt hour (kWh) have decreased by over 25% across the EU.

In contrast, downstream (energy consuming) areas, such as the transport and heating/cooling sectors, have seen lesser progress over the last decade, yet represent approximately 79% of final energy demand in EU households[1]. To address this shortfall and to bring these sectors in line with European decarbonisation objectives, the European electricity sector proposes progressive electrification of final energy demand in Europe by 2050.

Based on the value that electricity provides today, and can provide in the future, both to the individual and European societies as a whole, this report advocates the benefits of electrification for the European transport and heating/cooling sectors in the context of decarbonisation.

The value proposition of electricity in European societies today is magnified by the fact that these sectors can benefit from the carbon neutrality trajectory that is set for the power sector.

Divided into four distinct sections, the report first aims at ***defining value:*** What does electricity mean for society today? What recognition does electricity receive as a value good, by society and by the individual consumer? Following that, various initiatives and activities are identified, which allow for ***improving the value*** proposition of electricity. This is mainly elaborated in the context of progressively assisting the decarbonisation of the power sector in Europe and thereby limiting European contributions to global climate change.

The third section is focused on ***expanding value*** – here the report recognises the longer term decarbonisation commitments agreed in the Paris Agreement on Climate Change. It explores the case for further electrifying across the transport and heating/cooling sectors with a view to achieving a system-wide reduction in greenhouse gas emissions. Finally, the report focuses on ***realising value*** by establishing a vision for electrification across Europe for the coming years. It identifies current barriers for electrification while reiterating key benefits. The report concludes by providing concrete proposals from the European electricity sector aimed at fostering electricity's position as a key energy carrier for a decarbonised and competitive Europe.

DEFINING VALUE

Electricity is a symbol for societal and economic progress. The American inventor Thomas Edison is attributed with the invention of the electric light bulb, which is among the very first practical examples of how electricity has paved the way for progress. During the first public demonstration of his incandescent light bulb on 31 December 1879, Edison is claimed to have announced that he *"[...] will make electricity so cheap that only the rich will burn candles"*.

Soon thereafter, the huge commercial potential of electricity was recognised and it has since become the energy carrier of choice for numerous household and commercial applications across the world.

MEETING THE **NEEDS OF SOCIETY**

Electricity is woven into societal fabric. Today, electricity allows society to meet key human needs in an efficient way: **lighting** through artificial lighting; **space and water conditioning** through electric heating and cooling; **water** through mechanised pumping and filtration; **health** through modern medical diagnostics apparatuses; **food** through refrigeration and cooking; and **security** through electronic surveillance of critical infrastructures and door locking mechanisms.

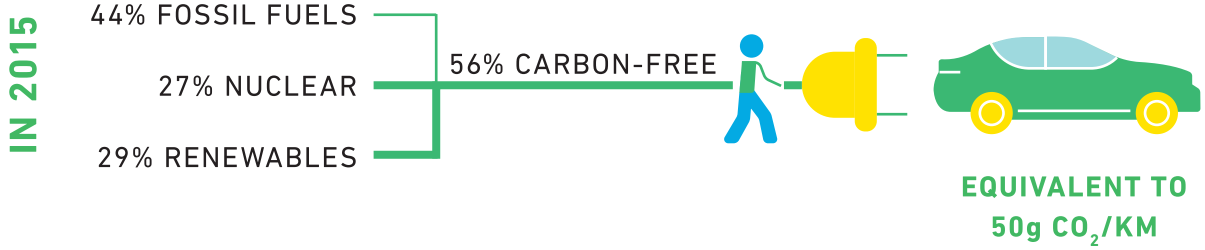
In addition, electricity has become indispensable to other elements of modern society: **Education** and **knowledge exchange** nowadays are largely supported through electronic channels. **Modern communication** is facilitated by **information technologies** which use **electronic channels.**

SCALING **DECARBONISED ENERGY GENERATION** AND **ENERGY EFFICIENCY**

Electricity provides an unrivalled degree of scalability to promote the benefits of energy efficiency and carbon-free energy generation methods. Facilitated by energy saving legislation, the European electricity sector has already actively contributed towards reaching the EU-wide 20% energy efficiency target for 2020. Carbon-free generation assets are supplying an increasing amount of Europe's electricity requirements. Following a clear upward trend, in 2015 56% of all electricity generated across the European Union came from carbon-free sources[2] (29% from renewables and 27% from nuclear).

The electrification of transport, when considered in parallel with the decarbonisation of electricity generation, presents a sensible option to achieve Europe's 2050 objectives as GHG emissions from the sector are shifted and mitigated through the power sector. For example, when switching from an internal combustion engine (ICE) car to an electric vehicle (EV), all direct (tailpipe) emissions are eliminated as there are zero emissions at the end-user level.

When calculating the indirect GHG emissions related to the production of electricity, using today's average European electricity mix, an EV requiring 10 kWh per 100km is responsible for less than 50gCO_2/km. This represents a fraction of the carbon emissions produced by even the most efficient ICE car available on the market today, and significantly lower than the average target under current regulation for all new cars of 95gCO_2/km by 2021. In addition, the efficiencies delivered by an electric engine are three times that of an ICE due to lower heat losses during the energy conversion process.



REDUCING **ENERGY IMPORTS**

The electrification of the European transport and heating/cooling sectors can further lead to an overall reduction in energy imports. Electricity can be generated using indigenous renewable resources; increasing Europe's RES portfolio will lead to a reduction in foreign energy import requirements.

Such a reduction in energy imports is beneficial both in terms of preserving economic value in Europe, but also improves security of supply given that a significant proportion of European fossil fuel imports originate from more volatile regions of the globe.

DRIVING **INNOVATION**

Electricity is a driver for innovation. Electric lighting in homes and the workplace massively improved the quality of life in the early 20th century. The introduction of household white goods, such as refrigeration devices, brought about a revolutionary change to how food was stored and conserved at a domestic level and ultimately led to significant reductions in food costs.

More recently, epoch-changing developments such as the internet, e-commerce and mobile data communication would not have been possible without the mass provision of electricity.

Looking ahead, electricity will continue to play an important role in supporting technological innovation that will provide benefits to our everyday lives. The mass deployment of technologies that are already in use today, such as electric vehicles (EVs) and heat pumps have the potential to revolutionise the transport and heating and cooling sectors as they pursue pathways towards improved efficiency and sustainability. Here information technology, through the implementation of smart meter and smart grid initiatives, further develops opportunities for additional efficiency gains thereby improving the value case for electricity.

USING A **VERSATILE PRODUCT**

Electricity is extremely versatile. This characteristic has meant that it has been adopted as the key energy carrier across various service sectors. For many applications it is the only energy vector that can be utilised. As pointed out by the examples given above, the true value of electricity lies in the services it can facilitate and which are considered valuable and required by consumers and society as a whole. In fact, it is precisely the services provided by electricity which define its real value.

EURELECTRIC believes that the extent of electricity's value proposition has yet to be fully recognised.

Electricity production in Europe is decarbonising and aims to be fully carbon-neutral by 2050. Given this clear trajectory, the European electricity sector sees huge benefits for fostering electrification across sectors that are about to embark on their own decarbonisation journey, such as transport, and heating and cooling. Electrification is therefore a key vehicle for a decarbonised and competitive Europe which seeks to retain its global competitiveness whilst increasing its energy independence.

IMPROVING VALUE

As part of its continuous effort to promote the benefits of electricity and electrification across the European Union, EURELECTRIC has provided numerous contributions to the debate. By doing so, the value proposition of electricity has increased significantly in the context of the energy transition towards a decarbonised Europe.

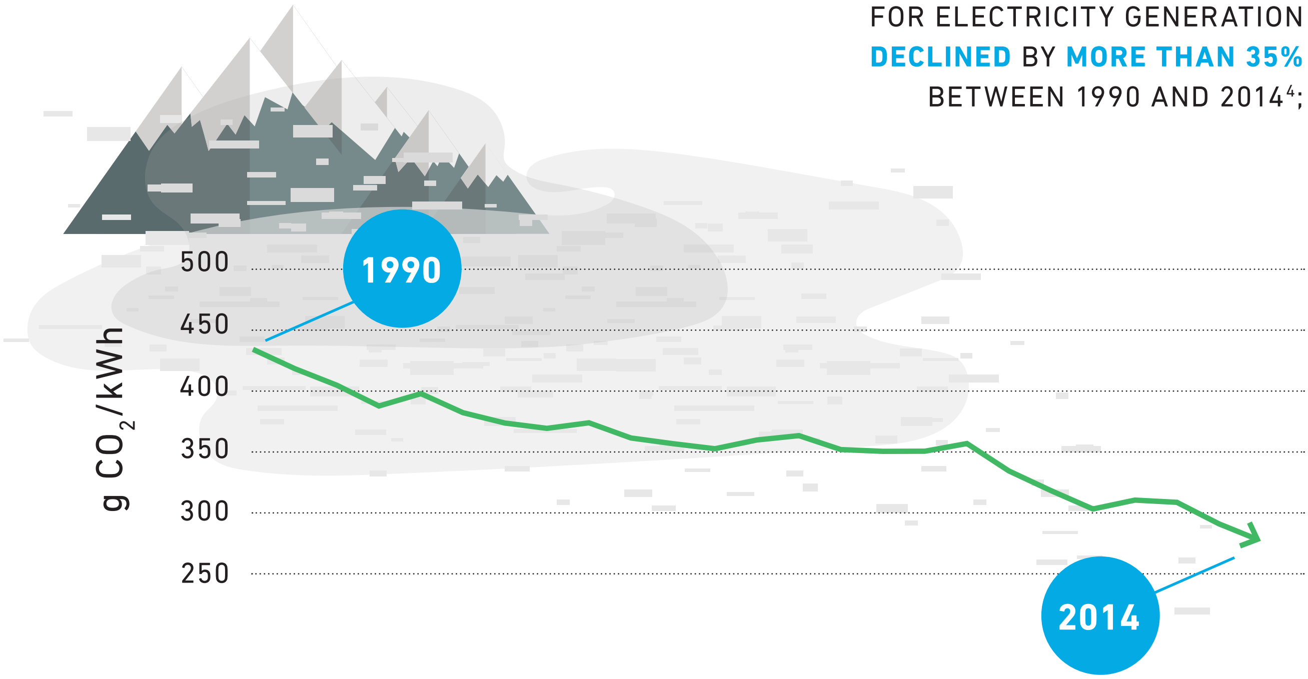
COMMITTING TO **CARBON-NEUTRALITY**

In March 2009, sixty-one CEOs from key European utilities representing well over 70% of total power generation in the EU, signed a declaration in which they committed the European power sector to deliver a carbon-neutral power supply by 2050[3]. They pledged to progressively make use of all available and economically sound low-carbon and carbon-free options when investing in power generation assets, taking into account national energy policies: renewable energies, nuclear power, high-efficiency combined heat & power, and clean and efficient fossil technologies including carbon capture & storage (CCS).

