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Electrification Action Plan

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March 2024

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Introduction:

Decarbonisation through electrification – why we need an EU Electrification Action Plan now.

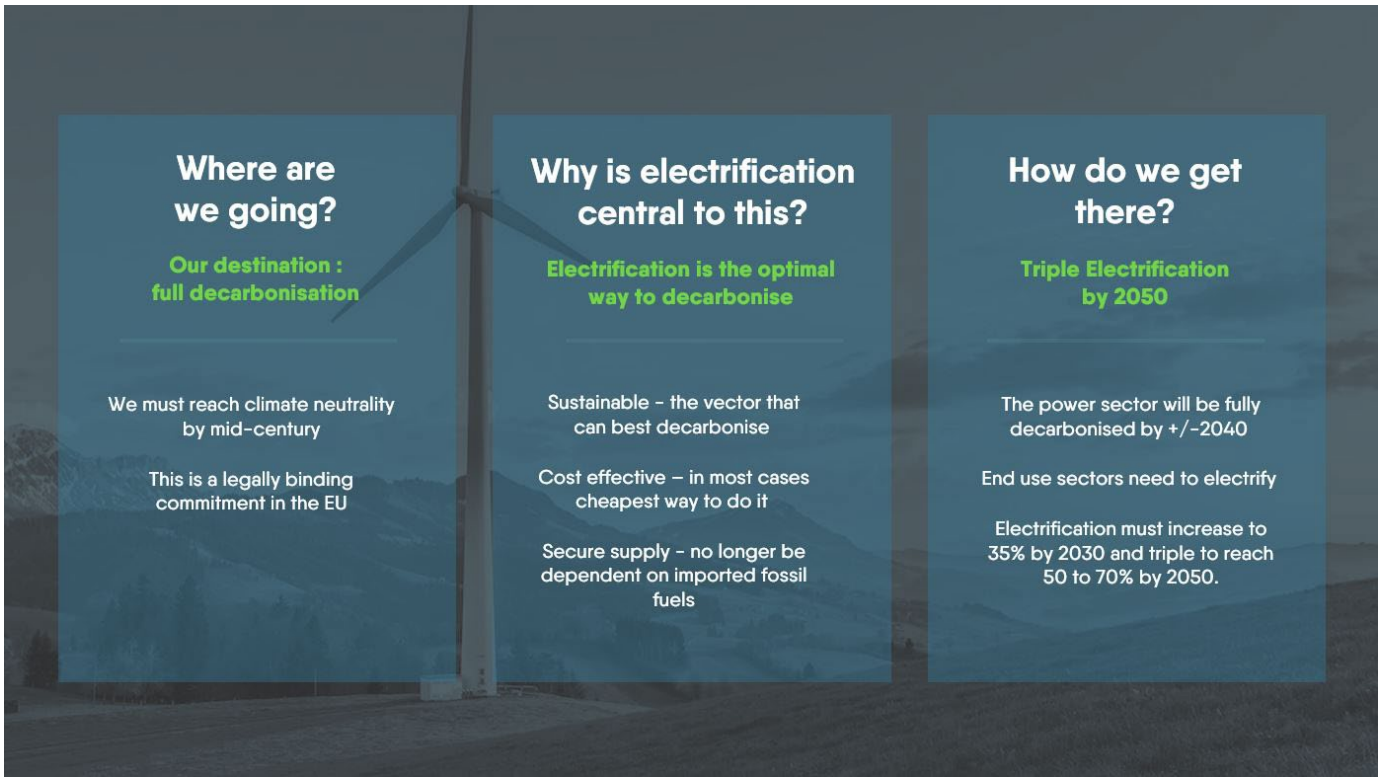
Electricity makes up only 23% of all the energy consumed in Europe. This means that while we are working hard to decarbonise electricity, large parts of the economy are still running on fossil fuels. If we are to have any hope of achieving our climate and energy policy, we need to ramp up electrification as quickly as possible. This electrification choice is also a no regret option for energy efficiency. Deploying heat pumps, for instance, could reduce energy demand by two-thirds. All modelling shows the rate of electrification will need to reach around 50% up to 70% by 2050 for Europe to reach climate neutrality, according to our *Decarbonisation Speedways* study. In the medium term, to achieve our REpowerEU ambitions, we need to already reach 35% by 2030. Europe must set both the right milestones and a clear plan to deliver that trajectory.

Therefore, we ask policymakers to:

- **Reinforce governance with an EU Electrification Action Plan** – Publish an Electrification Action Plan (EAP) the first 100 days of the coming mandate with the building blocks outlined in this file to guide policy makers. This should set an indicative target of 35% electrification of final energy use across the EU by 2030. In addition, an electrification indicator in the national energy and climate plans (NECPs) to monitor and deliver progress should be introduced.
- **Showcase the true value of electricity** – Continue efforts to relieve the electricity price of taxes and levies to create favourable economic conditions for consumers to switch from more carbon-intensive energy carriers.
- **Increase awareness of electricity's cost saving potential** – Acknowledge that our exposure to volatile fossil fuel imports from external sources is coming with a massive yet avoidable cost: the positive impact of large-scale electrification with clean domestic power generation on security of supply should be duly considered as a saving in the mid to long term, rather than just an expenditure.

This EAP serves therefore as a guidance for dedicated policy proposals to let electrification play its required role in the energy transition and guide EU Member States in successfully implementing provisions from the European Green Deal and the REpowerEU legislation with decarbonisation and electrification at its core.

The EAP is also not an end in itself: further analysis is needed to better understand the effects of an increased share of electricity in certain sectors of the economy with due recognition of sector specific differences and starting points in decarbonisation of the various EU Member States.



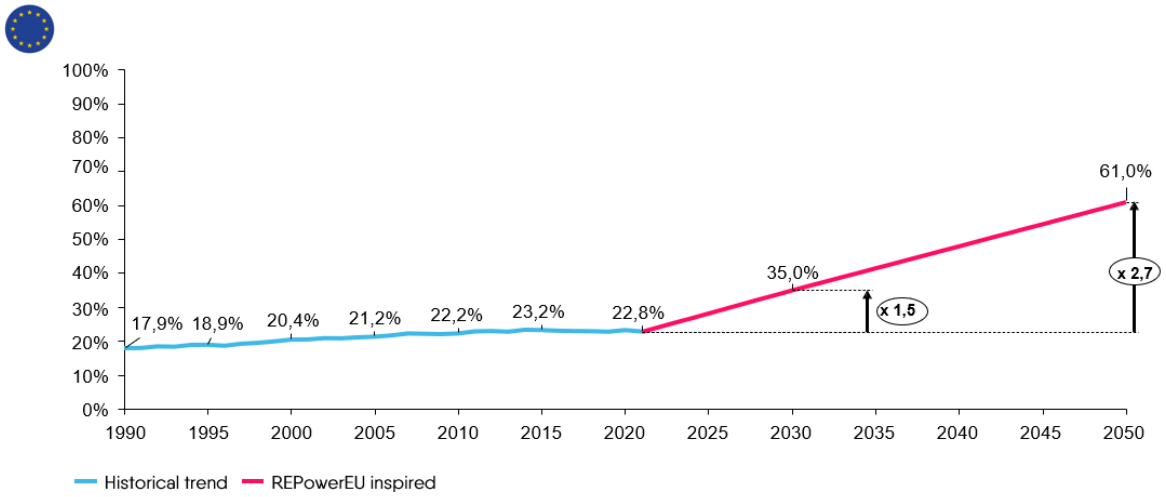
1. Electrification trends in the EU and problem definition

Electrification trends: at a glance

- Overall: In the EU, electrification stagnated around 23% during the past decade which should increase up to 35% by 2030, according to the EU's REpowerEU scenarios and substantiated by the Eurelectric *Decarbonisation Speedways* study. Most of the prospective studies for achieving carbon neutrality show an increase in the rate of electrification between 50% and 60% and up to 70% in some cases in Europe. In the updated 2023 *Net Zero Roadmap* report by the IEA, a target of more than 50% is expected in 2050 worldwide.
- At sectoral level: the almost flat trend for electrification rate is common to all end-use sectors in the EU, see also subsequent graphs.
- At national level: electrification rates have similar evolution patterns among EU countries, however, there are country-specific differences, as for example in Eastern European countries with regards to heating. Analyses show growing electrification in industry overall, while there is a decreasing trend in commercial/public buildings such as in Southern Europe, see also subsequent graphs.

