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AN ELECTRIFICATION ACTION PLAN TO SECURE EU INDUSTRY'S FUTURE

TOWARDS A SUPPORTIVE POLICY FRAMEWORK

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The new European Commission is expected to deliver on several political priorities, including supporting the decarbonisation and competitiveness of EU industry, maintaining technological leadership, and ensuring energy resilience. Concerted action to enable direct industrial electrification, overlooked so far, can contribute to all these objectives. The upcoming Electrification Action Plan[1] is a unique opportunity to get the right policy framework in place.

The new plan can ensure that this previously underutilised technological lever receives policy attention. This briefing argues that industrial electrification can contribute to addressing a range of the EU's top concerns, and can become a core pillar of the Clean Industrial Deal.[2] It can decarbonise most industrial processes, given the potential to directly electrify[3] an estimated 90% of remaining industrial energy demand.[4]

Other benefits of decisively backing direct industrial electrification are:

[1] European Commission, 2024, **Mission letter to Dan Jørgensen, Commissioner-designate for Energy and Housing** (PDF)

[2] Ursula von der Leyen, 2024, **Europe's Choice: Political Guidelines for the next European Commission 2024–2029**

[3] As opposed to indirectly electrifying through the use of intermediate energy carriers, such as hydrogen or its derivatives (synthetic fuels).

[4] Fraunhofer Institute for Agora Industry, 2024, **Direct Electrification of Industrial Process Heat**

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- If Europe manages to create sufficient scale through lead markets, it could still lead technologically using first-mover advantage in industrial electrification where markets are less saturated.
- Crucially, the more electrified the energy system, the greater its resilience against global fossil fuel price shocks will be.
- Electrifying will unlock new, modern industrial flexibility, helping some businesses cut costs. This is desperately needed in an era where the energy system is increasingly based on intermittent energy sources as conventional power plants are pushed out of the merit order.

Direct electrification of industrial processes has so far been stifled by high electricity costs. Difficulties integrating the technologies into specific sites also impact capital costs. On top of this, domestic EU manufacturing capacity of these technologies is currently not prepared for mass adoption by industry. Grid connections are also hard to come by; conversely, the uncertainty over future industrial electricity demand is making network planning complicated.

So far, the industrial decarbonisation policy framework has not provided the necessary signals for direct electrification. This is why regulatory clarity for electrification technology producers, industrial offtakers and network operators is needed. A supportive framework will also be particularly helpful to small and medium-sized enterprises (SMEs) – where directly electrifying is often a key mitigation pathway – which will soon feel the pinch with the introduction of the EU Emissions Trading System (ETS) II. These challenges can all be addressed by the proposed Electrification Action Plan.

Summary policy recommendations for the EU Electrification Action Plan

E3G recommends that the proposed Action Plan sets out a vision for ramping up direct electrification in the industrial sector.

It should form a core part of the announced Clean Industrial Deal, and be backed by three sets of instruments (details are set out at the end of this briefing):

- **Technology deployment and monitoring** – such as adopting a manufacturing plan for electrification technologies; monitoring their

development; creating dedicated funding instruments for manufacturing and deployment (Innovation Fund, IPCEI).

> **Governance and planning** – such as establishing an Industrial Electrification Alliance; setting an aspirational target for direct electrification of industrial process heat; making electrification indicators mandatory in National Climate and Energy Plans; facilitating an integrated approach to infrastructure planning.

> **Electricity pricing** – such as finalising the Energy Taxation Directive; improving the efficiency and integration of EU electricity markets; ensuring any potential short-term electricity price support is weighed up against political trade-offs.

The time for action on industrial electrification is now

Competitiveness concerns have been at the top of Europe's political agenda in recent years. Caught in a perfect storm of rising fossil energy costs, fierce competition from China and sluggish domestic demand, energy-intensive industries have seen significant drops in output. This has happened at a time when these industries were planning significant investments to decarbonise to help meet Europe's long-term climate goals.

The sustained drop in costs of renewables is prompting the emergence of a new industrial era where access to abundant, cheap renewable energy and the ability to electrify production processes will be increasingly important determinants of the cost-competitiveness of energy-intensive industries.[5] The European Commission's recent impact assessment estimates that cost-effective decarbonisation would lead to an increase in the proportion of electricity in final energy consumption from 33% today to 41% by 2030 and 54% by 2040 (Figure 1).