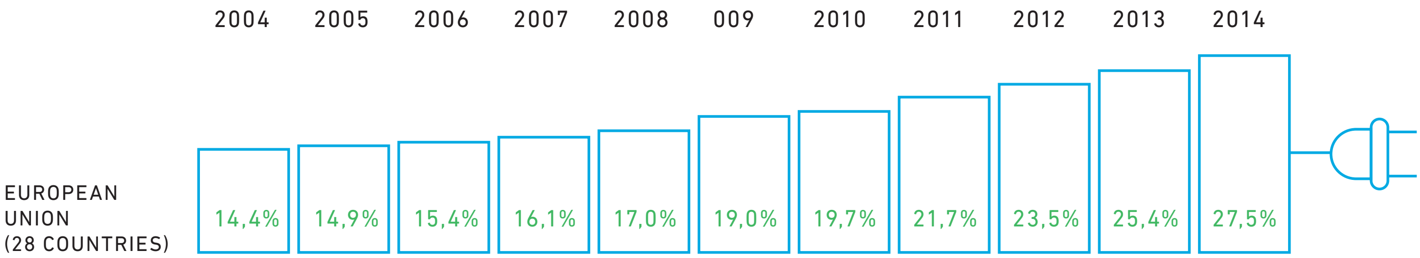
FROM COMMITMENT TO RESULTS: **OBSERVING ELECTRICITY'S DECARBONISATION JOURNEY**

Clear evidence of progress in the decarbonisation of Europe's electricity supply can already be identified. Data from the European Environment Agency (EEA) and EUROSTAT shows how the European power sector is making significant strides towards decarbonisation:

THE **CO_2 EMISSION INTENSITY** FOR ELECTRICITY GENERATION **DECLINED** BY **MORE THAN 35%** BETWEEN 1990 AND 2014[4];



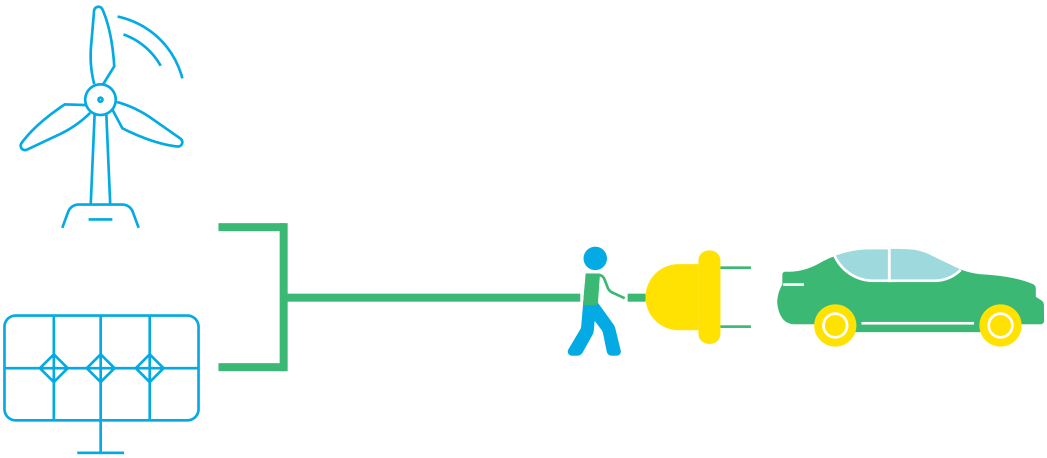
THE **SHARE OF RENEWABLES IN ELECTRICITY PRODUCTION** ACROSS EUROPE **INCREASED** FROM 14.4% IN 2004 TO 27.5% IN 2014[5];



The vast majority of EU Member States have overachieved on their respective indicative trajectories 2013-2014 for renewable energy sources (RES) share under the Renewables Directive (Directive 2009/28/EC)[6].

EURELECTRIC data further confirms that between 2010 and 2015 the amount of power generated across the EU coming from carbon-free sources rose from 46.5%[7] to 56%[8] respectively. In EURELECTRIC's 2015 publication *The European Power Sector in Transition* national electricity associations report that while available fossil capacity across Europe decreased by over 11,000MW in 2015, there was a gain in wind and solar capacity exceeding 14,500MW[9]. All this signals clearly that existing legislative interventions are delivering incentives for the power sector to invest in low carbon forms of power generation.

Following EURELECTRIC's commitment to carbon neutrality and the clear evidence of progress made in the European electricity sector towards reducing carbon emissions, there is a desire to future-proof the decarbonisation of the European power sector.



In this context we are tabling the following set of proposals which underlie this ambition:

A. Improving the EU's toolset to foster decarbonisation

The European legislative framework should be conducive to decarbonisation taking place in an efficient and cost-effective manner, focusing on the use of market-based tools and principles. For example, EURELECTRIC has called for constructive improvements to strengthen the EU Emissions Trading Scheme (EU ETS) to secure its efficacy in further driving cost-effective investment in low carbon technologies in the European power system.

The EU ETS should be equipped to become the instrument to drive investment in renewables and other low carbon technologies. Strengthening it should be viewed as a no-regrets option. As an established, technology-neutral, European-wide instrument, the EU ETS has the capability to stimulate low carbon technology investment and innovation across the Union. To achieve this ambition, EU ETS reform must ensure consistency and coherence across all elements and targets of the 2030 framework, as well as developing an effective governance framework for the delivery of the Energy Union's objectives.

Achieving the EU's decarbonisation objectives in a cost-efficient way means addressing both the long term and short term supply of allowances in the EU ETS. While an adjustment to the Linear Reduction Factor (LRF) would align the EU ETS with the higher end of the EU's 2050 decarbonisation objective, a concurrent revision of the parameters of the Market Stability Reserve (MSR) would address the oversupply in the EU ETS in the short and medium term.

In this context, EURELECTRIC calls for an increase of the LRF to at least 2.4%, a rise in the intake rate of the MSR to 24% per year from 2019 until at least 2023, and a mechanism to future-proof the MSR by lowering the applicable thresholds (e.g. to 300-600 million EUAs[10] across Phase IV). EURELECTRIC is confident this will contribute towards ensuring the cost-effective decarbonisation of the European electricity sector in both the short and the longer term. We believe that a strengthened market-based mechanism will remove the requirement for financial support for low carbon technologies and remove these elements from the consumer bill. At the same time, these proposals require measures to mitigate increased costs for Member States with highly carbon intensive power generation portfolios and low GDP per capita ratios. Solutions to mitigate these costs include using the increased income from auctioning and proportionally increasing compensation to eligible Member States arising from the current provisions of the proposed Article 10c and Article 10d of the revised ETS Directive.

B. Accessing energy efficiency savings

Energy efficiency improvements play a significant part in supporting decarbonisation efforts across the European electricity sector. However, in order to ensure these are delivered in a cost-efficient manner we believe that this should be done via tools that are market-based and technology-neutral.

As European utilities are increasingly investing in energy efficiency services it becomes evident that energy savings are an important part of the solution to reach a sustainable level of supply and demand over time. It is essential, however, to ensure that such energy savings come from fossil/carbon intensive sources in order to deliver the overall decarbonisation of buildings and transport in the European economy. Reducing demand for energy from sustainable sources with proper consideration for the achievement of the broader Energy Union objectives will undoubtedly slow the decarbonisation process and lead to unnecessary increases in costs.

EURELECTRIC advocates an energy efficiency policy at the EU level which promotes innovation and allows the consumer to engage in an active and positive manner. Many of these opportunities depend on a smart system approach for the development of European energy efficiency policy and legislation.

C. Levelling the playing field

The policy cost burden should be shared proportionately across all energy carriers to support a competitive and decarbonised Europe. Measures should be developed which ensure that energy carriers which are currently outside of the EU ETS are captured, in order for these to contribute to financing the decarbonisation transition in a balanced way.

Market distortions created by policy support schemes should be minimised by refraining from targeting the electricity consumer as a financing source and artificially increasing the retail price of electricity. Such distortionary market signals are likely to lead to a rise in cost for decarbonisation in Europe that will affect consumers adversely and in turn lead to a possible deceleration of the decarbonisation process across Europe. Policy support costs should be financed primarily through national budgets.

D. Designing a market for a decarbonised energy system

The decarbonisation trajectory of the European electricity system will lead to a situation where the current market design, fundamentally based on marginal costing, will no longer be able to provide suitable market signals to stakeholders. Some market participants argue this situation is already present today: an increased amount of renewable generation capacity with very low operational costs has pushed European power prices to levels which are hampering investments and potentially threatening security of supply. Such market failures must be addressed through a thorough market redesign where new technological realities are adequately reflected.

The integrated European energy market needs to properly value energy, flexibility, and capacity in all timeframes. This includes a holistic approach to integrate EVs and electrified heating and cooling solutions as valuable assets which provide consumption, storage, and flexibility services to the electricity system. Furthermore, the energy market must be fit to provide sufficient pricing and investment signals where low carbon power generation with zero marginal cost is present. Market integration must be achieved and cross-border capacity must be used efficiently to fully integrate high shares of renewables. Among the challenges that need to be addressed are the following:

- Foster the competitiveness of low carbon technologies and allow for the development and deployment of flexible solutions;
- Enable markets to provide price signals which are adequate, both for existing assets and future investments, across all timeframes;
- Tackle structural over-capacity or under-capacity and to ensure security of supply in a cost-efficient way.

E. Updating the Primary Energy Factor to reflect new realities

A highly technical, yet critically important item in the future-proofing of Europe's legislative framework in the decarbonisation transition is the methodology to determine the Primary Energy Efficiency of electricity. Using a primary energy factor (PEF), current EU energy legislation determines that each unit of electricity (a final energy carrier produced from a range of energy sources) reflects 2.5 times the amount of primary energy (such as oil, gas or coal). The current methodology therefore assumes overall EU electricity generation efficiency to be at 40% (100%/2.5=40%). Most strikingly, the current calculation methodology does not distinguish between the sources of electricity, including electricity from renewable sources.

The PEF takes effect in key pieces of EU energy legislation:

In the context of the Energy Efficiency Directive (EED) it influences which fuel is most desirable to save by Member States in order to meet their energy efficiency targets (electricity or fossil fuels). Saving a unit of electricity can be multiplied by the PEF to determine the primary energy saved, even if the electricity came from renewable or carbon neutral sources.

In product legislation the PEF determines which energy rating label is assigned to energy-consuming devices (applying a heavy artificial burden on electric products). This rating ultimately impacts the decision-making process of businesses and individual consumers with regard to the energy carrier they choose for heating, hot water etc. in decades to come.

The methodology to determine the PEF is long outdated and is having a negative impact on the degree of perceived efficiency of electric heat pumps, boilers, and other electricity electricity-based technologies, through energy labels and also in statistical terms. This is also having a distortive effect on competition across different heating and cooling technologies, meaning that electricity-consuming technologies are perceived to be less efficient than they actually are.

A new methodology for calculating the PEF is required. Such updated methodology must adequately recognise that electricity is increasingly coming from renewable and low carbon sources and is on a clear pathway towards decarbonisation. It should therefore identify and reward electrification, replacing fossil fuel heating/cooling systems with electric systems powered by electricity, as an effective method to facilitate the decarbonisation of these sectors. Specifically, a PEF factor of 0 is needed for electricity generated from RES sources and a factor of 1 for electricity produced from nuclear sources. Most importantly, the new PEF methodology should be calculated in a more dynamic manner: it must not only look at historical data, but also acknowledge future trends in technology and decarbonisation and account for existing legislation which will increase the share of low carbon energy consumption across the EU power mix.