Electrification trends: problem definition

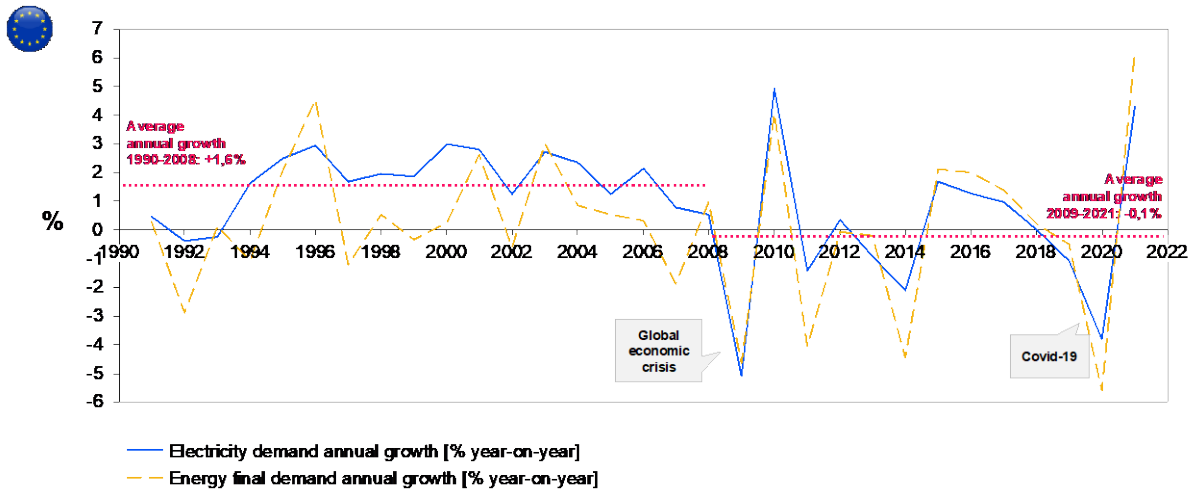
The analysis of historical energy trends reveals that the electrification rate within final energy uses stayed almost flat during the last decade. After a gradual but continued increase since the 1990s, electrification rates stagnated at around 22%-23% in the last five years. Looking forward, in the vast majority of scenarios the EU energy transition calls for a significant increase in electrification, leading to 35% by 2030 and 61% by 2050 (according to the REpowerEU, the recent 2040 greenhouse gas [GHG] target Communication as well as Eurelectric's *Decarbonisation Speedways* projections.)



Source: Eurelectric *Decarbonisation Speedways*

The evolution of absolute electricity demand in Europe is impacted by global dynamics. A deeper investigation shows that, after a +1,6% annual average growth in the period 1990-2010, the electricity demand increase halted after the global crisis in 2008 and the following geopolitical shocks and the COVID-19 pandemic.

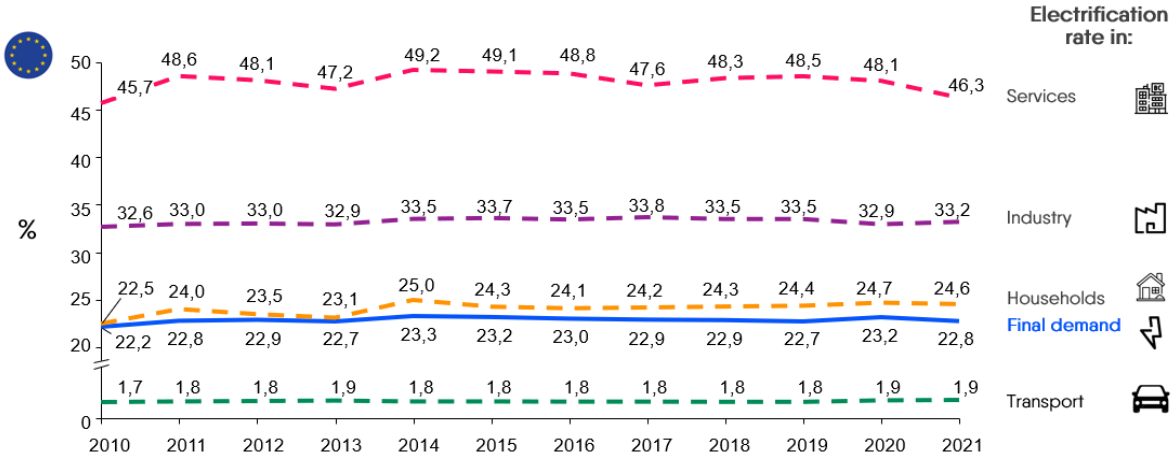
Electricity demand annual growth in the EU



Source: Eurostat

Looking both at sectoral level and national level, the almost flat trend for electrification rate is common to all end-use sectors and countries. Despite different national starting points and depending on specific sectors, the electrification rates experienced a similar evolution pattern.

Electrification rate trends at sectoral level in the EU



Source: Eurostat

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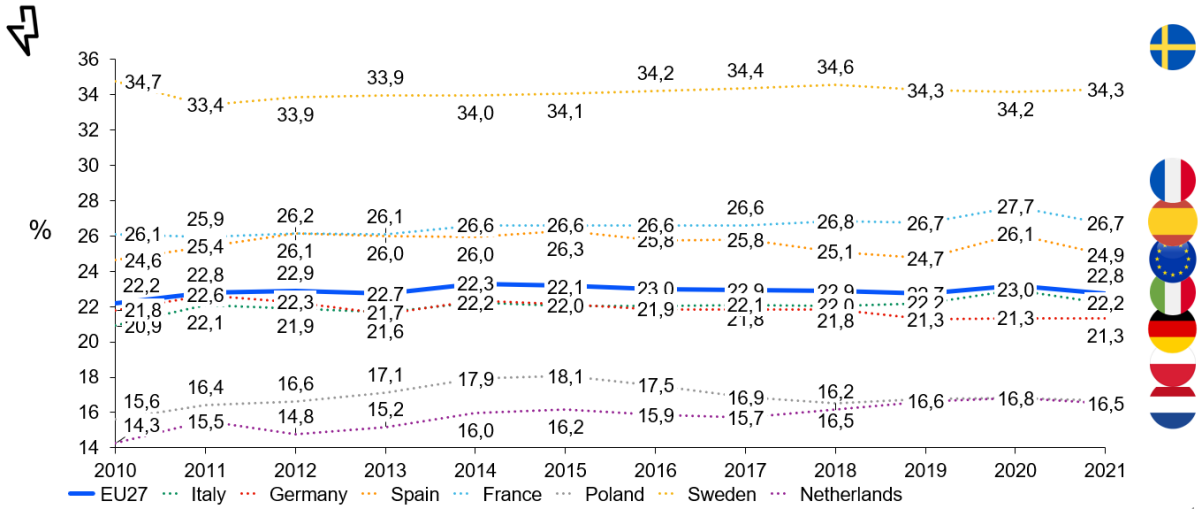
Electrification rate trends in the EU's major economies

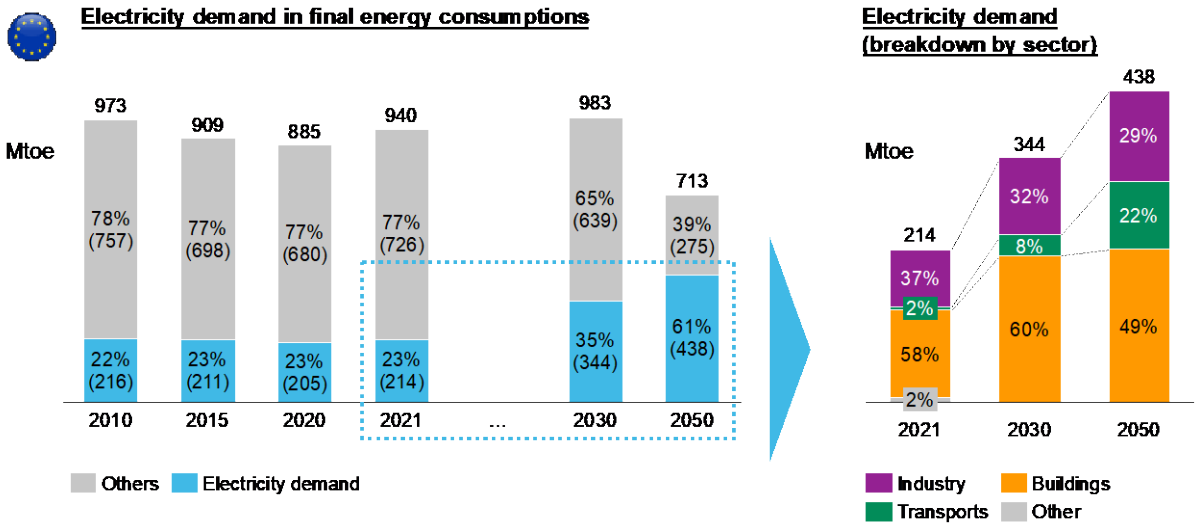


Source: Eurostat

Despite encouraging signals in 2022, the pace of adoption for electric vehicles (EVs) and heat pumps needs to increase three to four times in order to meet 2030 goals. Latest projections see the electrification rate growing from the current 23% to 35% by 2030 and 61% by 2050. It is expected that buildings and industry will drive the growth by 2030, while transport will follow this trend steadily in the following decades by 2050.