[5] Verpoort et al., 2024, **Impact of global heterogeneity of renewable energy supply on heavy industrial production and green value chains**, Nature *Energy*, vol.9, pp. 491–503, DOI:10.1038/s41560-024-01492-z; RMI, 2024, **X-Change: Race to the Top: Cleantech competition between China, Europe, and the United States**

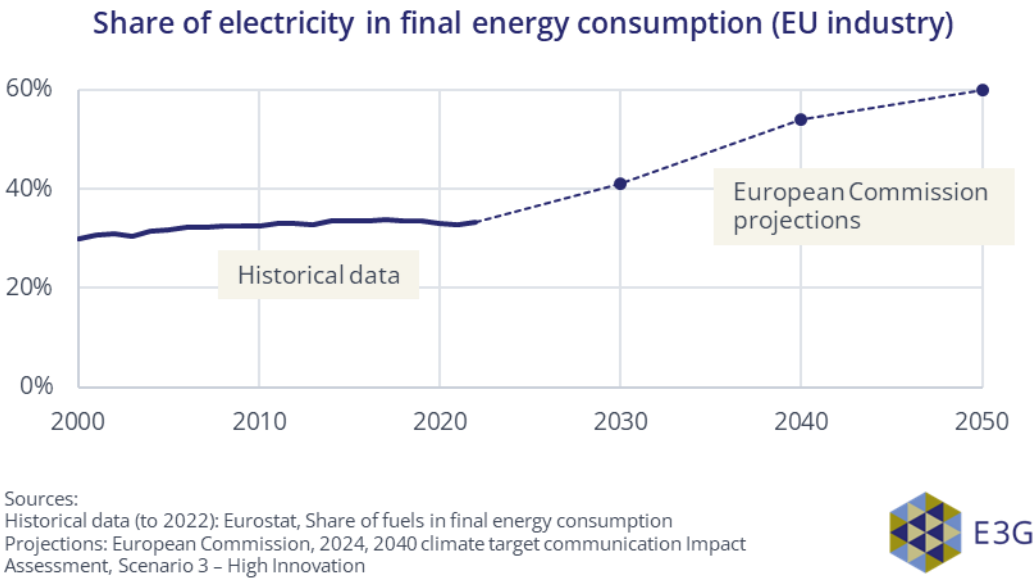

Figure 1: The share of electricity in final energy consumption in industry has been flatlining in recent decades. Commission modelling of industrial decarbonisation pathways suggest that this number should double by mid-century.

Despite its expected role in decarbonisation pathways and associated benefits, concerted action to support direct industrial electrification has so far been lacking. Final electricity consumption in European industry has been stagnant for decades (see Figure 1). Policymakers have dedicated most of their attention in recent years to supporting other decarbonisation levers like hydrogen[6] and carbon capture and storage (CCS).[7] Meanwhile, countries like China are electrifying their economies, including industry sectors, at a rapid pace.[8]

The new European Commission has finally recognised the need to act. The Electrification Action Plan for industry to be presented by the new Energy Commissioner[9] is an opportunity to course correct. It can put the right framework in place to help industry electrify and reap the competitiveness benefits of cheap, clean electricity.

[6] European Commission, 2020, **A Hydrogen Strategy for a Climate-neutral Europe** (PDF)

[7] European Commission, 2024, **Towards an ambitious Industrial Carbon Management Strategy**

[8] RMI, 2024, **X-Change: Race to the Top: Cleantech competition between China, Europe, and the United States**

[9] European Commission, 2024, **Mission letter to Dan Jørgensen, Commissioner-designate for Energy and Housing** (PDF)

Supporting direct electrification will contribute to core EU objectives

With the announcement of the Clean Industrial Deal,[10] Ursula von der Leyen has made boosting industrial competitiveness a central priority of the new European Commission. The Deal's high-level objectives include supporting decarbonisation, increasing investment, bringing down energy bills, as well as innovating and creating lead markets for strategic technologies. It is part of a larger European Prosperity Plan which also aims to support SMEs through simplifying processes. Helping industry electrify can contribute to all these objectives (Figure 2).