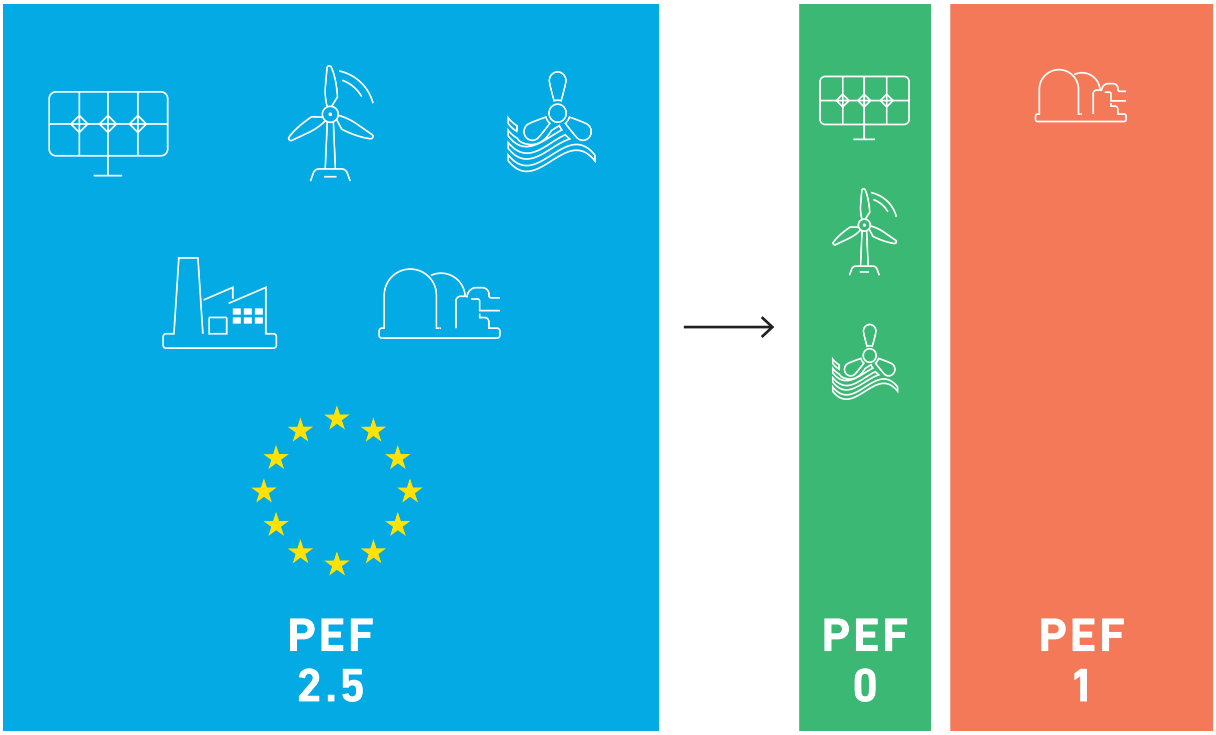
THE CURRENT PEF METHODOLOGY DOES NOT DISTINGUISH BETWEEN THE SOURCES OF ELECTRICITY, INCLUDING ELECTRICITY FROM RENEWABLE SOURCES.

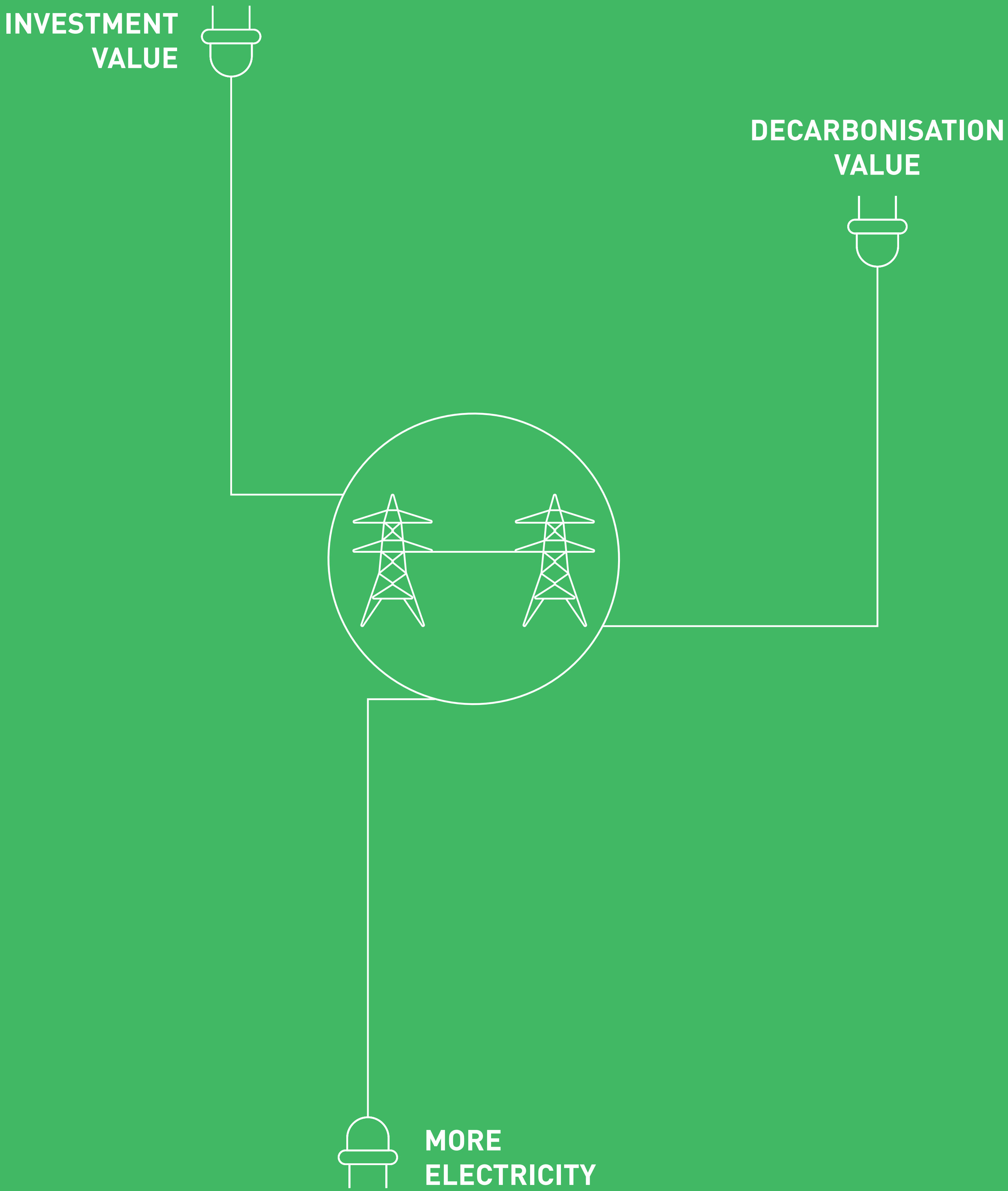
A REVISED PEF METHODOLOGY SHOULD BE CALCULATED IN A MORE DYNAMIC MANNER:

IT MUST NOT ONLY LOOK AT HISTORICAL DATA, BUT ALSO ACKNOWLEDGE FUTURE TRENDS IN TECHNOLOGY AND DECARBONISATION.

IT SHOULD **IDENTIFY AND REWARD ELECTRIFICATION**, **REPLACING FOSSIL FUEL HEATING/COOLING SYSTEMS WITH SYSTEMS POWERED BY ELECTRICITY**, **AS AN EFFECTIVE METHOD TO FACILITATE DECARBONISATION**.

CURRENT PEF METHODOLOGY | **EURELECTRIC CALLS FOR**




INVESTMENT VALUE
DECARBONISATION VALUE
MORE ELECTRICITY

EXPANDING VALUE

Acknowledging the commitments and measuring real progress which the European power sector has made towards reducing the carbon intensity of electricity generation, it becomes evident that major utilities across Europe have the conviction to continue on this pathway and further reduce the GHG emissions associated with electricity generation. Given that electricity has developed a value proposition for becoming the leading energy vector to achieve carbon neutrality by 2050, it is important to identify other sectors of the economy where electricity can play a key role to support decarbonisation.

The rationale for other sectors (such as transport, heating and cooling) to decarbonise is as clear as it has been for the European power sector. The EU has continuously demonstrated leadership at the global level to tackle the causes of climate change, and EURELECTRIC believes this ambition should reach further. By utilising electricity as an increasingly decarbonised energy carrier, other sectors of the European economy can benefit directly from the achievements of European electricity producers to reduce the carbon intensity of their inherent energy system.

The current European legislative framework sets out clear deliverables, targets, and ambitions for three key time horizons. By 2020, the EU is to cut greenhouse gas (GHG) emissions by 20% compared to 1990 levels, derive 20% of its energy needs from renewable sources, and deliver a 20% improvement in energy efficiency[11]. For 2030, the EU targets a cut of GHG emission of 40% compared to 1990, a minimum share of 27% of energy consumed originating from renewable sources[12], and a 30% energy efficiency target (as proposed by the European Commission in November 2016 as part of the Clean Energy Package). Beyond this horizon, the EU has announced its 2050 ambition of cutting GHG emissions by at least 80% compared to 1990 levels, including full carbon-neutrality of the power sector by 2050[13].

In light of commitments made in the Paris Agreement, which includes the global commitment to hold *"[...] the increase in the global average temperature to well below 2°C above industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above industrial levels [...]"*[14], the EU will be required to deliver progressive and transformative change to sectors which are currently lagging behind with their decarbonisation efforts. We believe that this is where electricity has a significant role to play.

Electricity's decarbonisation potential should be extended into both the transport and the heating and cooling sectors. Transformative technologies using electricity as their power source are already available for both sectors (electric cars, heat pumps, and smart electric thermal storage technologies etc.) can already meet the demands of consumers today whilst fully removing the consumption of fossil fuels at the point of use.

ELECTRIFICATION

The concept of electrification refers to the idea of broadening the use of electricity to satisfy an increasing proportion of final energy demand of a system. It is about replacing fossil fuel reliant systems with low carbon electricity to meet the energy needs of sectors whose energy needs are currently only marginally satisfied by electricity. In doing so, these sectors are able to access significant improvements in efficiency. A simple comparison of the average efficiency factors of an internal combustion engine (30-40%) with that of an electric motor (90-95%) quickly reinforces the rationale for electrification.

Driving the decarbonisation of systems through electrification

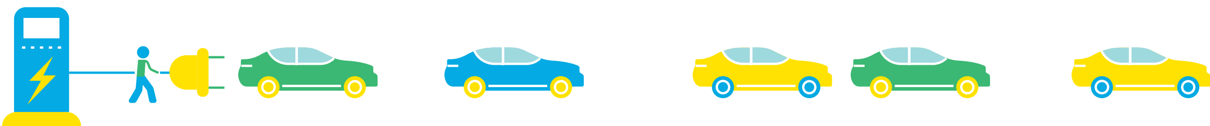
Another key benefit of choosing electricity as the main energy carrier is that while the electrification of other sectors gains momentum, electricity production will continue on its ambitious journey towards decarbonisation. Significant economic benefits are already available by opting for electrification as the main means to decarbonise other sectors.

Given that electricity generation is already on a steady and predictable decarbonisation trajectory, all investment commitments can be directed at the target sectors to become fully accepting for increasing shares of electricity to meet their respective energy demand. This would translate into direct GHG savings for the target sector as there is effectively no 'waiting time' for alternative decarbonisation infrastructure to be developed and implemented.

Maximising the utility of EU ETS

Progressive electrification in key economic sectors can also lead to an automatic strengthening of the EU ETS. As a sector becomes increasingly electrified, the emissions from such sector shift, *de facto*, from being outside the ETS to falling under the ETS: As emissions from the electricity sector these become subject to the linear reduction trajectory as well as the electricity sector's own carbon neutrality commitment.

Not only does electrification mean that sectors currently external to the EU ETS indirectly become part of the mechanism, by increasing electricity demand there is also the potential for this market-based instrument to increase in effectiveness as it covers an increasing portion of the economy. This in turn would lead to stronger market signals for carbon pricing, providing additional incentives to sectors under the EU ETS to further decarbonise or take carbon-mitigating measures.