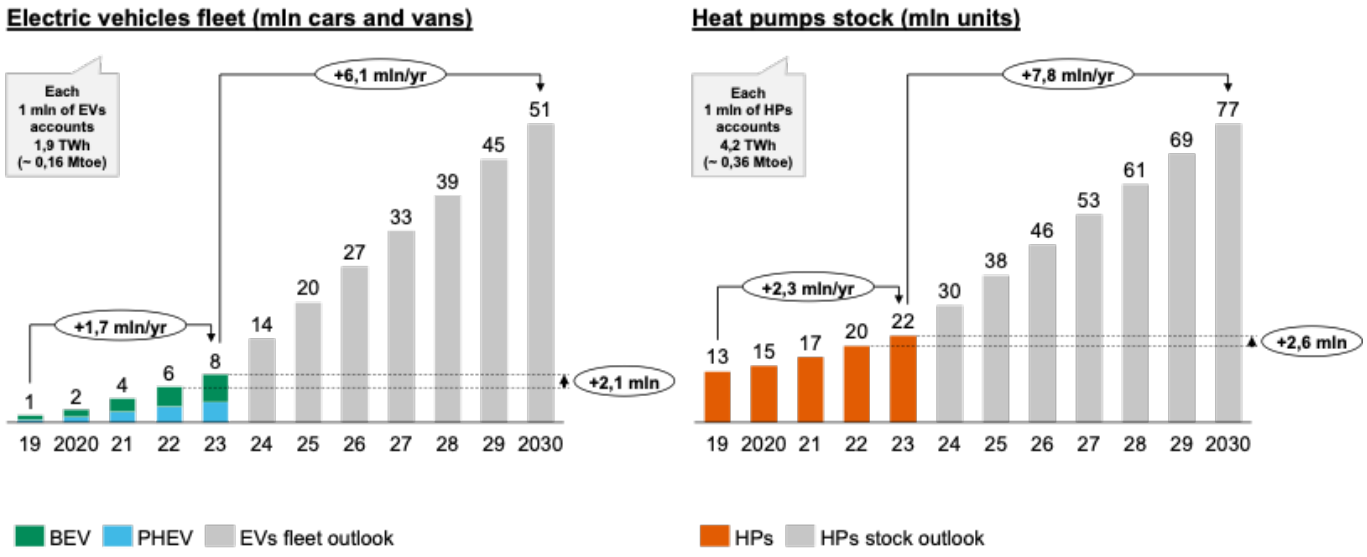
In terms of impact on electricity demand, it is estimated in the Eurelectric's *Decarbonisation Speedways* study that each additional 1 million EVs will account for 1.9 TWh (~ 0.16 Mtoe), while each additional 1 million heat pumps will account for 4.2 TWh (~ 0.36 Mtoe). However, these estimates need to be put in context of overall savings on primary and final energy demand, making direct electrification the most energy efficient solution for decarbonising road transport and residential heating in most cases. See also case studies below.

Electricity demand outlook in final sectors



Source: historical data from Eurostat, outlook from Eurelectric *Decarbonisation Speedways*

Technology adoption trends and outlook



Source: Electric vehicle estimations from EAFO, heat pumps from EHPA as well as Eurelectric *Decarbonisation Speedways*

2. Barriers to Electrification

2.1 The case for electrification and general barriers

Even if not yet at the speed required for a cost-efficient energy transition, electrified solutions are already changing our daily lives. There are numerous successful examples where electrification has provided considerable benefits in personal or professional use, depicted in the subsequent case studies:

Case Study 1 - electrified vs gas/oil-based household

The potential monthly savings of an electrified household has increased under the spike price scenario compared with the pre-war scenario on average in the EU. This is mainly due to the increase in gas prices with the specific weight of heating in savings increasing relative to that of transport. Still, consumer choices with regards to decarbonised solutions are in many cases not economically evident, mainly due to incoherent and insufficient incentives and an ongoing energy taxation policy which often favours gas over electricity use.

Pre-war prices (Q1 2021)

Monthly savings	Heating	Cooking	Transport
78 €	28%	-3%	75%

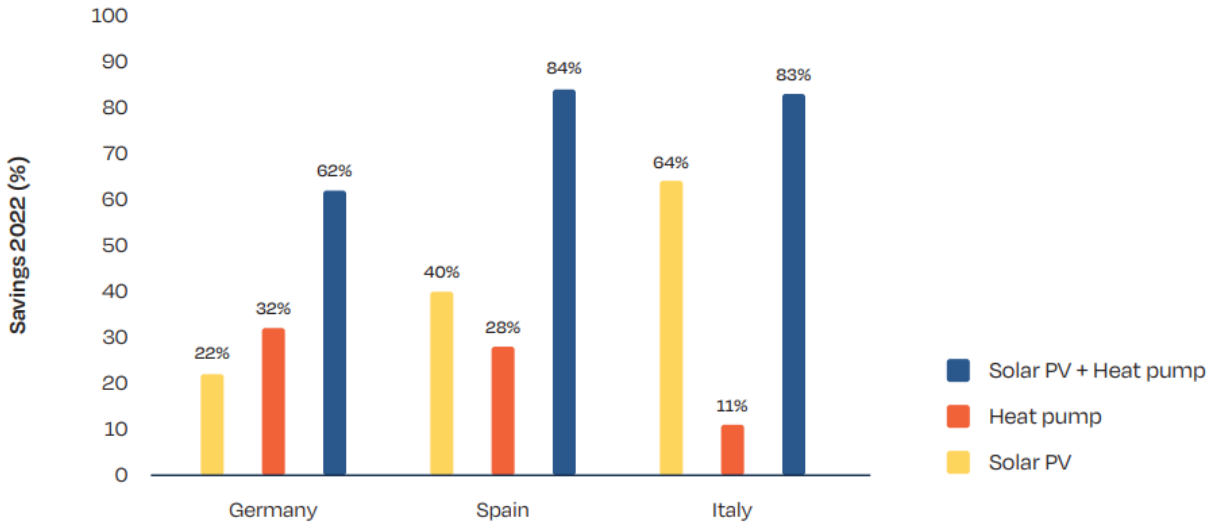
Spike prices (Q3 2022)

Monthly savings	Heating	Cooking	Transport
149 €	54%	-1%	45%

Sources: Calculations by Enel based on average EU household demand and public data; assuming full electrification of a household based on oil (private transport) and gas (heating)
Notes: The percentage shows the contribution of each energy use to the overall monthly monetary savings from full electrification of an average household. Negative values imply extra expenditure.

Case Study 2 – combined electrification technologies and distributed generation

According to a recent SolarPower Europe Study, residential owners of a solar photovoltaic (PV) system and a heat pump in Germany, Spain or Italy would have decreased their energy expenses by up to 84%. The report further provides ten case studies from actual homes across European countries applying an array of electrification solutions to meet their daily energy demand needs for heating, cooling and transportation (including heat pumps of different kinds, e-mobility, battery storage and solar PV). They show positive monetary savings in all cases as well as overall satisfaction of owners from having detached themselves from fossil fuels while securing their energy supply thanks to electrification both from on-site resources and from the grid.



Annual Energy Bill Savings in % for Households with Different Power & Heating Technologies in Germany, Spain, Italy in 2022.

Source: *Solar Powers Heat Report* 2023, SolarPower Europe, Avere and EHPA

Case Study 3 - electrification cost Benefit analysis for heating: case of Ireland

In Ireland the Sustainable Energy Authority Ireland conducted a *National Heat Study*. It examined four decarbonised scenarios of heat which achieve net zero by 2050.

1. **Decarbonised Gas** - weighted towards green hydrogen use, carbon capture utilisation and storage (CCUS) infrastructure or bio-derived gases, or both, coupled with domestic and commercial fuel switching to green hydrogen or bio-derived gases, or both.
2. **High Electrification** - weighted towards electrification, coupled with minimal amounts of bio-derived gases, CCUS and green hydrogen.
3. **Balanced** - Progresses steadily and comprises a mix of cost-effective deployment of low-carbon technologies (electricity, bio-derived gases, green hydrogen).
4. **Rapid Progress** - Accelerated progress, driven by policy targets; all low-temperature applications are quickly electrified, while bio-derived gases are prioritised for industry sites.

The study compared these with the Baseline, business-as-usual scenario where all sectors continue to use carbon-intensive practices which does not achieve net zero by 2050.

Three of the four decarbonised scenarios have a lower net present cost (NPC) compared to the Baseline scenario. The shadow cost of the additional emissions produced in the Baseline scenario is the primary driver of the higher costs. The costs of the High Electrification scenario are 6.3% lower than the Baseline scenario, with the Balanced and Rapid Progress scenarios showing total discounted costs that are 1.4% and 0.3% lower. The Decarbonised Gas scenario has the highest cost of all the energy systems, 4.5% higher than the Baseline scenario.