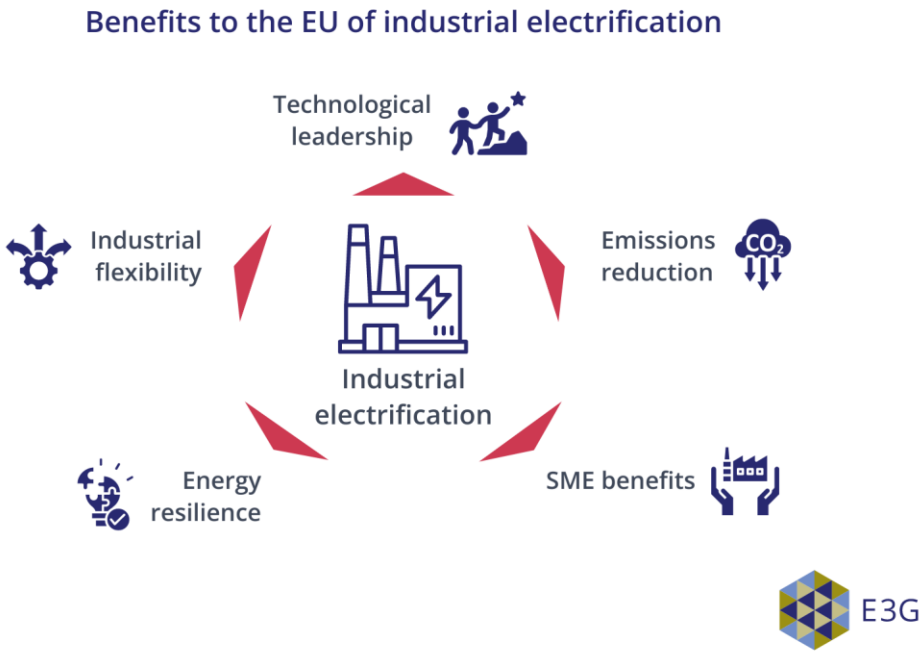

Figure 2: Industrial electrification can contribute to a range of the EU's current core objectives, as outlined in the Political Guidelines 2024–2029 and the Commissioner mission letters.

[10] Ursula von der Leyen, 2024, **Europe's Choice: Political Guidelines for the next European Commission 2024–2029**

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Direct electrification technologies can decarbonise most industrial processes

Industry is responsible for almost 30% of end-sector CO_2 emissions in the EU.[11] The EU Commission's updated GHG emissions reduction pathway for industry foresees a rapid acceleration in the 2030s, of −50.59% in the period 2030–40, compared to −34.4% in the period 2015–30.[12]

Current research suggests that deep electrification of the sector could displace up to 78% of industrial CO_2 emissions.[13] This is because there is an estimated potential to electrify 90% of remaining fossil-based industrial process heat by 2035.[14] Historically, EU industrial decarbonisation policy focused on energy efficiency improvements and CCS,[15] later emphasising hydrogen-based solutions as a silver-bullet. It is now clear that the industrial sector – previously considered "hard to electrify" – has a variety of technological mitigation options to choose from to reach this level of reduction.[16] According to the energy efficiency first principle, and Commission modelling,[17] direct electrification has a foremost role to play in decarbonising industry.

In low-to-medium temperature ranges, many electrification technologies are already fully mature. They include industrial heat pumps, electric boilers and arc furnaces, induction and resistance heating. Heat pumps and electric boilers do not even require complex shifts in production methods and can be applied as drop-in replacements of fossil-based solutions. Less mature technologies also show significant potential to decarbonise industrial process heat even in the highest temperature ranges. Table 1 summarises key technologies highlighted as most promising in a recent study for Agora Industry by the Fraunhofer Institute.[18]

[11] When process and indirect CO_2 emissions from electricity and central heat use are included. Industry includes manufacturing sectors, mining, construction, coke ovens and blast furnaces. Madeddu et al., 2020, **The CO_2 reduction potential for the European industry via direct electrification of heat supply (power-to-heat)**

[12] European Commission, 2024, **2040 Climate Target Communication. Impact Assessment Report**

[13] Of the 92% EU industry CO_2 emissions which correspond to the sectoral coverage of this study: Madeddu et al., 2020, **The CO_2 reduction potential for the European industry via direct electrification of heat supply (power-to-heat)**

[14] Fraunhofer Institute for Agora Industry, 2024, **Direct Electrification of Industrial Process Heat**

[15] European Commission, 2011, **Energy Roadmap 2050**

[16] Direct electrification, hydrogen- and CCS-based solutions are key technological levers to decarbonise energy-intensive industries. In select sectors, biomass-based solutions are warranted. Chan et al., 2019, **Industrial innovation: Pathways to deep decarbonisation of industry. Pt. 1: Technology analysis**

[17] European Commission, 2024, **2040 Climate Target Communication. Impact Assessment Report**

[18] For a more detailed overview consult: Fraunhofer Institute for Agora Industry, 2024, **Direct Electrification of Industrial Process Heat**



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Table 1: Current state of technological maturity of direct electrification technologies applicable in the industrial sector for decarbonising process heat. All of these technologies are expected to reach full technological maturity by 2035.

Technology	TRL*	Sectoral applications
Electric boilers	9	Chemicals (select); food & beverage; paper & pulp
Industrial heat pumps	8–9†	Chemicals (select); food & beverage; paper & pulp
Electric arc furnaces	9	Steel
Induction heating	9	Metals
Resistance heating	9‡	Cement & lime; ceramics; chemicals; glass; metals; thermal energy storage
Combined thermal storage systems	7–9	Versatile
Plasma torches	7–9§	Chemicals (select); container glass; lime; metals
Shock-wave heating	6**	Chemicals; container glass; lime; steel

* Technological Readiness Level; † 8 at high temperature ranges.; ‡ Use in high temperatures requires development.; § Use in clinker burning requires more research.; ** Pilot stage. Versatile use in very high temperatures.