Reducing dependence on energy imports

The transition of the European electricity system towards carbon-neutral and renewable generation capacities means there is a lower degree of dependence on foreign imports of coal, oil, and gas to meet Europe's energy demand. The ability to provide an increasing amount of Europe's energy needs domestically, without the need for imports, adds significant economic, environmental, and security of supply benefits to the rationale of electrification. By replacing classic fossil-based energy fuels, European consumers and industry will be less exposed to volatility in global oil and gas pricing and any potential supply shocks.

Creating opportunities for grid management

Recognising the challenges currently faced by grid infrastructure operators as the amount and diversity of distributed renewable generation capacity continues to grow across Europe, further electrification can offer a solution to manage demand and supply across networks more efficiently.

By way of example, electric vehicles (when connected to the electricity system for charging) should not solely be considered as demand factors, but also as connection points which can offer balancing and load shedding services to the grid. Similar principles apply to heating and cooling systems where heat pumps or thermal storage tanks can provide grid management services.

The progressive electrification of sectors opens further opportunities to access mechanisms which improve system efficiency and maximise system benefits and investments. One demonstrator currently underway is the Real Value project. This energy storage project (funded by Horizon 2020) combines physical demonstrations across 1,250 households in Ireland, the UK, Germany and Latvia showcasing how local small-scale energy storage, optimised across the whole EU energy system with advanced ICT, could bring benefits to all market participants[15].

Aiming for sector coupling

Maximum value of decarbonisation can only be achieved if the reach of energy system investments is extended into other sectors. The ultimate aim should not only be to decarbonise the power system, but to deliver maximum optimisation of the entire European energy system. Allowing renewable and low carbon electricity to penetrate the heating, cooling, and transport sectors will lead to additional system benefits. The concept of sector coupling is currently gaining momentum in Germany where legislators are seeking to achieve the aim of triple-sector decarbonisation: the power sector which is seeing a growing share of renewables, the heating sector which is to replace fossil fuel fired heating systems with electric systems powered by low carbon electricity, and the transport sector where electric mobility is to meet the transportation needs of the future[16].

The holistic approach of sector coupling presents multiple, system wide benefits with direct implications for energy consumers. Most importantly, the energy transition becomes more cost effective for all market stakeholders. Instead of being exposed to cover the costs of three distinct decarbonisation programmes (for energy, transport, and heating and cooling), a holistic investment approach ensures transition costs are kept at a lower level for European energy consumers.

Sector coupling will also prompt a change in the relationship between energy system operators and consumers. The introduction of smart technology means that electrified transport and heating/cooling solutions can be integrated into the wider electricity system. This opens up opportunities for system operators to maximise the utilisation of existing systems as well as the development of system management tools which reduce the need for capital-intensive infrastructure upgrades.

The direct benefits for the consumer are three-fold:

1. The transition from being a passive to an active energy consumer creates potential revenue streams at the individual household level. By allowing system operators or aggregators to use storage or load shift potential of electrified transport and heating/cooling solutions, households can gain financial advantages.

2. Consumers will notice increased operational efficiencies created at the network level reflected in a relative decrease in their consumer bills compared to the current situation.

3. Finally, households which choose to invest in electricity-based transport and heating/ cooling solutions will immediately benefit from the energy efficiency gains provided by an electric device. On average, a European household replaces a private vehicle approximately once every 10-12 years and a heating system approximately every 30 years. It is therefore all the more important to provide the right decision signals for consumers to avoid technological lock-in and technological redundancy.

SECTOR COUPLING MEANS INVESTMENTS IN LOW CARBON ELECTRICITY ARE ACCESSIBLE TO THE TRANSPORT AND HEATING/COOLING SECTORS TO SUPPORT THEIR RESPECTIVE DECARBONISATION JOURNEYS

CONSUMER BENEFITS THREE-FOLD:

1. **PASSIVE CONSUMERS BECOME ACTIVE PLAYERS**
2. **INCREASED OPERATIONAL EFFICIENCIES WILL MEAN LOWER BILLS**
3. **HOUSEHOLDS BENEFIT FROM ENERGY EFFICIENCY IMPROVEMENT THROUGH THE USE OF ELECTRIC DEVICES**

DECARBONISATION **OF TRANSPORT**

The European transport sector is currently responsible for around a quarter of Europe's GHG emissions[17]. The European Commission's Low Emission Mobility Strategy (2016) envisages higher degrees of efficiency for petrol and diesel-fuelled cars, as well as the deployment of alternative fuelling technologies such as biofuels and EVs[18].

In this context it is important to bear in mind that achieving at least 80% decarbonisation across the EU by 2050 will most likely require the decarbonisation of the road transport sector of around 95% by 2050[19]. EURELECTRIC believes that there is a viable option to displace a significant proportion of GHG emissions in this sector by changing the primary energy carrier from petrol and diesel to increasingly decarbonised electricity.

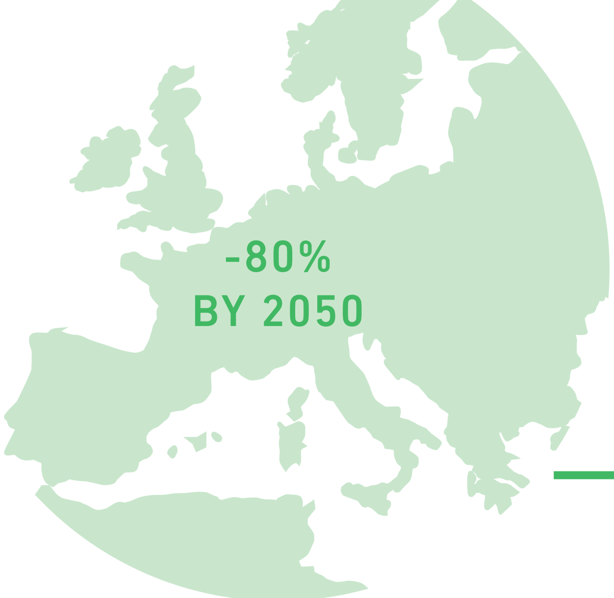
Addressing the challenge of decarbonising transport

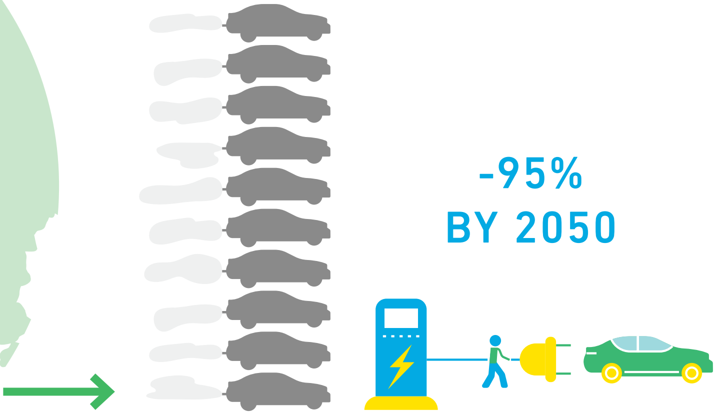
According to the EU 2016 Reference Scenario it is clear that the current set of policies and measures across the EU are likely to have an unsatisfactory effect when it comes to progressively reducing the emissions contribution from the transport sector. It highlights increasing CO_2 emission standards which result in a lower carbon intensity for the passenger car and van fleet as the main driver for a decrease in emissions from the sector by 2050[20].

ACHIEVING 80% DECARBONISATION ACROSS THE EU BY 2050 WILL MOST LIKELY REQUIRE THE DECARBONISATION OF THE ROAD TRANSPORT SECTOR OF AROUND 95% BY 2050

However, whilst the Reference Scenario projects a reduction of passenger car specific CO_2 emissions of 45% between 2010 and 2050, it also notes that total CO_2 emissions from the road transport sector will see a low absolute decrease – from ca. 900MtCO_2 in 2005 to 750MtCO_2 by 2050[21]. This statement, alongside the claim that 66% of the final energy demand in Europe's transport sector will be met by diesel and gasoline fuels, leads to the conclusion that there is significant scope for the development and adoption of progressive policies to foster the electrification of this sector.

A number of Member States, Norway, and European metropoles have already tabled initiatives aimed at phasing out diesel and petrol-powered vehicles over the next decade in order to achieve the emission reductions required under the Paris Agreement.





Recognising electro-mobility as already being a viable option

A study focused on the City of Milan has shown that the current electricity mix prevalent in Italy already provides a climate-friendly alternative to ICEs in road transport. It recognises that even with a legal limit of $95gCO_2$/km for passenger cars, a 50% emissions reduction for light duty vehicles (LDVs), and no change in the renewable contribution to the Italian electricity mix, CO_2 emissions from ICE vehicles would still be higher than those associated with the electrical power generation for EV replacements.

Extrapolating the results of this study, Perujo and Ciuffo (2009) state that "EVs powered by the present European electricity mix [in time of study] offers a 10% to 24% decrease in global warming potential relative to conventional diesel or gasoline vehicles assuming lifetimes of 150,000km"[22] and a target 25% of Europe's vehicle fleet to become electric by 2030 does not represent an unachievable objective.

Addressing the health impacts of fossil fuelled road transport

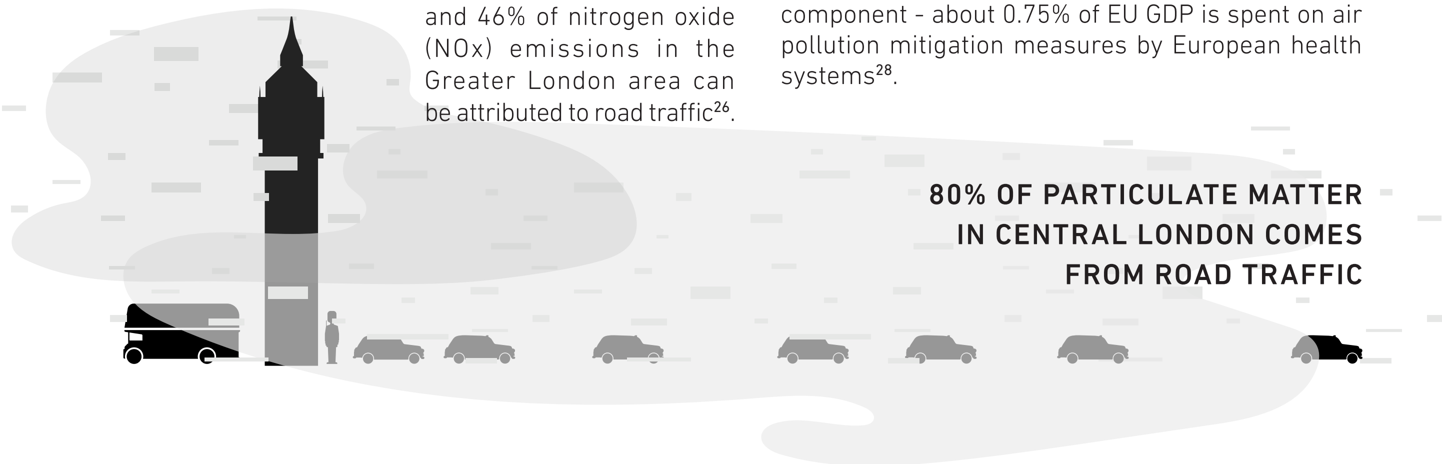
When considering the potential impact of a transport sector that would still rely on fossil fuels for two thirds of its energy requirements in 2050, there is a need to recognise the added value that electrification can bring to safeguard European citizens' health and to reduce the consequential costs for European health systems.