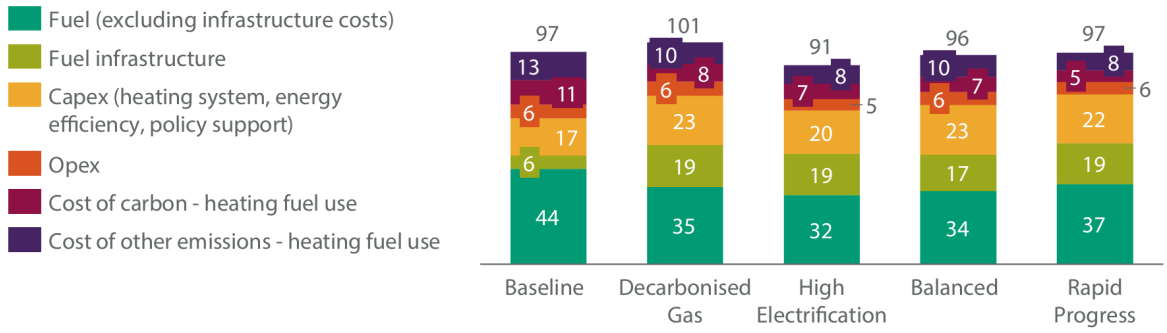


Figure 13: Economic Cost-Benefit Analysis (CBA) – summary of net present costs (€bn) across scenarios

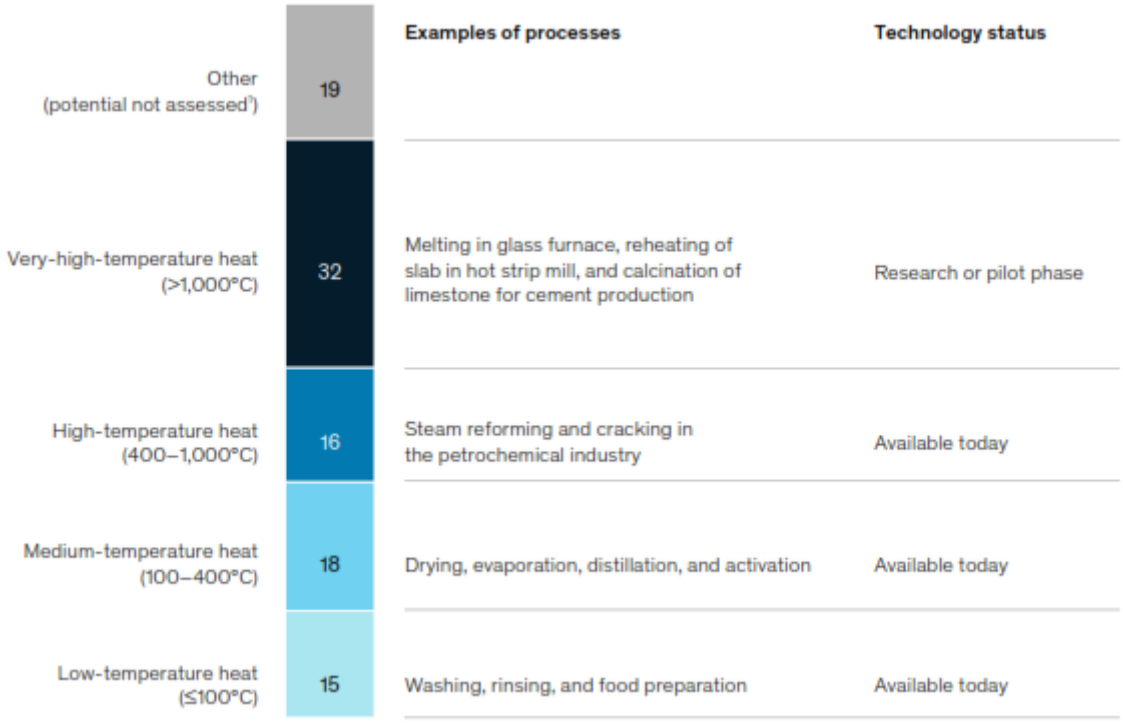
Case Study 4 – potential of electrification in industrial processes

As shown by the study undertaken by McKinsey, of all the fuel that industrial companies use for energy, the estimation is that at least 50 percent could be replaced with electricity, using technologies available today, see also graph below. This includes all energy required to generate heat for industrial processes up to approximately 1,000 degrees Celsius. Electrification of industrial processes that require heat up to approximately 1,000 degrees Celsius does not require a fundamental change in the industrial process setup, but rather a replacement of a piece of equipment, such as a boiler or furnace, running on conventional fuel with a piece of electric equipment.

Up to a heat demand of approximately 400 degrees Celsius, electric alternatives to conventional equipment are commercially available. Electric heat pumps for low- and medium-temperature heat demand and electric-powered mechanical vapor recompression (MVR) equipment for evaporation are already used on some industrial sites. Electric boilers that can generate industrial heat up to approximately 350 degrees Celsius are widely available.

The maturity of electrical equipment determines what processes can be electrified. The pace at which electric technologies for very-high temperature industrial processes such as steel and cement production are developed and proven at scale will dictate when they can be applied widely on industrial sites.

Share of total estimated fuel consumption for energy in industry, in %



Source: *Plugging in: What electrification can do for industry,* 2020, McKinsey

Case Study 5 – opportunities of heat pump roll-out

The 2023 study by the Joint Research Centre calculates that replacing 30 million existing gas and oil boilers with heat pumps and implementing partial building envelope renovations by 2030 would result in a 36% reduction in the total final energy consumption of gas and oil in those buildings. This reduction corresponds to 348 TWh of energy saved for residential space heating for the scenario of approximately 40% of the installations involving a switch to a heat pump without any improvement in envelope efficiency, while more than 60% of the heat pump installations, including those replacing gas and oil boilers, are accompanied by building envelope renovation.

In the EU, Germany would reduce its gas and oil usage the greatest in absolute terms, with a potential saving of 125 TWh. That is followed by France with 50 TWh, Italy with 48 TWh, Spain with 22 TWh and the Netherlands with 18 TWh.

Figure 9. Running costs for gas and electricity for single-family houses located in Austria, Italy and the Netherlands

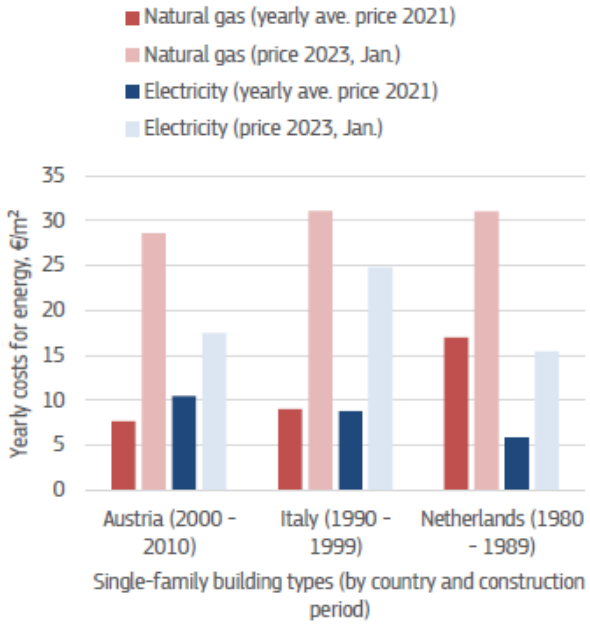
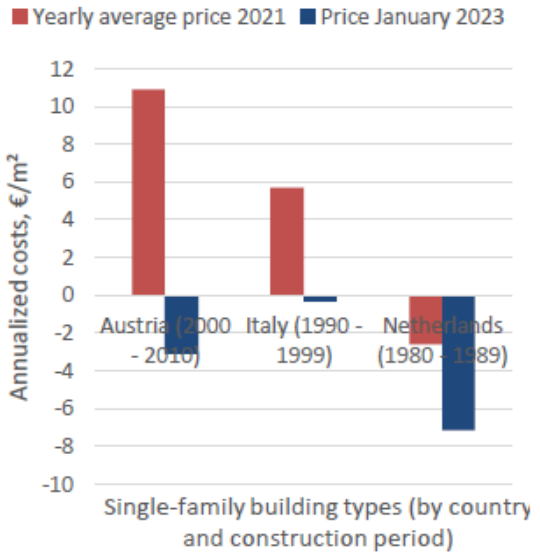


Figure 10. Total early average costs from switching from gas to heat pump (including savings on energy and investment cost)

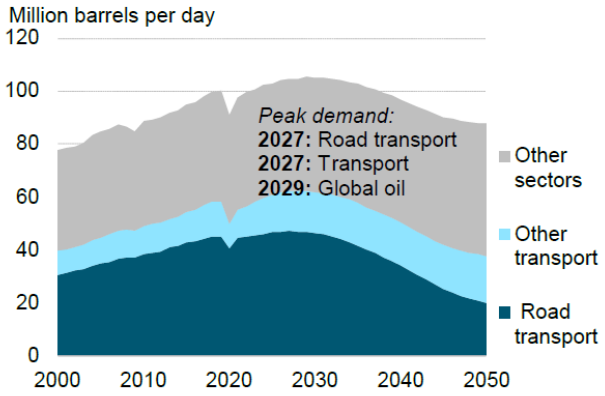


Case Study 6 – e-mobility and avoided oil consumption

Electrified transportation is quickly becoming a staple on European streets. As shown by BloombergNEF, direct electrification via batteries is the most efficient, cost-effective, and commercially available route to fully decarbonising road transport.

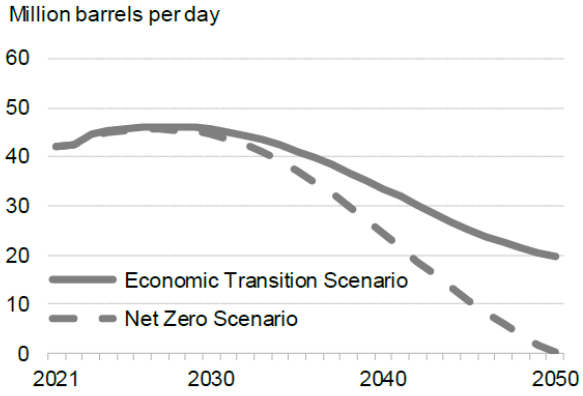
Electric vehicles of all types are already displacing 1.5 million barrels/day of oil demand. This rises dramatically in the years ahead, leading to a peak in overall road fuel demand in 2027. Demand in the US and Europe has already peaked, while demand in China is set to peak in 2024. Global oil demand from two-wheelers, three-wheelers and buses has also already peaked and demand from passenger cars is set to peak in 2025. Commercial vehicles take longer to shift as heavy trucks continue to rely on diesel to move booming freight demand.