Source: Fraunhofer Institute for Agora Industry, 2024, **Direct Electrification of Industrial Process Heat**

The EU can take a technological lead, using first-mover advantage in direct industrial electrification

Some technologies for directly electrifying end-use sectors, especially in the highest temperature ranges, have not yet reached full technological maturity (Table 1).[19] Those countries which innovate, demonstrate and commercialise them first will reap the rewards of first-mover advantage – securing significant shares of global markets and intellectual property (IP) ownership.

[19] Madeddu et al., 2020, **The CO_2 reduction potential for the European industry via direct electrification of heat supply (power-to-heat)**; Fraunhofer Institute for Agora Industry, 2024, **Direct Electrification of Industrial Process Heat**



For instance, German chemicals manufacturing company, BASF, has developed a world-first electrical heating concept for steam crackers, testing both direct and indirect heating technologies.[20] The EU is a global market leader in the field of novel thermal energy storage solutions. For example, European companies control 80% of the molten salts storage technology market, which is predicted to grow over 700% by 2030.[21]

However, to achieve the scale necessary for technological leadership it is essential to establish lead markets in tandem. Heat pumps are already one of the more promising technologies for the EU to compete on globally.[22] The EU is a near rival to China[23] and there are a significant number of large-scale heat pump companies in Germany, Italy and Switzerland,[24] but stagnating demand risks stalling market growth. The EU is currently aiming for 31 GW (60% of deployment) domestic heat pump production by 2030.[25] Further encouraging domestic demand, including in heavy industries, will be instrumental to achieving this goal.

Supporting direct electrification is necessary to protect small and medium-sized enterprises

Recent fossil fuel price shocks have particularly affected SMEs, which are especially prone to profitability and liquidity issues.[26] On top of this, a second emissions trading scheme will come into force in 2027 – the EU ETS II – where 100% of emissions allowances will be auctioned off. Its sectoral coverage will include small industrial installations so far exempt from the original EU ETS. It will inevitably make fossil fuels more expensive for small businesses. To keep costs in check and make sure SMEs have economical options available to them to decarbonise, further policy support is needed.

SMEs are often family-owned and operated, and form an important pillar of the European economy, contributing significantly to economic growth, innovation and employment.[27] Smaller companies dominate industrial sectors that use

[20] Process Worldwide, 2023, **Make Way for the E-cracking Technology**

[21] Clean Technology Observatory (EU), 2023, **Novel Thermal Energy Storage in the European Union** (PDF), p. 42

[22] Marina et al., 2021, **An estimation of the European industrial heat pump market potential**

[23] Bruegel, July 2024 (updated), **European clean tech tracker**

[24] Joint Research Centre, 2023, **Heat Pumps in the European Union**

[25] European Commission, 2024, **2040 Climate Target Communication. Impact Assessment Report**

[26] Juergensen et al., 2020, **European SMEs amidst the COVID-19 crisis: assessing impact and policy responses**

[27] DG GROW & JRC, 2023, **Annual Report on European SMEs 2022/2023** (PDF)

lower temperature heat.[28] The main technological pathway to decarbonise these firms is to directly electrify current fossil-based heat generation capacity: so heat pumps or electric boilers replacing what are largely combined heat and power plants and fossil-based boilers. Hence, policy developments on CCS and hydrogen have little impact for these companies.

In energy-intensive industries SMEs bring just as much value added as large enterprises. Yet they tend to receive less public support.[29] Getting decarbonisation right for these companies will be key to securing positive outcomes for businesses and their employees; this will help preserve their political backing for the transition, while shielding them from volatile fossil fuels.

Direct electrification will support the EU's energy resilience

Electrified systems are much less vulnerable to global fossil fuel market shocks.[30] Currently, over half of Europe's industrial energy consumption is still based on fossil fuels, the majority of which is natural gas.[31] Coupled with simultaneous power system decarbonisation, electrification can help end the current reliance on volatile fossil gas markets and import dependencies.

Furthermore, electrification technologies are generally more energy efficient than fossil-based ones,[32] resulting in lower overall final energy demand. Direct electrification will also require less additional renewables capacity compared to a scenario with more reliance on hydrogen and e-fuels to decarbonise. This is because conversion losses can be avoided.

Further energy savings can be gained by utilising waste heat. This can be maximised for instance by the large-scale installation of industrial heat pumps that rely on repurposing environmental heat.[33] Moreover, doing so would reduce the overall strain on grids and the need for related investment.