Air quality figures for road emissions in urban centres across Europe paint a bleak picture:

- *Transport & Environment* notes that over 80% of the EU's urban population is exposed to unacceptable levels of air pollution (according to WHO guidelines)[23]; little progress has been made in reducing PM2.5 background concentration across urban centres from 2006 to 2012[24], and ozone concentrations observed a flat trend at 80% of European monitoring stations between 2003 and 2012[25].
- The Greater London Authority recognises that 80% of particulate matter in central London and 46% of nitrogen oxide (NOx) emissions in the Greater London area can be attributed to road traffic[26].
- On 1 August 2016, *The Economist* published data painting an alarming picture of air pollution across major European cities compared to other global centres averaged between May 2015 and May 2016. For example, London and Paris observed nitrogen oxide levels above WHO guidelines across 19 and 18 hours per day respectively; Paris, London, and Amsterdam all observed PM2.5 background emissions above WHO guidelines around the clock[27].

Low carbon electricity provides an opportunity to make significant progress in decarbonising the transport sector as it can displace carbon-intensive petroleum fuels and also replace first generation biofuels which carry a questionable carbon balance.

Furthermore, electrification of road transport, specifically in large cities and densely populated areas, means eliminating air pollutant emissions at source where they are most harmful. Finally, the current fuel base of road transport causes significant public health implications with a measurable fiscal component - about 0.75% of EU GDP is spent on air pollution mitigation measures by European health systems[28].



80% OF PARTICULATE MATTER IN CENTRAL LONDON COMES FROM ROAD TRAFFIC

Enabling the mass roll-out of electro-mobility

Industry leaders in electro-mobility are currently demonstrating how a transition from ICEs to EVs can be delivered in an efficient manner. Norway has a world-leading uptake of EVs where the EV market share has increased from 1.4% in 2011 to 17.1% in 2015[29]. Progressive policies (exemption from VAT, reduced road charges and taxes, access to bus lanes and free parking, amongst others[30]) combined with an aggressive infrastructure programme, low carbon electricity production, and the political will to shut out petrol/diesel-fuelled vehicles from the national market from 2030, are moving the electrification of transport into the midst of society.

Traditional technological limiting factors such as battery capacity and range anxiety are becoming less of a barrier to the mass-market uptake of EVs. A team of MIT (Massachusetts Institute of Technology) researchers has determined that

87% OF ALL PERSONAL CAR RETURN JOURNEYS IN THE UNITED STATES TODAY

CAN ALREADY BE ACHIEVED

BY THE CURRENT TECHNOLOGICAL STANDARD OF EV FLEETS,

with this proportion being expected to increase to 98% of all car journeys by 2020[31].

The development of charging infrastructure holds significance in increasing the perceived accessibility for household-level electro-mobility. However, recent technological progress has led to a significant decrease in pricing for batteries that has outpaced all expectations. Consequently, EURELECTRIC is confident that related barriers to EV penetration will begin to reduce successively.

A clear policy commitment coupled with infrastructure investment and an incentivisation scheme at household level could lead to the development of sufficient signals which can propel the electrification of transport. While Europe's electricity production mix moves towards carbon neutrality, EU Member States need to develop pathways which drive forward the deployment of EVs in European markets. European countries have already demonstrated that incentive programmes to promote specific vehicle technologies work.

For example, the diesel motor car continues to prevail in Europe (unlike in other mature vehicle markets across the world such as the US or Japan) due to the tax incentive schemes provided to the technology. There is an argument that the decision to incentivise diesel technology with fuel tax incentives of ~10-50% lower than gasoline across various European countries was not justified, given that the reduction in carbon emissions from passenger cars was mainly driven by efficiency improvements and not by a shift from petrol to diesel across the European fleet[32]. In addition to failing to achieve its original objective, the fostering of the diesel car in Europe is now causing significant health issues for citizens in urban centres.

SHIFTING FUEL TAX INCENTIVES TOWARDS ELECTRIC VEHICLES IS AN OPPORTUNITY

TO PROVIDE A STIMULUS TO A TECHNOLOGY WHICH PROVIDES A VIABLE SOLUTION TO AIR POLLUTION PROBLEMS IN EUROPEAN URBAN AREAS,

AND WHEN POWERED BY LOW CARBON ELECTRICITY ALSO MAKES A SIGNIFICANT CONTRIBUTION TO REDUCING SECTOR GHG EMISSIONS.

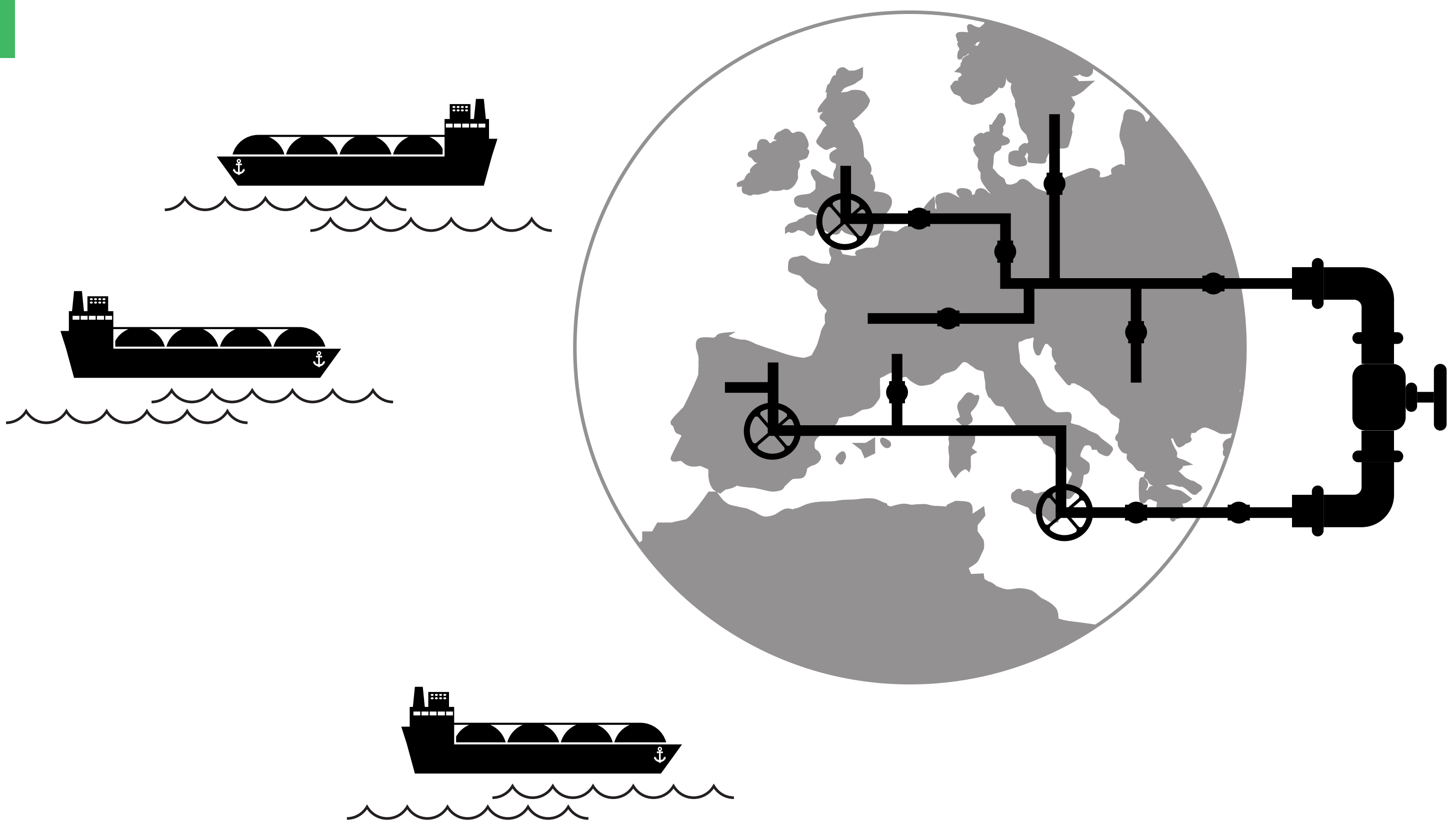
Moreover, given that GHG emissions are capped under the EU ETS, any potential increase in electricity demand will come at a net zero increase in overall emissions.

Reducing dependence on oil means increasing security of supply

Electrification further provides an opportunity to progressively reduce the primary energy requirement of the transport sector and simultaneously increase Europe's energy independence. Noting that the "[...] much higher efficiency of electric motors compared to ICEs as well as the potential to decarbonise the energy chain used in transportation[...]"[33] offers an opportunity to improve energy system efficiency and break Europe's road transport sectors' reliance on foreign oil imports.

The European Commission has acknowledged that currently 94% of transport in Europe is dependent on oil, 84% of which is imported at a cost of €1billion/ day[34]. Consequently, an advance in the electrification rate of this sector alone can yield significant savings for the European economies. Policy proposals fostering electrification will contribute to the reduction of oil-based fuel in Europe's transport sector, create significant financial benefits, and increase EU energy independence as it reduces reliance on global oil markets to meet its transport energy demands.

94% OF TRANSPORT IN EUROPE IS DEPENDENT ON OIL,
84% OF WHICH IS IMPORTED AT A COST OF
€ 1 000 000 000 / DAY



Creating system efficiencies through EVs

The potential benefits are compounded as electrification of transport also introduces system efficiencies to a degree that cannot be matched by fossil fuels. When comparing direct driving performance, an ICE travelling at an average of 100km/day requires the equivalent of 80kWh/day[35]; an EV requires a fraction of this energy (10kWh/day).

One method used to show the carbon emissions for an electric car is to identify the carbon emissions related to the production of the electricity used to drive the car. Using this principle, the current electricity production mix in Europe translates to indirect emissions of approximately 50gCO_2/km, which is already significantly lower than the current average fleet target for all new cars in the EU of 95gCO_2/km by 2021.

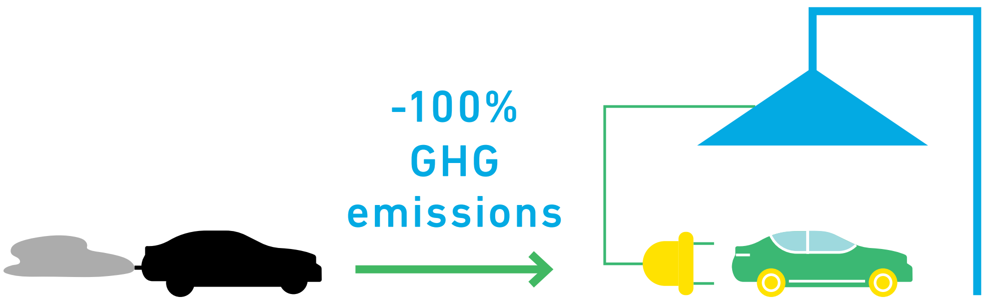
However, it could be argued this is an invalid comparison as it neglects system efficiencies achieved when electrifying vehicle fleets. In fact, it can also be argued that the use of an EV does not produce any direct CO_2 emissions. The European electricity sector is almost fully covered by the EU ETS which caps and reduces the amount of emissions allowed across covered sectors.

Therefore, any increase in EV ridership across Europe will lead to an increase in electricity demand; however, no additional carbon will be emitted due to emissions from the electricity sector being capped under the EU ETS*. This will effectively result in a reduction in actual GHG emissions of 100% for every ICE that is replaced by an EV.