Figure 8: Global oil demand – Economic Transition Scenario



Source: BloombergNEF. Note: Includes biofuels.

Figure 9: Oil demand from road transport by scenario



Source: BloombergNEF. Note: Includes biofuels.

Source: *Electric Vehicle Outlook 2023*, BloombergNEF

Even if successful cases of electrification are numerous, so are the barriers that are preventing electrification from playing its role in the energy transition. Such barriers act at both transversal and sector specific level, and often prevent citizens and businesses from switching to cleaner solutions, either due to the complexities implied, to the risks assumed in changing their energy supply solutions or both.

General Barriers

Technology

General barriers related to the technology for electrification solutions imply more aspects than just the actual performance of the technology itself. In some cases, users may not fully perceive the benefits from electrifying their energy needs, while outdated assets such as aged buildings with insufficient cable capacity and obsolete

transport systems with outdated infrastructure may pose challenges in terms of integration and interoperability of new technologies.

Energy efficiency is often still perceived as strictly related to insulation and operational efficiency rather than to fuel switch savings. Aversion to change is another relevant issue, where installers and businesses may perceive electrification as a commercial risk instead of an opportunity for increased shared value. Finally, some electrification solutions struggle to appeal to consumers, as they may not look as attractive and accessible as other mass market products, even if their economic and lifestyle returns may be larger.

Main technology barriers for electrification:

- Untapped potential of electrification benefits to consumers and lack of users' expertise and habits, paired with a lack of public support and perception of low investability/profitability
- Challenges related to energy system integration, complexity and interoperability
- Skills gap, supply chain tightness in some instances often paired with a negative perception and lack of information from sectors
- Ongoing implementation and R&D support of short- and medium-term innovations in market products
- Lack of fully operational large-scale demonstration and reference projects directly applicable in households, services, public buildings and industry

Infrastructure

The lack of adequate infrastructure poses a principal barrier for electrification. Even if reliable, and in most cases is fit for purpose to date, the state of European grids is becoming a bottleneck for electrification, particularly when taking into account new technologies and the changes in prosumers behavior. Grid congestions are increasingly jeopardising the capacity to manage new connection requests, and the infrastructure is often not smart enough to deal with the challenges placed by the digitalisation of energy consumption and self-production. Moreover, despite the capacity of electrical solutions to be controlled, demand-side flexibility and equipment control are still poorly developed.

Main infrastructure barriers for electrification:

- Capacity issues with the electricity grid including long lead times for grid connection
- Lack of large-scale rollout of digitalised infrastructure solutions and system integration
- Lack of focus on power grid investments as gas – and now also carbon capture and storage (CCS) – infrastructures are competing for available EU infrastructure funding, see e.g. TEN-E programme

Economic/Financing

EU citizens and businesses are already under economic pressure due to the increase of their energy bills. Even though emergency measures were adopted, energy prices soared as consequence of geopolitical and socio-economic contexts. Energy prices in European markets have not yet gone below pre-pandemic levels and global projections foresee that they will not recover such levels in the near future. The result is that citizens and businesses often lack the financial resources to face energy-related investments and continue to struggle with insufficient energy savings and steep bills.

Uneven taxation and continued subsidies to fossil fuels continue to be part of the problem. According to the European Environment Agency, EU fossil fuel subsidies remained at considerable levels of about €56 billion (2022 prices) over the period 2015-2021, constituting a main barrier for the transition as well as providing misleading incentives to the public. Furthermore, renewable energy source (RES) surcharges are often levied only on electricity and not on other energy carriers.

Main economic/financing barriers for electrification:

- Poor economic indicators paired with continuous subsidies and support schemes for fossil fuels
- Lack of access to finance including lack of information on available financing options
- Split incentives dilemma for both energy efficiency and electrification investments, implying that the subject ultimately responsible for carrying out investments on electrification is often not the main beneficiary of the energy and monetary savings to be made from that intervention
- Inadequate tariff structure and energy taxation frameworks which still favour fossil fuel over electricity use
- Insufficient implementation of the energy and climate efficiency first principle in policy frameworks

2.2 Sector specific barriers – transport

The electrification of EU transport faces several barriers that range from the current level of EV market maturity to the insufficient deployment of e-mobility infrastructure up to perception issues. The number of EV models available in the market is still way below other options, and often does not cover all segments and consumers appeals affordably. Given that the introduction of EVs in European markets is recent, the availability of used vehicles - something of uttermost relevance for consumers with low purchase capacity - is still very limited. EV ranges and charging times are still not comparable to traditional vehicles, and the upfront cost of an EV is higher than of an

internal combustion engine (ICE) vehicle, as manufacturers have to still cash in the large investments in the manufacturing value chain in recent years.

Main barriers for the electrification of transport:

- Vehicle battery capacities and charging speeds still improvable across the available EV portfolio.
- Charging infrastructure rollout, especially in Eastern Europe, as well as grid capacity issues, particularly for HDV charging
- Lack of rollout of digitalised infrastructure solutions including data interoperability, as well as increased integration with smart technologies and vehicle-to-X (V2X) to better manage energy demand.
- Higher purchasing price for EVs compared to ICE vehicles as well as insufficient number of second-hand vehicles on the market which can drive prices down
- Lack of a truly European value chain and high dependency from imports from outside the EU, such as on batteries and other components

2.3 Sector specific barriers – buildings

Technology

The buildings sector is characterised by considerable inertia and lengthy lifetime of its assets. Changes often occur slowly, and once installed, technologies often stay in use for decades due to design issues and challenges that adopting deep energy renovations pose. Barriers include elements related to the lack of users' expertise, their attitudes and habits, restrictions in installers' skills and delivery portfolio, challenges in integration and complexity, and lastly, high upfront costs of renovations as well as insufficient and ever unstable incentive frameworks.

Main barriers for the electrification of buildings:

- General lack of an EU-wide policy framework for a transition to decarbonised and electrified heating and cooling. The Energy Performance of Buildings Directive (EPBD0 is, despite its recent revision, a Directive requiring adequate implementation at Member State level which is often not the case. Moreover, there are inadequate criteria to evaluate buildings' performance, e.g. the focus of the EPBD is on reducing the primary energy consumption rather than on emissions reduction
- Insufficient offer of adapted solutions for certain sub-sectors, especially in multi-family buildings including architectural and technical constraints as well as a lack of related demonstration projects
- A large range and variety of available technologies leading to complex information and lack of awareness for consumers. Generally, there seems to be a lack of information and promotion of available and efficient electric solutions for heating and cooling

- Limited installation capacity combined with current supply chain and manufacturing limitations. Long waiting times and lack of trained personnel to execute the installations
- Slow pace of renovations across Europe and very high number of old and inadequately insulated buildings – especially in Southern and Eastern Europe
- Lack of digitalised grid solutions rolled out to alleviate congestions and accelerate electrification of buildings paired with insufficient development and promotion of energy management equipment to facilitate demand side flexibility
- High upfront costs for electrified solutions such as heat pumps. This is combined with persisting subsidies for standalone fossil fuelled boilers across the EU as well as for other technologies using fossil energy and lack of sufficient financing incentives for heat pumps, paired with a lack of stability and consistency of incentive mechanisms for decarbonised heating solutions
- A delayed EU Heat Pump Action Plan by the European Commission that would boost the rollout of heat pumps and remind Member States about the importance of higher ambition is creating further insecurity for the sector.
- Economic challenges with decarbonisation of large-scale district heating systems, as available options are either not economically viable yet or might suffer from feedstock shortages, such as in the case of biogas
- Organisational, as well as cultural barriers which imply complex and long decision-making processes (in co-owned buildings for example) when investing in sustainable solutions. Habits, low acceptance levels and lack of knowledge of possible cost-savings are further obstacles
- High electricity primary energy factors (PEF) which are often two to three times higher compared with fossil fuels putting electricity solutions at a disadvantage. Lower PEF values for renewables and a specific PEF for electricity would in turn incentivise cleaner energy use, ideally paired with periodic adjustments reflecting technology advances and considering energy storage impact

2.4 Sector specific barriers – industry

European industries face substantial barriers to electrify their operations. Cost-competitive electric technology applications are needed to enable further electrification of industry. There are different mature technologies to electrify industrial processes and industrial heat. Industrial heat pumps can be a viable option for low and medium temperature heat needed in many industries, including pre-heating for high temperature applications, if the right regulatory frameworks are in place. Electric boiler, electric furnace, mechanical vapour compression also exists and are mature technologies that could develop within an appropriate regulatory and incentive framework.