[28] Eurostat, updated 1 March 2024, **Industry by employment size class**

[29] Open Markets Institute & Balanced Economy Project & European DIGITAL SME Alliance, 2023, **Open letter: State aid and corporate concentration** (PDF)

[30] European Commission, 2024, **2040 Climate Target Communication. Impact Assessment Report**

[31] Even with the temporary switch to oil products during the energy crisis. Eurostat, May 2024, **Electricity and gas: 64.5% of industrial final energy use**

[32] IEA, **https://www.iea.org/energy-system/electricity/electrification**, accessed July 2024

[33] Agora Industry, 2022, **FutureCamp (2022): Power-2-Heat: Gas savings and emissions reduction in industry**



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Electrification unlocks flexibility, offering a business opportunity and guaranteeing power system reliability

The electric energy systems of the future also afford the opportunity for energy consumers to become more active. Electrification, including direct electrification of industrial process heat, allows companies to increase the flexibility of their electricity consumption.[34] This is because many of the available technologies have relatively short response times. In turn, such flexible procurement of electricity enables industrial consumers to respond to price incentives, optimising their operations to happen while prices are lowest, and thereby minimise their expense.[35]

From a system perspective, developing industrial flexibility, in particular demand side response (alongside other options),[36] will enable countries to integrate larger volumes of renewable energy sources into power networks and maintain security of supply. The development of a reliable net zero power grid is also ultimately in the interest of industry, as it is the only long-term means to ensure stable clean power supply and lower electricity prices.

The new Electrification Action Plan must address key barriers

While the arguments for direct electrification of industrial process heat are clear, reaping the benefits outlined above will require new policies to address practical barriers.[37]

Difficulties integrating direct electrification technologies into specific sites

Manufacturing assets are particularly long-lived[38] and many sites would have invested in energy efficiency improvements or gas-based technologies in the

[34] Agora Industry, 2022, **FutureCamp (2022): Power-2-Heat: Gas savings and emissions reduction in industry**

[35] Industrial consumers are already actively providing flexibility on some electricity markets. TenneT, Strategy& PwC, 2021, **Unlocking Industrial Demand Side Response** (PDF)

[36] Historically, inelastic electricity demand meant that it was mostly up to suppliers to balance demand and supply on the grid. This will change as demand side flexibility becomes increasingly critical to managing the growing integration of intermittent and more distributed power sources. This flexible demand will gradually reduce the profitability of conventional peaking and load-following power plants by pushing them out of the merit order. Heffron et al., 2020, **Industrial demand-side flexibility: A key element of a just energy transition and industrial development**

[37] Assessment grounded in desk research and stakeholder interviews.

[38] A. Erumban, 2008, **Lifetimes of Machinery and Equipment: Evidence from Dutch Manufacturing**



recent past due to policy or market pressure. This makes the decision to invest in optimal, future-proof technologies tricky from the firm's perspective.

While most technologies are mature or close to maturity, further research into demonstrating uses for different applications and site types is needed. This is especially true for a subset of promising technologies which are still in pilot stage like shock-wave heating.

Even though many direct electrification technologies are not very capital intensive themselves,[39] their integration into a specific site can bring a range of further costs, for instance related to electricity infrastructure. Around 40% of electricity in industry is currently self-produced, while only a fourth of that is generated from renewables.[40] Increasing electricity consumption for firms will necessitate expanding the onsite capacity or ensuring sufficient connections to the centralised grid – or a combination of both. These and further necessary additions, such as electrothermal energy storage, can be faced with space limitations at certain sites.

Energy networks are not yet prepared for the electric future

Power network investments are key to deploying direct electrification technologies. This means a rapid and large-scale buildout of renewable energy capacity, as well as adapting the transmission and distribution networks to new temporal and spatial load patterns and volumes. At the moment, long connection queues are the norm[41] – a problem linked to both limited grid capacity and lengthy permitting procedures. This environment is making it very difficult for companies to make long-term decisions about their thermal energy generation systems.

Another major issue is that network planners have insufficient information to properly plan ahead for industry's future electricity needs. General lack of clarity on the pace and scale of industrial electrification is complicating the picture.[42] Uncertainty over the future location of rising power demand poses further challenges.[43]

[39] Agora Energiewende & Frauenhofer IEG, 2023, **The roll-out of large-scale heat pumps in Germany. Strategies for market ramp-up in district heating and industry** , Agora Industry & Frauenhofer Institute (2024) **Direct Electrification of Industrial Process Heat**

[40] FfE, 2019, **Relevance and Potential for Industrial On-Site Electricity Generation on a European Scale**

[41] Ember, October 2023, **Electricity grids: Key policy actions**

[42] Bruegel, 2024, **The changing dynamics of European electricity markets and the supply-demand mismatch risk**

[43] Bruegel, November 2021, **A new economic geography of decarbonisation?**

Developing the electricity grid needs to also be accompanied by the managed decommissioning of the fossil gas network,[44] a process that is muddled by potential repurposing of existing pipelines to transport hydrogen. Related to this, industry participation in network planning to date has been insufficient and lacked structure.

Energy prices do not incentivise electrification

Apart from the capital costs of installing direct electrification technologies, a key consideration for firms in choosing how to fuel their operations are energy prices, both present and future. Currently, the incentives arising from fossil gas and electricity prices in Europe are not favourable towards gas-to-electricity switching.