EURELECTRIC analysis also shows that the additional electricity demand due to EV loads in terms of increase in total energy demand can be managed by the European grid provided that the EVs are charged in a smart way, i.e. during off-peak hours. Charging will therefore need to be coordinated by means of smart ICT systems[36].

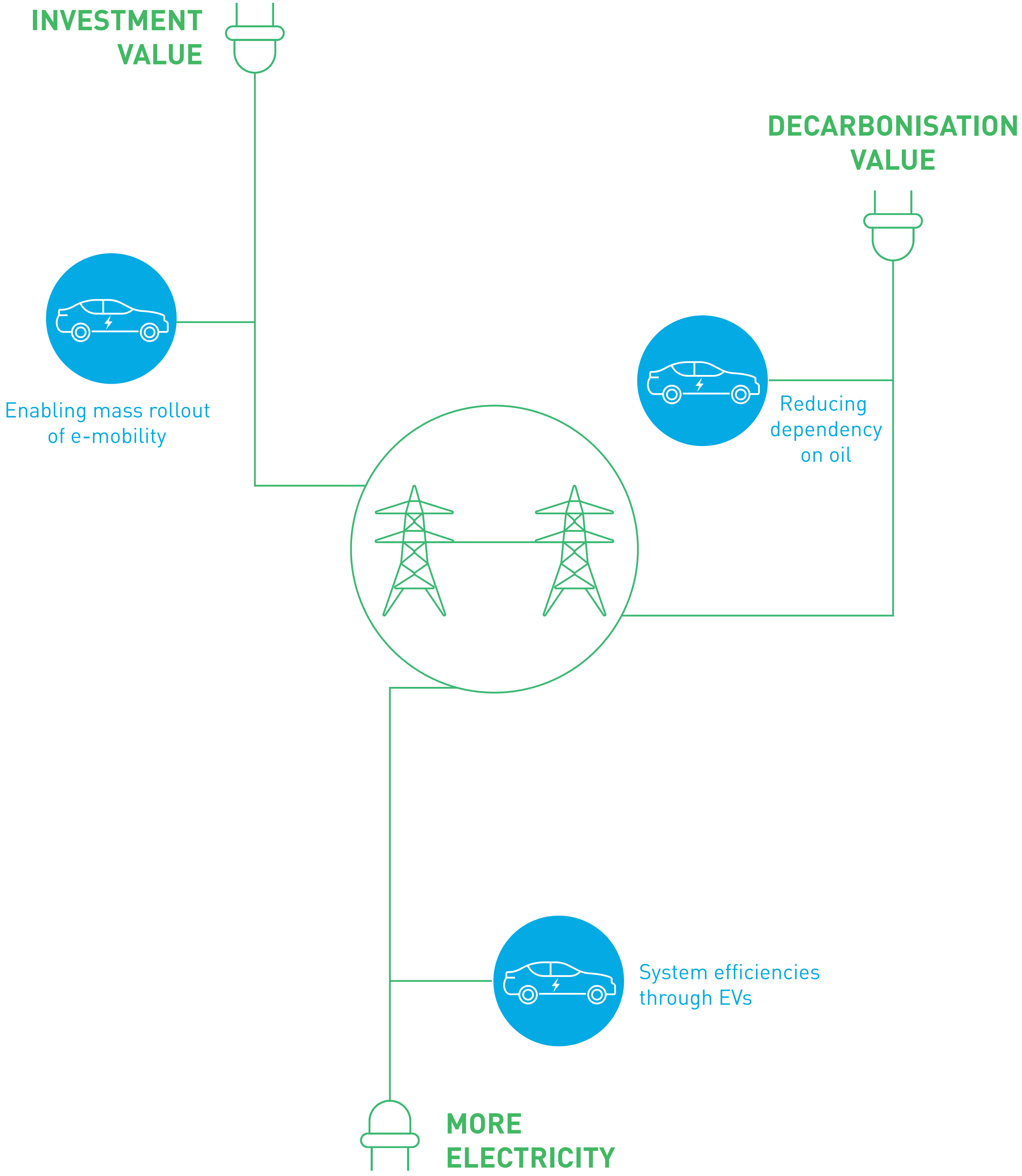
In summary, the electrification of the transport sector offers numerous benefits. It has been shown that Europe's electricity systems can already deliver today a positive impact on system-wide carbon emissions through the electrification of road transport.

Given that emissions related to electricity production in Europe continue to decline (driven by existing policies, the continued desire to invest in carbon-free generation by European utilities, and an effective EU ETS) the value of electricity is clear: Creating health benefits for Europe's population by reducing air pollutants in densely populated areas, tackling global climate change through the decarbonisation of the sector, increasing the system efficiency of the sector, and improving Europe's energy independence. All these provide very tangible benefits for Europe and are easily accessible through the electrification of transport.



REPLACING CONVENTIONAL CAR WITH AN ELECTRIC VEHICLE RESULTS IN AN EFFECTIVE REDUCTION OF GREENHOUSE GAS EMISSIONS BY 100% AS EMISSIONS FROM THE ELECTRICITY SECTOR ARE CAPPED UNDER THE EU ETS

* As long as a cumulative surplus of allowances remains accessible to operators in the EU ETS, new demand arising from transport electrification will absorb these in the first instance. Once this accessible surplus is removed, via the market stability reserve mechanism or more directly, then further electrification of transport will result in no emissions to atmosphere (and a saving of those that would have arisen from the corresponding combustion of petroleum fuel).


INVESTMENT VALUE
DECARBONISATION VALUE
Enabling mass rollout of e-mobility
Reducing dependency on oil
System efficiencies through EVs
MORE ELECTRICITY

DECARBONISATION **OF HEATING AND COOLING**

In 2014, 75% of Europe's heating and cooling demand was met by fossil energy sources, with nearly half of the demand being met by natural gas[37]. The European Commission's Heating and Cooling Strategy highlights the need for action to address energy usage in a sector which is inherently wasteful. Whilst the sector consumes half of the EU's energy budget, much of that is lost due to system inefficiencies[38].

In order for the EU to achieve its climate and energy objectives, the heating and cooling sector will need to rapidly reduce its dependence on fossil fuels as well as its overall energy consumption. The sector can benefit from untapped energy efficiency potential. Relatively simple insulation measures can offer significant energy demand reductions across a wide range of housing stock in Europe and should form the first wave of investment. This should be complemented by the electrification of heating and cooling in modernised building stock where electrified solutions can offer real and practical solutions.

Protecting the climate and citizens' health

The electrification of space heating and cooling is environmentally advantageous, reducing the carbon output originating from the sector. The International Energy Agency (IEA) developed various energy scenarios in its 2014 publication ***Energy Technology Perspectives***. It notes how "advanced heat pump technology clearly delivers"[39]; showing a significantly reduced dependence of the European heating sector on natural gas and thereby realising a reduction of 67 $MtCO_2$ in an electrified buildings scenario compared to the 2°C baseline scenario for the EU. This corresponds to emissions approximately 13% below the 2°C base case with a 2050 horizon[40]. Alongside any electrification of the space heating and cooling sector, the European electricity production mix will continue to decarbonise.

Therefore electrification offers an opportunity to phase out technologies which are inherently carbon-intensive due to their fuel use.

Furthermore, European cities could see a significant improvement in air quality levels as a direct consequence of the electrification of heating. Residential and commercial heating systems are responsible for a sizeable share of particulate matter, nitrogen oxides, and sulphur oxides emissions in urban settlements. These directly affect the human respiratory system leading to the development and exacerbation underlying medical conditions such as asthma. Electricity-based heating technologies such as heat pumps and smart electronic boilers produce zero emissions at source. Consequently, with increasing levels of electrification of heating in urban centres, an improvement of air quality would be observed.

Accessing efficiencies through modern heating and cooling technologies

The system efficiencies that electrification can provide are also achievable in the heating and cooling sector, thereby contributing significantly to a reduction in primary energy requirements for the sector. The EEA identifies that about 50-90% of household energy use across the EU is linked to space heating and cooling[41]. From an efficiency point of view, there is no known "[…] technology to rival heat pumps for efficiently using electricity to deliver residential and commercial space heating"[42]. Existing heating technologies linked with heat pumps or smart thermal storage technologies can play an important role in addressing a number of challenges for demand side decarbonisation, however, modern electric heating/cooling technologies provide even larger energy savings.

Modern heat pumps operate with a performance factor of 300%, meaning that for every kWh of electricity consumed about 4kWh of thermal energy is generated[43]. Therefore, progressive electrification of the sector enabled through the introduction of heat pump technology across residential and commercial space heating and cooling systems in Europe can deliver immediate and substantial efficiency improvements.

Saving consumers' cash

European Member States can achieve significant financial savings and make a positive contribution to the Union's security of energy supply by opting for electrification of the heating and cooling sector. Currently, the sector accounts for 13% of EU oil consumption and 59% of total EU gas consumption (around 68% of all gas imports into the European Union).

A shift away from such dominant fossil fuel energy needs for this sector would open the door to savings of around €40 billion for gas imports and €4.7 billion on oil imports per annum[44]. For the European energy consumer this would mean a lower degree of volatility in their energy bills. Furthermore, any reduction in reliance on foreign oil and gas imports will improve the EU's ability to meet its energy demands, reducing any potential impact of global energy supply issues and associated price volatility.