Main barriers for the electrification of industry:

- Lack of advanced and commercially viable technological solutions for the electrification of heavy-duty industry with high-grade heat requirements,

- Limited number of manufacturers for electrified solutions combined with a long lifespan of existing equipment, as well as a limited number of existing examples
- Higher upfront costs for electrified solutions such as electric arc furnaces, as well as induction and resistance furnaces that apply generally in the metallurgical sector, both on the captical expenditure (CapEx) and operating expenditure (OpEx) side. Need of bespoke designs instead of standardised and replicable solutions
- Carbon pricing and related EU policies do not seem to incentivise a faster pace of decarbonisation for heavy industry as seen in the stagnant electrification rates overview
- Lack of awareness of heat consumption in companies as well as more systemic solutions such as the consideration of large-scale use of excess heat from industrial processes for residential heating
- General lack and incoherence of incentive mechanisms for investment and exploitation of electric solutions in industry – industrial policy remains largely a national competence with little room for EU-wide frameworks. Existing EU-wide tools such as State Aid legislation with its General Block Exemption Regulation often lack focus on specific electrification solutions
- Insufficient knowledge and awareness regarding available technologies and their capabilities. Need for combined knowledge of both process and electrical technology.

3. Policy recommendations

Consumers, businesses and governments are all looking to become sustainable and use more clean and renewable electricity. This comes along with the urgent need to create jobs, reduce pollution, boost innovation and cut Europe's dependence on imported fossil fuels.

In the following sections, Eurelectric has identified and reviewed policy measures which could accelerate the uptake of electricity in final energy uses. The measures were then assessed in terms of their feasibility and ability to rapidly deliver emission reductions in final energy uses. The results were then used to assign a relevance level for each measure identified. Hereunder are the more overarching policy recommendations which could be derived from this work:

1) **Governance setting visible targets and measuring progress achieved in pursuing them - Introduce an indicative electrification target of 35%** of final energy use across the EU by 2030. This should be accompanied by an **electrification indicator** in the national energy and climate plans (NECPs) to monitor and deliver progress. This will send clear investment signals across the

energy supply chain, enable anticipatory investments in electricity grids and provide predictability in terms of the workforce needed.

2) Furthermore, the supply disruption at the scale experienced in 2022 has made our security of supply vulnerability due to fossil fuel imports painfully clear. In setting electrification targets, policy makers at both the EU and national level should therefore duly reflect on this exposure to volatile imports, not least with regards to potential cost savings in the future: the **positive impact of large-scale electrification with clean domestic power generation on security of supply** is immense and should be duly acknowledged in energy policy and related investment decisions.

3) **Market signals letting the electrification business case emerge by reflecting all costs and benefits - Remove any non-electricity related taxes and levies from electricity bills.** This will provide for transparency when comparing costs and create favourable economic conditions for consumers to switch from more carbon-intensive energy carriers. Also, generic policies supporting vulnerable consumers or urban waste management should not be paid through electricity bills, but through general taxation. By the same token, incentives for fossil fuel-based residential heating must be phased out as soon as possible and visible incentives for decarbonised and electrified heating solutions must be upgraded. Especially in building and transport support mechanisms aimed at reducing upfront costs of heat pumps ad electric vehicles should be complemented by a clear and reliable carbon price emerging from the ETS2.

4) **Competitiveness or allowing electricity to contribute to the industrial sectors' efficiency - Specific economic barriers need to be addressed when it comes to increased electrification of industrial processes as well as buildings.** We need adequate incentives for pilot projects to further reduce high upfront costs for some processes and tackle the general lack and incoherence of incentive mechanisms for investment and exploitation of electric solutions in industry, in particular. Existing EU-wide tools such as State Aid legislation with its General Block Exemption Regulation should take into account decarbonisation and electrification solutions for industry. Network codes on demand response should support DSOs in selecting the most economically efficient solutions for flexibility services through appropriate long term remuneration schemes.

5) **Bringing our infrastructure up to speed - Grid modernisation is a necessary precondition as it is a no-regret option,** especially at distribution grid level and in many constituencies long overdue: approximately one-third of the EU's distribution grids are already over 40 years old as proven by the Eurelectric *Connecting the Dots* study. We need to urgently invest in grids to be fit-for-purpose in an increasingly decarbonised, decentralised and digitalised power system. In light of a rapidly evolving context, specific policy measures should

promote an anticipatory grid build-out and an immediate reform of the TEN-E legislation to adequately include distribution grids.

6) **Implementation to ensure that planned legislation hits the ground** – A lot of EU legislation has been agreed but often not implemented adequately at Member State level, such as the Clean Energy Package (CEP) and the newly adopted Fit for 55 (FF55) package which would be essential to accelerate electrification. **Before adding on new legislative layers, proper delivery of existing ones should be assessed and prioritised.** To stay with the example of the CEP, its implementation would allow consumers to sign up for dynamic price offers or be rewarded for flexibility that they provide to grid operators which would ultimately untap the flexibility opportunities and further incentivise the use of electric heating solutions such as heat pumps. FF55 provisions should promptly be integrated into NECPs and national legislation, particularly with regards to permitting provisions.

7) **Awareness raising – Adequate levels of information and transparent comparison are key but often missing for consumers.** In many constituencies, consumers are simply not aware or even misinformed about true cost implications and available incentives when choosing between fossil fuel and clean electric heating or transport solutions. This needs to be alleviated and access to existing incentives for decarbonised and electric solutions be made as simple as possible, such as by reducing paperwork in the application procedure or by the provision of accessible and reliable comparison tools. Measures to be implemented should include communication campaigns, the creation of electrification observatories providing credible and unbiased information as well as promoting the necessary upskilling and reskilling programmes.

These specific policy measures are explored in greater detail in the table below. The full set of policy measures identified is presented in the Annex.

Measure	Details	Expected benefits
Governance of the EU Energy Union		
Set an indicative target of 35% electrification of final energy use across the EU by 2030 which could be expanded to 2035 and 2040 including a relevant trajectory	Electrification EU headline targets aligned with the EU-wide decarbonisation trajectory and scenarios including intermediate steps.	Predictability and stability for investors. Improved governance. Cost efficiency gains through increased electrification rates.
Require the EU to define (indicative) electrification targets at sector level	Electrification targets at sector level consistent with an overarching target.	Predictability and stability for investors. Improved governance. Cost efficiency gains through increased electrification rates.
Require Member States to include in their National Energy and Climate Plans and electrification indicator, with further breakdown of KPIs and targets on electrification	NECPs to contain trajectories on electrification of the economy and its sectors that can be monitored overtime, including the adoption rates of main technologies (EVs, Heat Pumps, solutions for low-medium temperature and high temperature in industries).	Certainty on the development of each sub-sector electrification and consistency with measures.
Ensure that technological neutrality in terms of decarbonised power sources is acknowledged in upcoming legislation to support electrification objectives with sufficient electricity production	A technology neutral approach in terms of encompassing all decarbonised power generation sources while taking into account regional/country related specificities regarding both variable RES as well as dispatchable generation such as hydro, nuclear and biomass.	An optimal and balanced mix of policy measures which acknowledges the different power generation portfolios in member states and ultimately faciltates a most cost efficient rollout of various decarbonised generation technologies.

Infrastructure fit for purpose		
Immediate reform of the TEN-E and the Ten-Year Network Development Plan processes encompassing both TSOs and DSOs and focusing on bottlenecks at both transmission and distribution grids	Prioritise cost-effective and energy efficient pathways and avoid inconsistencies with climate and energy targets and policies. The Commission should supervise the ENTSO's and the DSO entity planning to ensure consistency with overall climate and energy frameworks.	Better grid planning avoiding inconsistencies with energy and climate policies/planning, overlaps and stranded assets (eg. Continuing investments in fossil fuel relate infrastructure).
Introduce guidelines and specific regulations on regulatory incentives for anticipatory grid investments.	Guidelines or implementing acts to guide regulators and all stakeholders involved to establish adequate frameworks for such anticipatory grid investments.	Cost efficiency gains as limiting project development to those based on current system needs may increase the future system costs and hence costs for consumers.
Focus on implementation of existing electrification-related provisions		
Ensure that new provisions from the FF55 dossiers (eg. EPBD, RED, EED) are captured in NECPs through guidance and specific recommendations	Once the revised dossiers are enacted, the Commission should require Member States to integrate them in their national plans and strategies, in articular the NECPs.	Predictability and stability for investors. Increased electrification rates in buildings thanks to higher renovation rates, adoption of clean technologies; and in transport thanks to charging points requirements in buildings, public infrastructure, clean fuels.
Set economic incentives enabling electrification		

The ongoing revision of the Energy Taxation Directive should adopt measures to remove both direct and indirect tax exemptions to fossil fuels	Taking decisive action to cutting down harmful fossil fuel subsidies in any form is key to incentivise emissions reduction and boost budget revenues.	This can be achieved by removing disadvantages for clean technologies -including increasingly decarbonised electricity and heat pumps- and introducing higher levels of taxation for inefficient and polluting fuels.
Monitor and assess the success of the ETS2 for buildings and road transport in providing adequate market signals for fuel switching and social costs internalisation in the sectors covered	The Commission should adequately monitor the implementation of the ETS2 phases, ensure that emissions under scope are reported and supported by the required allowances, assess the overall functioning of the market and adopt recommendations and corrective actions whenever needed to ensure effectiveness of the mechanism	If the ETS2 price level is adequate, it should provide a strong market signal in favour of electricity vs fossil fuels, thus helping electrification and uptake of electrification technologies in the market.
Proceed with an EU-wide harmonisation of indirect cost compensation rules to ensure that sectors exposed to carbon leakage due to indirect costs are compensated equally regardless of the Member State where they are active in.	Ensure fair treatment and targeted support for industries that decarbonise their process via electrification. This measure could have a limited time-horizon (i.e. until the power sector is fully decarbonised by around 2040), and should also duly consider the risks of competition distortion in the internal market.	Increase the attractiveness of electrification for industrial consumers. Reduce differences with electricity costs incurred in non-EU jurisdictions. Support the decarbonisation of industries via electrification.
Adopt reduced VAT and duties for the purchase, maintenance and operation of heat pumps, electric vehicles and e-mobility infrastructure	Reduce upfront costs of HPs and EVs, and accelerate adoption of electrified solutions.	Reduce upfront costs of HPs and EVs and accelerate adoption.
Exceptions for State Aid to incentivise electrification (e.g. Cold Ironing exception for system costs)	Support to Member States in providing State Aid that may kickstart new successful business cases for electrification.	Help electrification uptake in different environments/specific cases.