This imbalance is visible not only in wholesale prices – where the electricity price is tied to gas-peaking plants, particularly affecting certain geographies – but also in other components of energy prices: taxes, network charges and other levies. For instance, the common minimum energy excise duties set at EU level, which were introduced over 20 years ago and aimed at increasing energy savings,[45] now send a perverse signal to market players. This is because fossil fuels still enjoy consumption tax benefits compared to electricity.

A proposed revision of the underlying Directive, tabled as part of the European Green Deal, has so far not found sufficient political support, particularly in the European Council. It will be imperative for European institutions to agree and implement this.

While network tariffs are not regulated at the EU level, in many member states they are not fit for purpose – often lacking granularity in spatial and temporal terms.[46] This does not duly incentivise electrification and flexible electricity use. Additionally, consumers may have to shoulder the costs of state-backed supply contracts for the massive deployment of renewables in the coming years;[47] this has certainly been the case in the past in many EU countries.[48]

[44] E3G, 2024, **Gas transition in the EU: What's next? A framework for a managed EU gas transition**

[45] Council of the EU, 2003, **Directive restructuring the Community framework for the taxation of energy products and electricity**

[46] Compass Lexecon, 2021, **RES development & network tariffs review in Europe** (PDF)

[47] Council of the EU, May 2024, **Electricity market reform: Council signs off on updated rules**

[48] Open Electricity Economics, **Renewable Energy Support Schemes**, accessed September 2024

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Manufacturing capacity is not prepared for rapid deployment

It is difficult to assess the exact current production capacity for mature technologies, such as industrial heat pumps, due to insufficient data being available. Even if the economic incentives for deployment of direct electrification technologies are adjusted and sufficient demand is created, the current production capacity would likely not be sufficient to meet it.

Additional considerations are around sufficient labour capacity, not only on the technology manufacturing side, but also related to installations. Without timely anticipatory supply planning, there will be physical and organisational constraints to such mass production when demand rapidly picks up.[49]

The current policy framework is insufficient

An accelerated uptake of direct electrification technologies will ultimately hinge on regulatory support. The current EU policy framework for supporting direct electrification of industrial process heat is incomplete: while direct electrification technologies are recognised as important for reducing emissions, they have not yet received as much dedicated policy focus or financial backing as have hydrogen-based and CCS technologies.

The new Electrification Action Plan could provide the necessary regulatory push to accelerate direct electrification of industrial process heat.

Missing regulatory signals for industrial electrification

Indicative targets can be a useful tool to inform expectations and help plan ahead. Electrification-related targets could inform producers about likely future demand and give technology consumers – industrial producers – clarity on preferred mitigation pathways or projected electricity demand.

The current regulatory framework for industry is largely technology-agnostic. The EU ETS aims for general emission reductions, the EED (Energy Efficiency Directive)[50] for overall energy savings and the RED (Renewable Energy Directive) for overall increase in renewable energy consumption. While all of these

[49] Euractiv, February 2024, **First drop in sales: Honeymoon is over for Europe's heat pump industry**

[50] European Parliament & the Council of the EU, 2023, **Directive on energy efficiency and amending Regulation (recast)**

incentivise electrification indirectly, they have not been sending clear enough signals.

While welcome, the whole-of-economy Energy System Integration Strategy[51] has not yet resulted in real world progress in industry (see Figures 1 and 3). Recent developments on hydrogen and carbon management have taken a more granular approach. Strategies have led to genuine aspirational targets to guide economic actors and policymakers, for instance an industry-specific target in the RED for the share of synthetic fuels consumed that should come from renewable sources.

Developments in direct electrification technologies for industry are insufficiently monitored

The current cleantech monitoring structures do not match the latest science. Policy action on direct industrial electrification technologies seems to be stifled by policymakers often lacking awareness of the technological options. This is different, for instance, for hydrogen- and CCS-based technologies where multiple pieces of legislation spell out lists of technologies, whose development is supported and regularly monitored.[52]

For instance, the Clean Energy Technology Observatory has published reports on technology groups linked to all the other industrial decarbonisation pathways, while those on direct electrification are limited to heat pumps and energy storage.[53] Similarly, the European Climate Neutral Industry Competitiveness Scoreboard lacks granularity on technologies outlined in Table 1, although it does cover select direct electrification technologies in higher temperature ranges (e.g. electric steam crackers).[54]

This lack of focus has also been reflected in the EU's recent actions on cleantech promotion, which has not been symmetrical across technology groups, despite the promise of technology neutrality. The Net-Zero Industry Act resulted in a long list of supported clean technologies.[55] The only categories mentioned which

[51] European Commission, 2020, **Powering a climate-neutral economy: An EU Strategy for Energy System Integration**

[52] European Commission, **Clean Energy Technology Observatory (CETO)**, accessed 2024; JRC, 2022, **European Climate Neutral Industry Competitiveness Scoreboard (CINDECS) - Annual Report 2022**

[53] European Commission, **Clean Energy Technology Observatory (CETO)**, accessed 2024

[54] JRC, 2022, **European Climate Neutral Industry Competitiveness Scoreboard (CINDECS) - Annual Report 2022**

[55] European Parliament & the Council, 2024, **Regulation on establishing a framework of measures for strengthening Europe's net-zero technology manufacturing ecosystem and amending**

is relevant to this briefing are (broadly) heat pumps and energy storage, alongside CO_2 capture targets and the Hydrogen Bank. Other similarly mature technologies are only referenced in the Act by means of the umbrella term "other transformative industrial decarbonisation technologies".