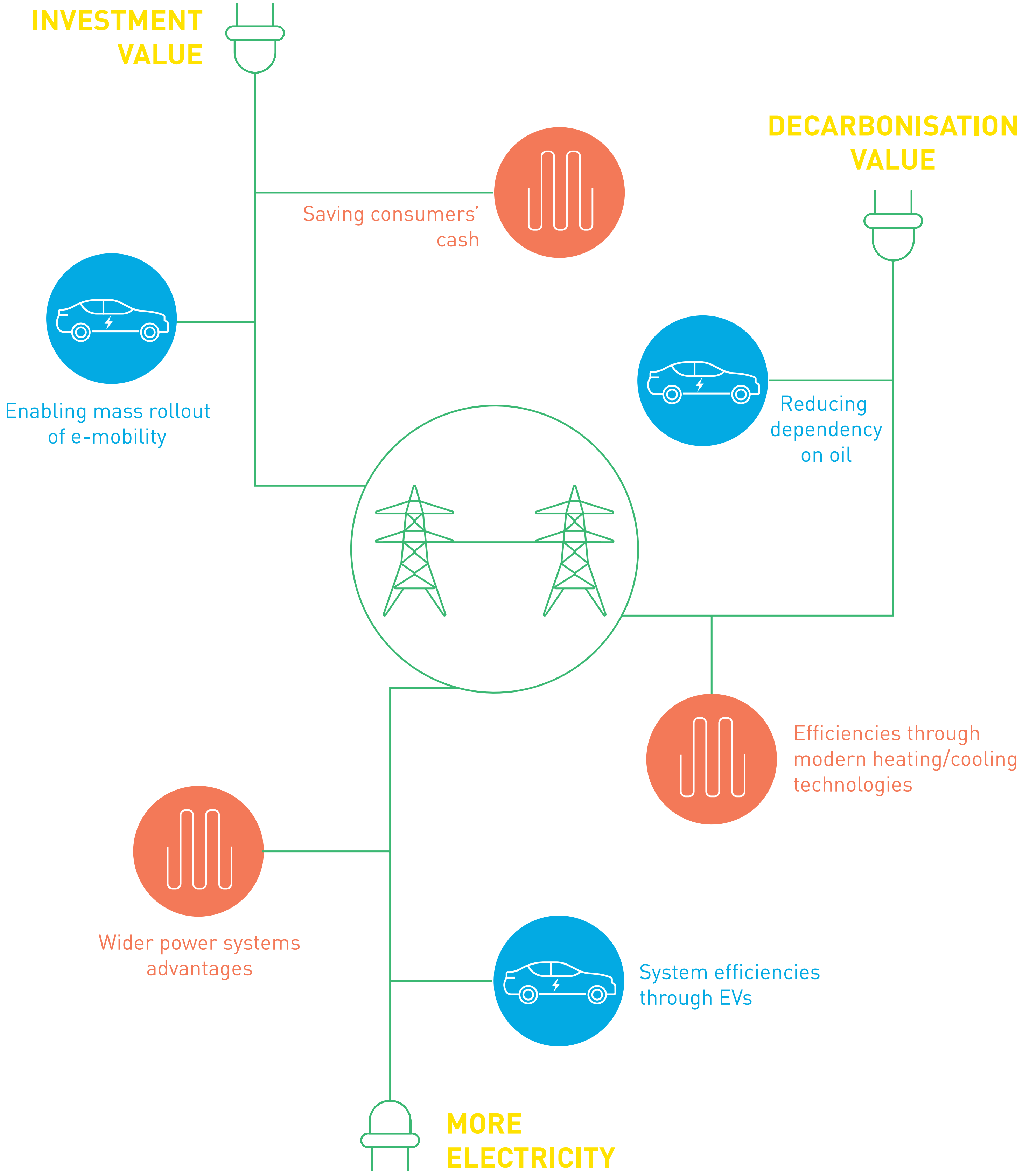
Recognising alternatives and barriers

Aside from electricity, there are other technologies such as combined heat and power (CHP) which provide opportunities to optimise fuel use when providing hot water, space heating, and electricity for dwellings. Biogas and biomass are also recognised low carbon alternatives to conventional heating technologies; in southern European countries, solar thermal may also provide a feasible alternative. With respect to the uptake of alternative heating technologies, it should be recognised that current low gas and heating oil prices provide a disincentive for households to convert their heating systems. In addition, there is a proportion of building stock where installation of current heat pump technologies is a complex undertaking due to structural and/or space constraints.

Providing wider power system advantages

Wider energy system benefits can also be accessed through a combination of technologies to address local issues. For example, electrification of heating/cooling alongside smart meter technology, flexible tariffing and energy storage technologies (power-to-heat, hydrogen storage, large-scale heat pumps) can reap further benefits for energy consumers. Kelly et al. (2015) highlight effective demand response as key to manage electricity system peaks and potential increases in average and peak demand which can be a direct consequence of the electrification of heating and cooling[45]. The Real Value project is currently trialling smart electric thermal storage systems at a household level, early results indicate there are respectable benefits available to the entire electricity value chain[46].

The value of allowing electricity to penetrate the heating and cooling sector is obvious: Electrification in this sector has the potential to unlock efficiency benefits which will reduce primary energy requirements – the efficiency levels which are realised by electricity-based technologies cannot be rivalled by conventional fossil-fuel based systems. This leads to another clear value factor: whilst electricity as an energy carrier continues to decarbonise in Europe it offers a solution which will drive carbon out of the system. Finally, advanced heating/cooling technologies such as heat pumps can further increase the value of using electricity as the main energy carrier in this sector. These technologies can make a successful contribution to system efficiency as they allow for direct demand response measures and offer the option of storing energy in their systems.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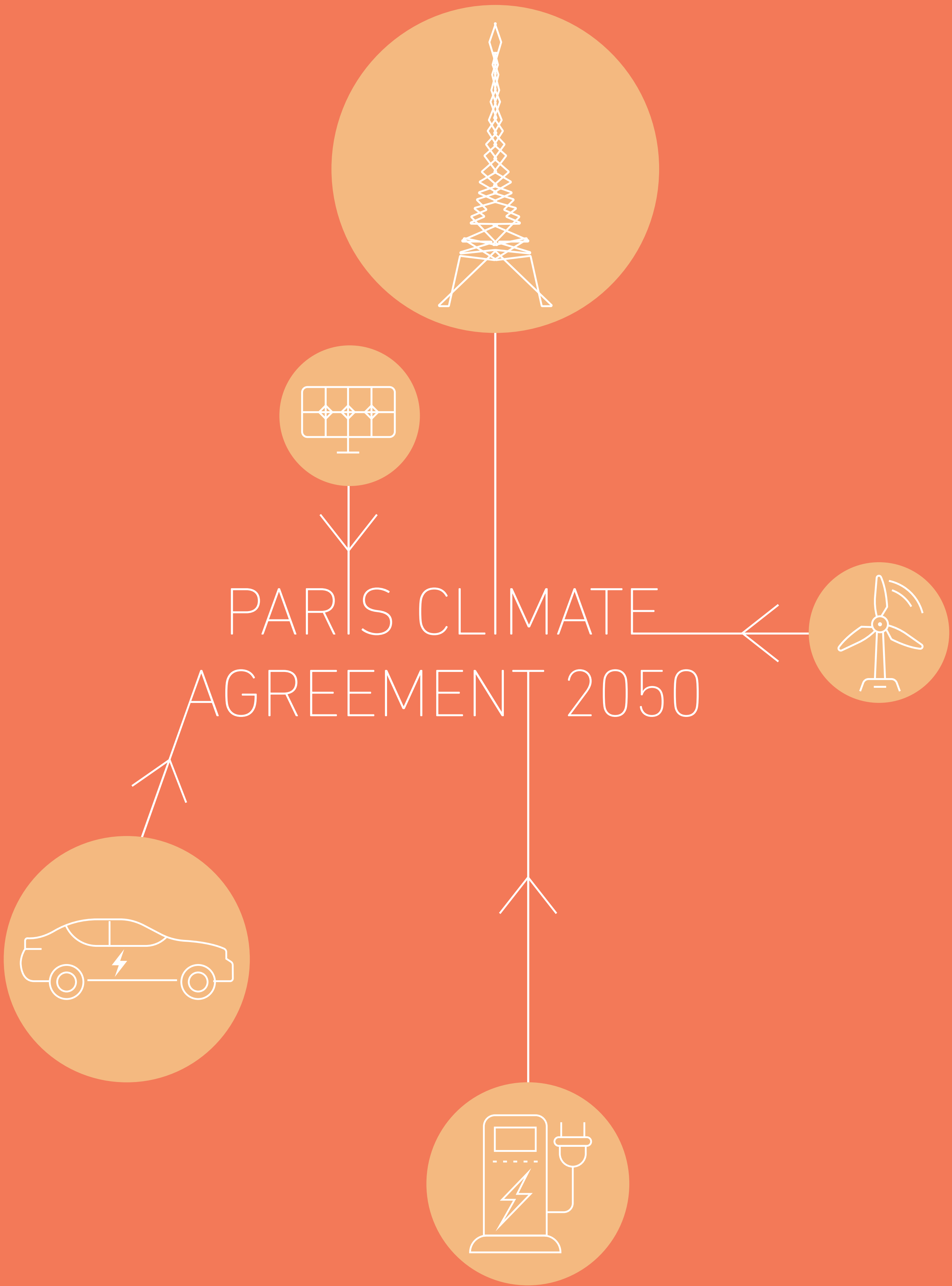

PARIS CLIMATE
AGREEMENT 2050

REALISING VALUE

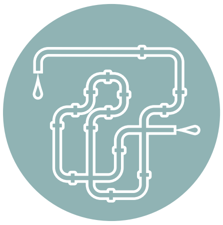
The electrification of the transport and heating/cooling sector provides a viable response to the challenge of decarbonising the European economy and allows for maximum value to be realised from the electricity system. Given the European electricity sector's continuing commitment and action to reduce greenhouse gas emissions, there is a significant opportunity to allow other sectors to benefit from these efforts. The EU 2016 Reference Scenario spells out multiple opportunities for electrification, while at the same time stating that lock-in of conventional, more carbon-intensive technologies should be avoided.

However, to achieve the best possible results for decarbonisation of the European energy system, to keep costs low for energy consumers, and to retain the competitiveness of European economies, barriers to electrification in the transport and heating/cooling sectors must be addressed as soon as possible. The failure to deliver a suitable framework may significantly increase the cost of decarbonisation and potentially hamper efforts to achieve the 2050 goals.

ESTABLISHING **A VISION** AND **OVERCOMING BARRIERS**

To deliver an effective future for electrification across the European Union, current structural, regulatory, and legislative barriers must be understood and overcome in line with a coherent vision for the progressive electrification of key sectors.

Focusing on pathways to **optimise the use of existing infrastructure** will keep costs down for energy consumers. Smart technology and demand side management will play an increasingly important role to facilitate the energy transition. Energy consumers, system operators and stakeholders will require novel reward mechanisms to send appropriate signals to market actors.



The **principles of sector coupling** allow for a holistic mechanism to drive greenhouse gas emissions for three key sectors of the European economy towards net-zero. Electricity based end-use technology that replaces fossil-fuel based technologies leads to a complete eradication of GHG emissions at the point of end use. Planning for European decarbonisation must focus on the opportunities and the challenges of combining energy-consuming sectors which are inherently linked.

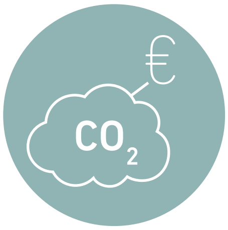
A clear **commitment to electrification of final energy demand in Europe** must be delivered now. Energy efficiency measures which address excessive heat waste across the European building stock can deliver quick wins. At the same time, infrastructure investments across electricity production, transport, and the heating/cooling sectors have an inherently long lead time and define operational standards for decades. By delivering confident policy signals, the EU can ensure delivery on its Paris commitments in a 2050 perspective.

A **lack of whole system thinking and analysis** is currently leading to the development of sector specific strategies whilst ignoring the benefits of cross-sector efficiencies. Decarbonisation of electricity production currently requires investments across the value chain to prepare the infrastructure for a carbon-free future. A holistic policy approach, under the principles of sector coupling, will allow for investment efficiencies to be created, hence saving time to achieve decarbonisation as well as saving for customers.

Corrections must be made to address the **absence of a level playing field for pricing** for different principal energy carriers. Disincentives currently exist for electricity with households picking up the cost of social policy and therefore perceiving higher costs for pursuing electrification.

A FRAMEWORK
FOR THE FUTURE

EURELECTRIC presents five proposals which aim to facilitate the electricity sectors' ability to be the key energy carrier for a decarbonised and competitive Europe.



Strengthening the EU ETS

by increasing the LRF to at least 2.4%, increasing the intake rate of the MSR to 24% per year from 2019 until at least 2023, and offering a mechanism to future-proof the MSR by lowering the applicable thresholds. At the same time, EURELECTRIC sees the necessity to mitigate increased costs for Member States with high carbon intensities and low GDP per capita ratios.

Bringing down policy support costs in the electricity bill

to reduce the pressure on electricity consumers who currently carry the bulk of decarbonisation costs. Instead, decarbonisation investment should be driven by market-based mechanisms such as the EU ETS. Sectors currently outside the EU ETS, such as buildings and transport, and energy carriers other than electricity should also make equitable financial contributions to decarbonisation.

Advocating an energy efficiency policy at EU level

which promotes innovation, allows the consumer to have active and positive involvement, and ensures savings come from carbon intensive sources.

Developing measures to

capture energy carriers currently outside of the EU ETS

so these too contribute to financing decarbonisation. At the same time, market distortions from policy support schemes should be minimised.