Ensure that the ongoing drafting of the Network Code on DR guarantee that DSOs can choose the most efficient and economically efficient solutions for local flexibility services and that these services are sufficiently remunerated in the long term	Require Member States to enable active remuneration schemes and tariffs for demand response and flexibility services of any kind of network user at any level and facilitate its aggregation, keeping the right for DSOs to choose their own optimal capex/opex mix through a medium-long term CBA.	Unlock the benefit that flexibility from end-users may provide to the system, recognising such through incentivising schemes that will help electrification thanks to possible additional revenue streams that may lower energy bills for those adopting it.
Avoid permitting bottlenecks for electrification		
Acceleration and implementation of permitting processes for the deployment and reinforcement of charging infrastructures, for Renewables and grids as outlined in REDIII	Reinforce the implementation and adoption of plans designating acceleration areas where permitting will be facilitated.	Accelerate the deployment of grid upgrades, RES and charging infrastructure including their connection to the grid.
Overcome the skills and communication gaps		
Shorten the skills gap by encouraging and financially support countries to introduce financial incentives targeted towards installers reskilling, set dedicated training programmes at technical schools on electrification and develop new professional categories related to electrification services	Introduce measures on reskilling and upskilling of the workforce, develop specific training requirements and teach a whole new wave of professionals more familiar with electrification technologies eager to find practical solutions for citizens.	Avoid that installers and technicians continue with business-as-usual practices offering fossil-based solutions as the "to-go" solution due to a skill gap, perception of lower risk compared to new technologies and lack of knowledge and training.
Develop communication campaigns on benefits of switching to electric solutions, such as heat pumps and e-mobility	Focus on the practical aspects of using a heat pump and an electric vehicle on a daily basis and on the step-by-step process to switch your heating system to a heat pump and your transportation to an electric one; including how to qualify for support and permits, access to qualified installers and how to choose between alternatives.	Increase awareness on electric solutions such heat pumps and EVs and facilitate their market deployment.

4. Policy Matrix / Annex

Annex I - List of measures in the electrification policies database

Mapping and characterising available policy measures to bridge the electrification gap
Measures identified as "**high potential**"

Sector (s) affected	Measure	Type of instrument	Dossier placement	Implementing entity(es)	Time for impact
All	Set an indicative target of 35% electrification of final energy use across the EU by 2030 which could be expanded to 2035 and 2040 including a relevant trajectory	regulatory instrument	Governance regulation	European Commission, EU Institutions, EU Member States	medium term
All	Require the EU to define (indicative) electrification targets accordingly at sector level	regulatory instrument	Governance regulation	European Commission, EU Institutions, EU Member States	medium term
All	Require Member States to include in their National Energy and Climate Plans and electrification indicator, with further breakdown of KPIs and targets on electrification by technology (EVs, Heat Pumps, solutions for low-medium temperature and high temperature in industries)	regulatory instrument	Governance regulation	European Commission, EU Member States	medium term
Grids	Immediate reform of the TEN-E and the Ten-Year Network Development Plan processes encompassing both TSOs and DSOs and focusing on bottlenecks at both transmission and distribution grids	regulatory instrument	Electricity Directive/ Regulation or possible delegated act?	European Commission	medium term

Sector (s) affected	Measure	Type of instrument	Dossier placement	Implementing entity(es)	Time for impact
All	Ensure that the on-going drafting of the Network Code on Demand Response guarantees that DSOs can choose the most efficient and economically efficient solutions for local flexibility services and that these services are sufficiently remunerated in the long term	regulatory instrument + State aid rules	Electricity Directive/ Regulation or possible delegated act / State aid rules	European Commission, Member States	medium term
Transport	Introduction of a regulatory scheme increasingly requiring electrified company fleets	regulatory instrument	New Regulation/ Directive	European Commission, Member States	medium term

Sector (s) affected	Measure	Type of instrument	Dossier placement	Implementing entity (es)	Time for impact
All	Acceleration of Permitting processes for the deployment and reinforcement of charging infrastructures, for Renewables and Grids infrastructures in REDIII	other	Non-legislative / guidance and best practices	Member States	medium term
Buildings, Industry	Develop dedicated electric solutions such as heat pump 'one-stop-shops' at regional and local levels, helping citizens and business throughout the whole process of switching to a new solution and clean fuel	other	EU Strategy on heat pumps	European Commission, Member States	medium term
Buildings	Ensure swift implementation of energy efficiency and emission standards for heating and cooling systems that make clean heating and cooling the standard	regulatory	EU Strategy on heat pumps, Alternative legislative piece to ecodesign (regulation or directive)	European Commission, Member States	long term
Grids	Propose specific EU-wide targets for distribution grids investments, integrating KPIs monitoring, targets and structural planning in the Governance regulation and in National Energy Climate Plans	regulatory instrument	Governance regulation	European Commission, Member States	medium term

Sector (s) affected	Measure	Type of instrument	Dossier placement	Implementing entity (es)	Time for impact
All	Ensure that technological neutrality in terms of decarbonised power sources is acknowledged in upcoming legislations to support electrification objectives with sufficient electricity production	Regulatory instrument	All	European Commission, EU institutions, Member States	Long term
Grids	Introduce guidelines and specific regulations on regulatory incentives for forward-looking grid build-out	Regulatory instrument	Electricity Market Design reform/ Commission guidance / Dedicated acts	European Commission	medium term
All	Monitor and assess the success of the ETS2 for buildings and road transport in providing adequate market signals for fuel switching and social costs internalisation in the sectors covered	Economic instrument	Guidance and recommendations / Delegated acts	European Commission, Member States	medium term
Buildings/ Transport/ Industry	Commission to ensure that new provisions the FF55 dossiers (eg. EPBD, RED, EED) are actuated at NECPs through guidance and specific recommendations	regulatory instrument	Commission Recommendations to NECPs, dedicated guidance to MSs	European Commission, Member States	short term
Buildings, Industry	Adopt reduced VAT and duties for the purchase, maintenance and operation of heat pumps, electric vehicles and e-mobility infrastructures	other	EU Strategy on heat pumps, delegated act	European Commission, Member States	short term

List of measures in the electrification policies database

Measures identified as **“medium potential”**

Sector (s) affected	Measure	Type of instrument	Dossier placement	Implementing entity (es)	Time for impact
All	Create an EU observatory to track electrification/heat pumps adoption and an EU official online dashboard/ data intelligence tool for electrification	other	Electrification strategy/ EU Heat Pump strategy	European Commission, Eurostat, possible dedicated entity	medium term
Buildings	Gradual introduction of a mandatory smart readiness indicator	other	Implementation of EPBD	European Commission, Member States	Long term
All	Exceptions for State Aid to incentivise electrification (e.g. Cold Ironing exception for system costs)	regulatory instrument/ State aid rules	State Aid Rules (existing)	European Commission, Member States	short term
Buildings, Industry	Encourage and guide Member States to adopt dedicated Heat Pumps strategies and plans, and adequate subsequent schemes and tools	other	EU Action Plan on heat pumps / State aid rules (existing)	European Commission, Member States	medium term
Buildings, Industry	Create an EU initiative to implement regulatory sandboxes and promote local demonstration projects all over Europe, incentivising heat pump rollout in different types of buildings, energy communities and industrial applications across Europe,	other	EU Action Plan on heat pumps	European Commission, Member States	medium term

Sector (s) affected	Measure	Type of instrument	Dossier placement	Implementing entity (es)	Time for impact
Buildings, Industry	Develop population-wide communication campaigns informing of the benefits of switching to a heat pump and to electric mobility	other	EU Strategy on heat pumps	European Commission, Member States	medium term
Buildings, Industry	Accelerate permitting of strategic industrial facilities	other	NZIA	European Commission, Member States	medium term
Industry	Accelerating electrification and energy efficiency measures in industry through dedicated state aid measures for clean technologies (for both deployment and manufacturing)	state aid	State aid rules (existing)	European Commission, Member States	medium term
Buildings, Industry	Enable funds provided by the "Recovery and Resilience Facility" to provide financial assistance to consumers to help adopt electric solutions (heat pumps, electric vehicles, etc).	other	Recovery and Resilience Facility (RRF)	European Commission, Member States	medium term
Buildings, Industry, Transport	Shorten the skills gap by encouraging and financially support countries to introduce financial incentives targeted towards installers reskilling, set dedicated training programs at technical schools on electrification and develop new professional categories related to electrification services	Economic	EU Electrification Action Plan	European Commission, Member States	Medium term