Direct electrification technologies are underrepresented in funding

The lack of strategic focus highlighted is reflected in a discrepancy between the amount of EU-level funding currently dedicated to deployment of hydrogen-based technologies and that spent on directly electrifying industrial processes. For instance, direct electrification technologies are severely underrepresented in Innovation Fund, compared to other technologies (Figure 3).[56] This becomes more striking when we consider that six out of seven direct electrification projects were in the glass industry.[57] This contrasts with four large-scale hydrogen generation or transportation projects aimed at supplying industrial clusters. This suggests that direct electrification projects are not occurring across sectors, or at a large enough scale.

Policy recommendations for the EU Electrification Action Plan

E3G recommends that the proposed Electrification Action Plan sets out a vision for ramping up direct electrification in the industrial sector. It should form a core part of the Clean Industrial Deal and be backed by governance, monitoring and funding instruments.

Technology deployment and monitoring

> **The Commission should consider a manufacturing plan to ramp up industrial electrification technologies, starting with mature low- to medium-temperature options such as industrial-scale heat pumps, then forecasting rapid adoption along an S-curve in the near future.** The plan must include a skills strategy, planning for training and ensuring that jobs in manufacturing, installation and maintenance will attract enough workers.

[56] Innovation Fund, **Portfolio of signed projects**, accessed September 2024

[57] Most projects concerned hybrid furnaces for glass production. One concerned the use of electron beam technology in the steel industry. This technology is considered to be rather a tool for cutting or welding, not a process heat electrification pathway in the sense of this briefing. Fraunhofer Institute for Agora Industry, 2024, **Direct Electrification of Industrial Process Heat**

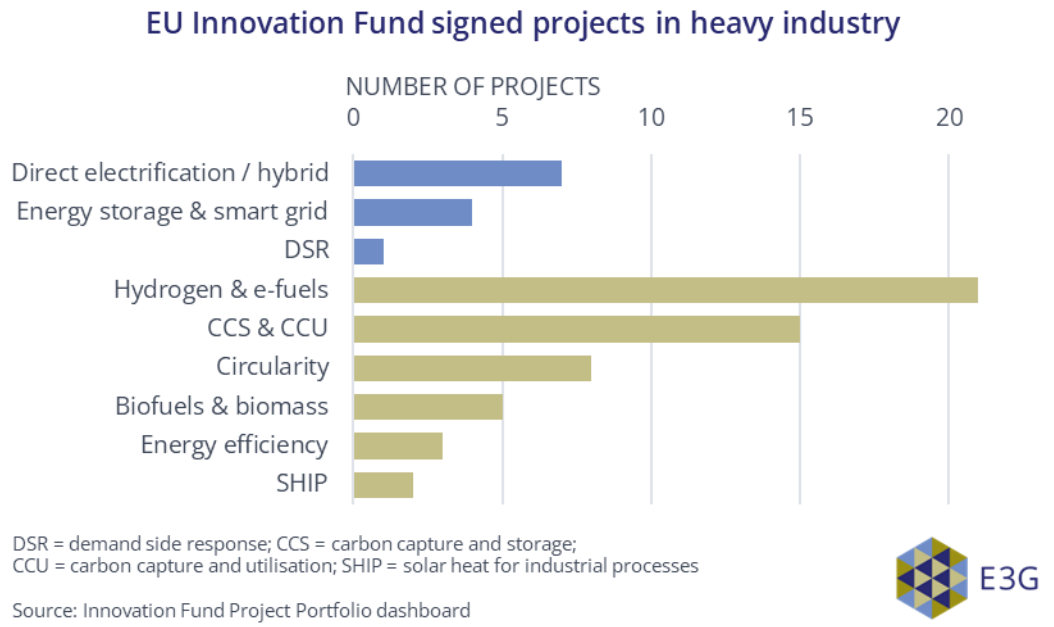

Figure 3: Among projects supporting heavy industry decarbonisation under the Innovation Fund, the focus is currently on supporting hydrogen- and CCS-based solutions, while direct electrification and supportive technologies (in blue) are underrepresented. Note: This graph does not include general infrastructure developments with indirect impact. Only big infrastructure projects explicitly naming connections to industrial clusters were considered. The hydrogen category has inevitable overlaps with other categories due to variety in production routes – biomass-derived hydrogen was grouped with biofuels & biomass, while hydrogen using CCS was grouped with hydrogen & e-fuels.