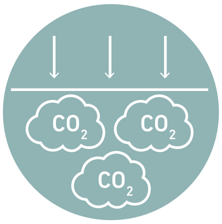
Ensuring the market effectively values energy, flexibility and capacity.

Market integration must be achieved and cross-border capacity must be used efficiently to fully integrate high shares of renewables.

ACTION **NOW**

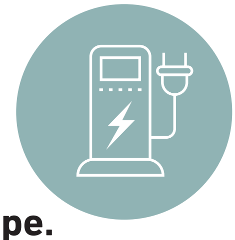
Whilst a framework provides the enabling conditions for electrification to thrive in the two target sectors, EURELECTRIC believes there are concrete actions that can be undertaken right now to foster the penetration of electricity as an energy carrier.

For transport



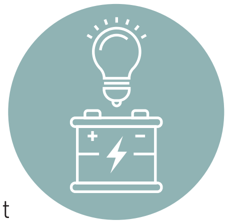
Implementing strict and coherently tested emission standards for light duty vehicles and heavy duty vehicles, as well as separate targets for the take up of zero emission vehicles.

As road transport emissions must fall sharply to achieve the decarbonisation objectives, the EU needs ambitious CO_2 emission standards to drive the decarbonisation of transport, backed by sound testing methodologies.



Ensuring sufficient charging infrastructure for electric vehicles is in place across Europe.

By encouraging Member States to facilitate the roll-out of sufficient public charging points (via the Alternative Fuels Infrastructure Directive) as well as making it as easy as possible for private parties to install their private charging point (via the revised Energy Performance of Buildings Directive).



Tapping into the potential of smart charging.

Smart charging offers significant benefits both to the electricity system as well as to the final customers. DSOs should receive appropriate incentives to procure and use such localised system management opportunities.

* Their significant advantage lies in the fact that they do not rely on social refinancing through the energy bill. Examples such as Energy Performance Contracts allow contracting customers to be provided with the planning, financing and installation of energy efficiency measures (technology and/or refurbishment) without the need to take on debt. Furthermore, standardising processes in public financing would help lower the burden for interested customers. Public financing institutions play a vital role in those sectors where private investments remain low due to market failures. They usually offer long-term financing which work towards desired policy goals. They do this while being unaffected by economic cycles which would otherwise slow investments.

For heating/cooling

Updating the methodology for calculating the Primary Energy Factor (PEF)

to recognise that electricity is increasingly coming from renewable and low carbon sources. Specifically, factors of 0 are needed for RES and 1 for nuclear sources.

Allowing for flexible ways through which EU Member States can reduce their energy demand.

Various tools in existing legislation allow each Member State to tailor its approach to individual circumstances. It is important to strengthen this toolset in the reviews of both the Energy Efficiency Directive and Energy Performance of Buildings Directive.

Closing the energy efficiency financing gap by encouraging private investment in technologies

(such as heat pumps etc.). The European power sector is convinced that non-economic barriers in financing need to be addressed at the EU level. In this regard, there is a clear need to revise the way in which investments in energy efficiency are being promoted. We advocate a much stronger development of innovative financing tools[47] such as Energy Performance Contracts* and the standardisation of processes in public financing in order to attract more interest and lower the burden for potential investors.

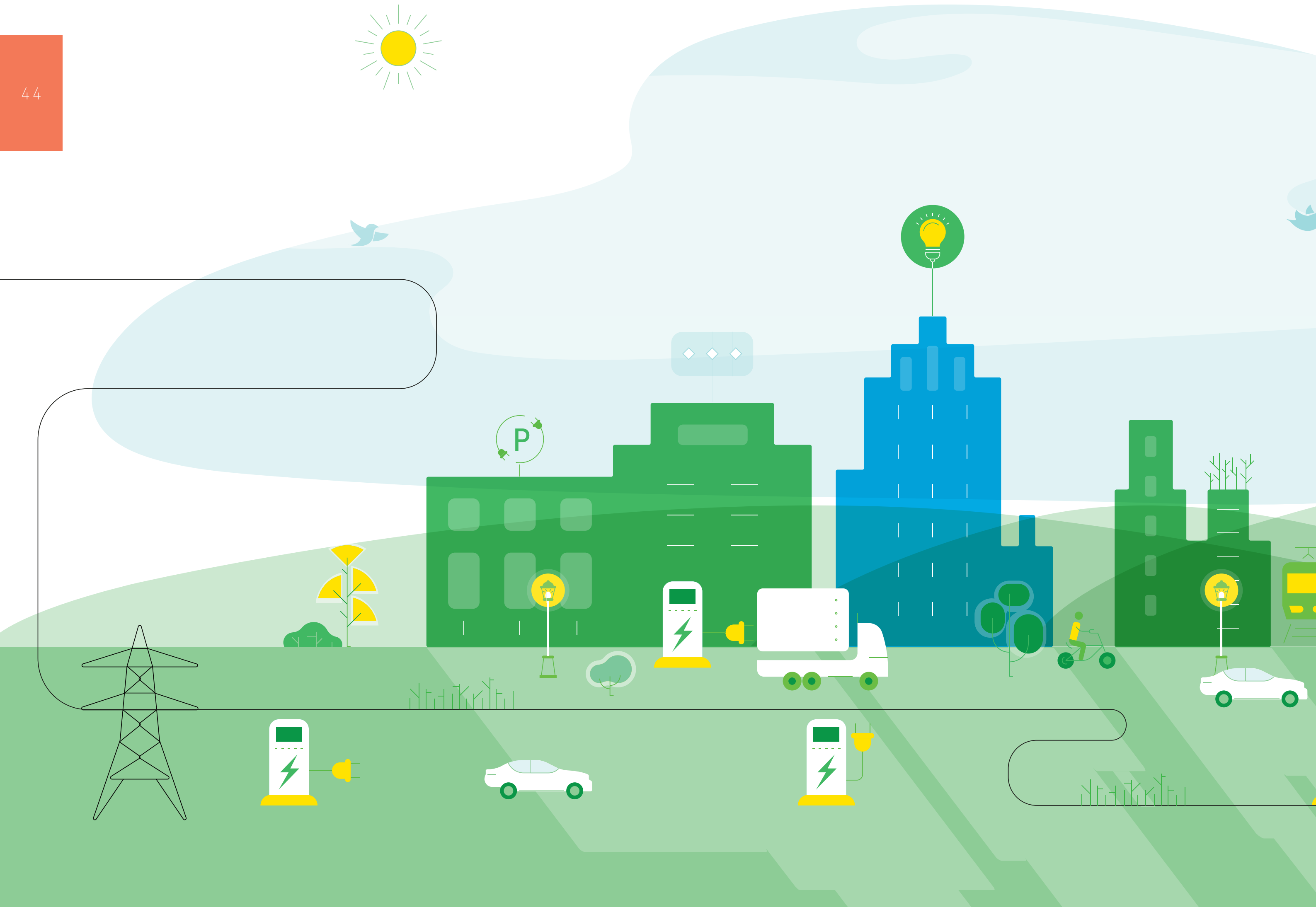
A WINNING STRATEGY **FOR EUROPE**

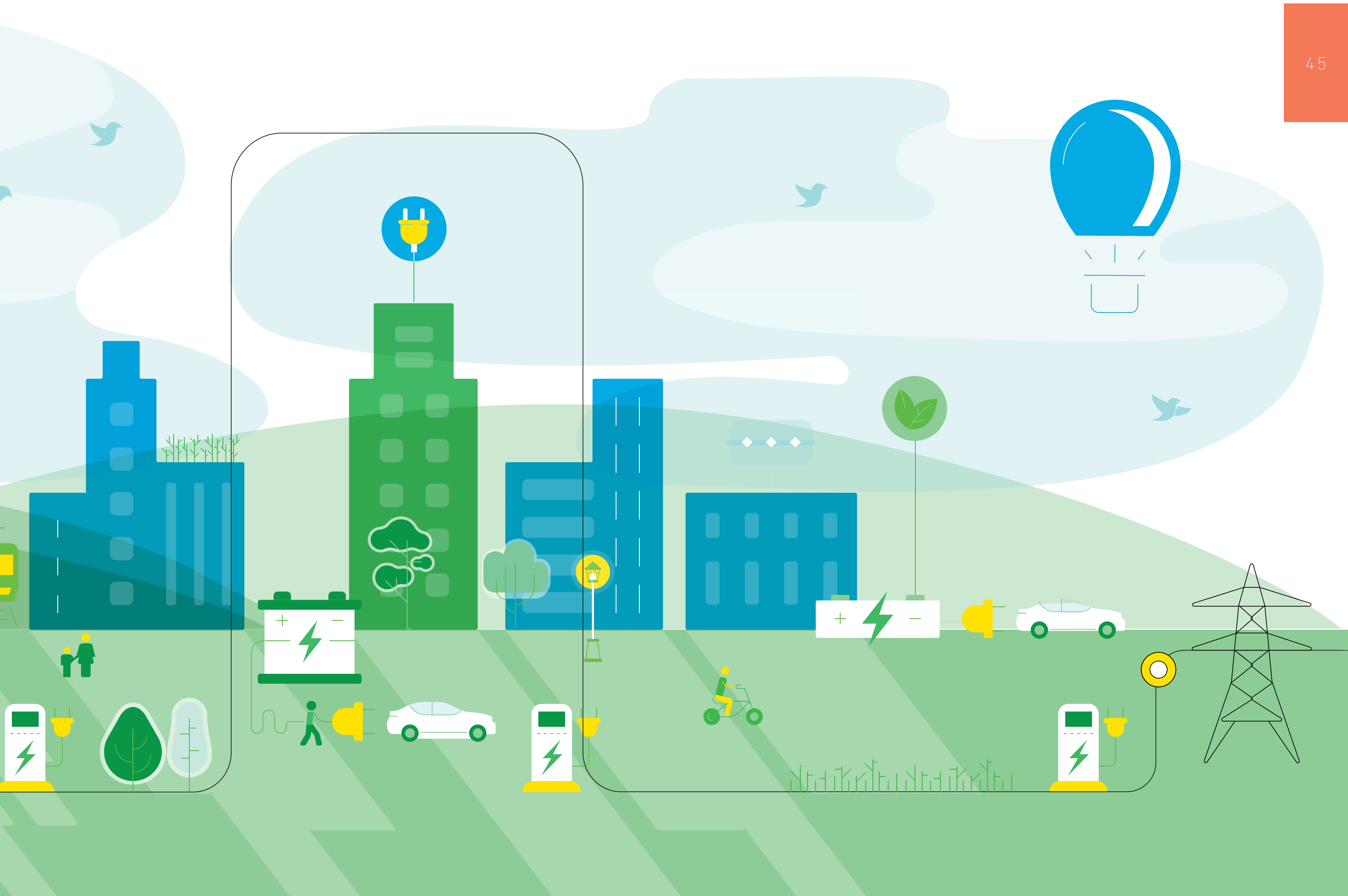
Electrification is a winning strategy for Europe. It will add value to everyday lives of European citizens whilst it fully supports and pursues the EU's key decarbonisation objectives. Cost-effective decarbonisation is crucial if Europe is to remain competitive in the global market place.

Electrification is the right policy choice to protect citizens from the potentially devastating consequences of global climate change as well as reducing the susceptibility of European economies to key energy resource availability and pricing on global markets.

Noise and air pollution in Europe's urban centres and associated health risks will be significantly reduced if conventional vehicles and heating systems are replaced by electrified systems.

Electricity has allowed European economies to develop and make available the comforts of a modern lifestyle which all European citizens enjoy today. With a commitment to the electrification of the European transport and heating/cooling sectors, citizens of the Union can expect a fundamental improvement of their living standards into the future.





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