List of measures in the electrification policies database

Measures identified as **“low potential”, as challenging to achieve**

Sector (s) affected	Measure	Type of instrument	Dossier placement	Implementing entity (es)	Time for impact
All	The ongoing revision of the Energy Taxation Directive should adopt measures to remove both direct and indirect tax exemptions to fossil fuels	economic instrument / State aid rules	Energy Taxation Directive	European Commission, Member States (unanimity required)	medium term
Transport, Buildings, Grids	Introduction of a regulatory scheme encouraging the use of vehicle system integration (starting from V2G to Vehicle to Everything)	regulatory instrument	New Regulation or Directive	European Commission, Member States	long term

Annex II – Impact matrix: Barriers vs Policy Measures

		Barriers										
		Technology					Infrastructures		Economic/Financing			
		T1 – Untapped potential of electrification benefits to consumers and lack of users' expertise and habits	T2 – Challenges in integration, interoperability and complexity	T3 – Lack of public support and low investability perception	T4 – Skills gap, supply chain issues and negative perception from the sector	T5 – Implementation of short and medium term innovations in market products	I1 – Capacity issues with the electricity grid	I2 – Digitalized infrastructure and system integration	E1 – Poor economic indicators	E2 – Lack of access to finance	E3 – Split incentives dilemma	E4 – Inadequate tariff structure and taxation
MEASURES	Set an indicative target of 35% electrification of final energy use across the EU by 2030 which could be expanded to 2035 and 2040 including a related trajectory			***						*		
	Require the EU to define (indicative) electrification targets accordingly at sector level			***						*		
	Require Member States to include in their National Energy and Climate Plans and electrification indicator, with further breakdown of KPIs and targets on electrification by technology (EVs, HPs, industries)			***						*		
	Create an EU observatory to track electrification technologies adoption and an EU official online dashboard/ data intelligence tool for electrification	**	**	**	*	*						

		Barriers										
		Technology					Infrastructures		Economic/Financing			
		T1 - Untapped potential of electrification benefits to consumers and lack of users' expertise and habits	T2 - Challenges in integration, interoperability and complexity	T3 - Lack of public support and low investability perception	T4 - Skills gap, supply chain issues and negative perception from the sector	T5 - Implementation of short and medium term innovations in market products	I1 - Capacity issues with the electricity grid	I2 - Digitalized infrastructure and system integration	E1 - Poor economic indicators	E2 - Lack of access to finance	E3 - Split incentives dilemma	E4 - Inadequate tariff structure and taxation
	Gradual introduction of a mandatory smart readiness indicator	**	*			*		*		**	*	
	Immediate reform of the TEN-E and the Ten-Year Network Development Plan processes encompassing both TSOs and DSOs and focusing in bottlenecks at both Transport and Distribution grids			**			**	*		**		
	Ensure that the on-going drafting of the Network Code on Demand Response guarantee that DSOs can choose the most efficient and economically efficient solutions for local flexibility services and that these services are sufficiently remunerated in the long term	***							***		*	*
	Commission to ensure that new provisions from the FF55 dossiers (eg. EPBD, RED, EED) are actuated at NECPs through guidance and specific recommendations		*	***	**				*	**	*	

		Barriers										
		Technology					Infrastructures		Economic/Financing			
		T1 - Untapped potential of electrification benefits to consumers and lack of users' expertise and habits	T2 - Challenges in integration, interoperability and complexity	T3 - Lack of public support and low investability perception	T4 - Skills gap, supply chain issues and negative perception from the sector	T5 - Implementation of short and medium term innovations in market products	I1 - Capacity issues with the electricity grid	I2 - Digitalized infrastructure and system integration	E1 - Poor economic indicators	E2 - Lack of access to finance	E3 - Split incentives dilemma	E4 - Inadequate tariff structure and taxation
	Exceptions for State Aid to incentivise electrification (e.g. Cold Ironing exception for system costs)								**	***		***
	Introduction of a regulatory scheme increasingly requiring electrified company fleets	**	***	*					**	**	*	
	The ongoing revision of the Energy Taxation Directive should adopt measures to remove both direct and indirect tax exemptions to fossil fuels								**			***
	Introduction of a regulatory scheme requiring gradual adoption of technical readiness for vehicle system integration (Vehicle to Everything)	**	**	*		**	**	**	**			
	Acceleration of Permitting processes for the deployment and reinforcement of charging infrastructures, for Renewables and Grids infrastructures in REDIII	*	***	**			**		*			

		Barriers										
		Technology					Infrastructures		Economic/Financing			
		T1 - Untapped potential of electrification benefits to consumers and lack of users' expertise and habits	T2 - Challenges in integration, interoperability and complexity	T3 - Lack of public support and low investability perception	T4 - Skills gap, supply chain issues and negative perception from the sector	T5 - Implementation of short and medium term innovations in market products	I1 - Capacity issues with the electricity grid	I2 - Digitalized infrastructure and system integration	E1 - Poor economic indicators	E2 - Lack of access to finance	E3 - Split incentives dilemma	E4 - Inadequate tariff structure and taxation
	Encourage and guide Member States to adopt dedicated Heat Pumps strategies and plans, and adequated subsequent schemes and tools			***	**		*	*				
	Create an EU initiative to implement regulatory sandboxes and promote local demonstration projects all over Europe, showcasing heat pumps in different types of buildings, energy communities and industrial applications across Europe	**			*	***					*	
	Develop dedicated heat pump one-stop-shops at regional and local levels, helping citizens and business throughout the whole process of switching to a new solution and fuel	**	***	*	*	*				**	*	
	Develop population-wide communication campaigns informing of the benefits of switching to a heat pump and to electric mobility	***	*			*					*	

		Barriers										
		Technology					Infrastructures		Economic/Financing			
		T1 - Untapped potential of electrification benefits to consumers and lack of users' expertise and habits	T2 - Challenges in integration, interoperability and complexity	T3 - Lack of public support and low investability perception	T4 - Skills gap, supply chain issues and negative perception from the sector	T5 - Implementation of short and medium term innovations in market products	I1 - Capacity issues with the electricity grid	I2 - Digitalized infrastructure and system integration	E1 - Poor economic indicators	E2 - Lack of access to finance	E3 - Split incentives dilemma	E4 - Inadequate tariff structure and taxation
	Ensure swift implementation of energy efficiency and emission standards for heating and cooling systems that make clean heating and cooling the standard	*	**	***	**	*			***			
	Adopt reduced VAT and duties for the purchase, maintenance and operation of heat pumps, electric vehicles and e-mobility infrastructure	*							***			
	Accelerate permitting of strategic industrial facilities		**	**		*						
	Propose specific EU-wide targets for the distribution grids, integrating KPIs monitoring, targets and structural planning in the Governance regulation and in National Energy Climate Plans						***	*				
	Accelerate electrification and energy efficiency measures in industry through dedicated state aid measures for clean	*		**		**			**	**		

		Barriers										
		Technology					Infrastructures		Economic/Financing			
		T1 - Untapped potential of electrification benefits to consumers and lack of users' expertise and habits	T2 - Challenges in integration, interoperability and complexity	T3 - Lack of public support and low investability perception	T4 - Skills gap, supply chain issues and negative perception from the sector	T5 - Implementation of short and medium term innovations in market products	I1 - Capacity issues with the electricity grid	I2 - Digitalized infrastructure and system integration	E1 - Poor economic indicators	E2 - Lack of access to finance	E3 - Split incentives dilemma	E4 - Inadequate tariff structure and taxation
	technologies (for both deployment and manufacturing)											
	Shorten the skills gap by encouraging and financially support countries to introduce financial incentives targeted towards installers reskilling, set dedicated training programs at technical schools on electrification and develop new professional categories related to electrification services	*	*	*	***	*				*		
	Introduce guidelines and specific regulations on regulatory incentives for forward-looking grid build-out			**			***	**				
	Monitor and assess the success of the ETS2 for buildings and road transport in providing adequate market signals for fuel switching and social costs internalization in the sectors covered	**							**			***

		Barriers										
		Technology					Infrastructures		Economic/Financing			
		T1 - Untapped potential of electrification benefits to consumers and lack of users' expertise and habits	T2 - Challenges in integration, interoperability and complexity	T3 - Lack of public support and low investability perception	T4 - Skills gap, supply chain issues and negative perception from the sector	T5 - Implementation of short and medium term innovations in market products	I1 - Capacity issues with the electricity grid	I2 - Digitalized infrastructure and system integration	E1 - Poor economic indicators	E2 - Lack of access to finance	E3 - Split incentives dilemma	E4 - Inadequate tariff structure and taxation
	Ensure that technological neutrality in terms of decarbonised power sources is acknowledged in upcoming legislations to support electrification objectives with suffi-cient electricity production		*	*		*						*

Eurelectric pursues in all its activities the application of the following sustainable development values:

Economic Development

- Growth, added-value, efficiency

Environmental Leadership

- Commitment, innovation, pro-activeness

Social Responsibility

- Transparency, ethics, accountability

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