> **The Commission needs to set up monitoring structures for the development of key industrial electrification technologies.** This could be led by the Joint Research Centre and should include gathering data on domestic manufacturing capacity, technological maturity, labour and competitiveness-related indicators, among others.

> **The Commission should explore calls for dedicated proposals under the Innovation Fund on direct industrial electrification** (e.g. of low-to-medium-temperature industrial heat) with special emphasis on SMEs, tackling sectoral technology integration challenges. It could take the form of an Electrification Bank, building on the Hydrogen Bank's experience.[58]

[58] European Commission, **European Hydrogen Bank** (last accessed: 2024)



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> **Finally, it could explore creating an Important Project of Common European Interest (IPCEI) for direct electrification technologies for industrial process heat.** The aim would be to boost EU innovation and technology capacity while supporting the creation of European value chains.

Governance and planning

> **The European Commission and member states should facilitate stronger cooperation on direct electrification between policymakers, industry actors across the value chain, and the R&D community, while ensuring inclusivity vis-à-vis SMEs**. This could be achieved through establishing a dedicated Industrial Alliance.[59] It would help raise awareness and visibility of direct electrification options, coordinate supply and demand, identify policy and finance gaps, as well as opportunities for investment.

> **The Commission could explore setting an aspirational target for direct electrification of industrial process heat.** This would help ensure planning certainty for technology providers and industrial offtakers through clarifying emissions reduction pathways to meet 2030 and 2040 EU climate targets.

> **It should make indicators related to industrial electrification under National Energy and Climate Plans mandatory** if the Energy Union Governance Regulation is reopened.[60] Member states must also ensure that the national long-term strategies deal with the projected scale and location of industrial sites.

> **It needs to facilitate an integrated approach to infrastructure planning.** This would ensure better integration of planning across the electricity grid, heat networks, and hydrogen and CCS infrastructure. It would also encourage close and timely cooperation between network operators and industrial energy users.

Electricity pricing

> **The co-legislators must finalise the Energy Taxation Directive**. Additionally, they should issue guidance on how member states can adjust network tariffs, other charges and levies at the national level to better incentivise electrification across the economy.

[59] European Commission, **Industrial alliances** (webpage, accessed September 2024)

[60] European Commission, 2024, **Mission letter to Dan Jørgensen, Commissioner-designate for Energy and Housing** (PDF); European Commission, 2024, **Report on the Review of the Regulation on the Governance of the Energy Union and Climate Action** (PDF)



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> **The Commission should continue to improve the efficiency and integration of EU electricity markets** by removing market barriers and encouraging industrial flexibility, digitalisation and general optimisation. It should work on overcoming barriers to Power Purchase Agreements (PPAs) to ensure price stability.

> **It needs to clearly weigh up and assess trade-offs of potential policy measures aimed at additional short-term electricity price support for industrial consumers.** In particular, it must consider projected reduction in emissions and fossil fuel consumption, regional labour market effects, impact on system costs, distributional effects and locational factors; these are set out in more detail below.

Considerations in developing policy measures for short-term electricity price support for industry

Industry is responsible for over 20% of EU emissions[61] and almost 25% of final energy consumption.[62] Electricity price support could lead to reductions in emissions and in consumption of fossil fuels like fossil gas. While time-bound electricity price support for energy-intensive industries could lead to faster decarbonisation of the sector and protect local jobs, it is crucial to consider the negative effects it could cause.

1. *Distributional effects* – favouring a subset of consumers will likely negatively impact non-energy intensive industries and residential consumers. Policy costs will have to be recovered and this can result in cross-subsidisation – other consumers paying for the industrial discount through e.g. higher tariffs. It could dampen the electrification incentive for other actors of the economy.

2. *Locational factors* – the current location of industrial manufacturing sites does not necessarily match the future availability of cheap and plentiful clean electricity.[63] Providing electricity price support can distort market signals and risk making the viability of industrial manufacturing in some areas dependent on costly subsidies while disincentivising investments into prospective, potentially more optimal regions for energy-intensive production.

3. *System costs* – subsidies on the wholesale electricity price will affect supply-demand dynamics and disincentivise efficiency gains, which will likely raise overall system costs.

[61] EEA, December 2019 (modified September 2024), **GHG emissions by aggregated sectors**

[62] Eurostat, **Complete energy balances**, accessed September 2024

[63] Bruegel, November 2021, **A new economic geography of decarbonisation?**

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About E3G

E3G is an independent climate change think tank with a global outlook. We work on the frontier of the climate landscape, tackling the barriers and advancing the solutions to a safe climate. Our goal is to translate climate politics, economics and policies into action.

E3G builds broad-based coalitions to deliver a safe climate, working closely with like-minded partners in government, politics, civil society, science, the media, public interest foundations and elsewhere to leverage change.

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