eurelectric
powering people

Europe's 2040 climate target & path to climate neutrality by 2050

Analysis of Commission communication and accompanying impact assessment

February 2024

Eurelectric represents the interests of the electricity industry in Europe. Our work covers all major issues affecting our sector. Our members represent the electricity industry in over 30 European countries.

We cover the entire industry from electricity generation and markets to distribution networks and customer issues. We also have affiliates active on several other continents and business associates from a wide variety of sectors with a direct interest in the electricity industry.

We stand for

The vision of the European power sector is to enable and sustain:
- A vibrant competitive European economy, reliably powered by clean, carbon-neutral energy
- A smart, energy efficient and truly sustainable society for all citizens of Europe

We are committed to lead a cost-effective energy transition by:

investing in clean power generation and transition-enabling solutions, to reduce emissions and actively pursue efforts to become carbon-neutral well before mid-century, taking into account different starting points and commercial availability of key transition technologies;

transforming the energy system to make it more responsive, resilient and efficient. This includes increased use of renewable energy, digitalisation, demand side response and reinforcement of grids so they can function as platforms and enablers for customers, cities and communities;

accelerating the energy transition in other economic sectors by offering competitive electricity as a transformation tool for transport, heating and industry;

embedding sustainability in all parts of our value chain and take measures to support the transformation of existing assets towards a zero carbon society;

innovating to discover the cutting-edge business models and develop the breakthrough technologies that are indispensable to allow our industry to lead this transition.

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Disclaimer: This document provides a preliminary analysis of the 2040 Communication and Impact Assessment (IA) by Eurelectric's Secretariat focusing on the main elements of interest to our sector. It does not express the views of our members.

1. The 2040 framework in a nutshell

What happened?

On 6 February 2024, the European Commission published its Communication and accompanying impact assessment on the EU climate target for 2040. In the Communication, the Commission recommends a target of **90% net emissions reductions by 2040**. The actual legislative proposal is expected to be tabled by the incoming Commission and will trigger the revision of the Climate Law. When approved (it needs to go through co-decision) it will enshrine in law (meaning it is legally binding) a target for 2040.

The EU already has binding laws for 2030 (55%) and for 2050 (climate neutrality). The 2040 target is designed to provide predictability to stakeholders and investors for the period between 2030 and 2050.

Why is the Commission coming up with this proposal now?

The Climate Law mandates the Commission to make a legislative proposal for a 2040 climate target within 6 months of the global stocktake under the Paris Agreement (December 2023). The 2040 target will also inform the EU's future post 2030 National Determined Contribution (NDC) that all Parties must submit to the UNFCCC by 2025.

What are the main elements of the Communication of relevance?

At its core, the three main elements are:

i. fast-tracking electrification of end-uses, to cut their emissions (50% electrification by 2050, increasing from 22.8% today)
ii. pave the way for a close to decarbonised power sector by 2040 (Renewables complemented by nuclear will make up 90% of power generation by 2040);
iii. a renewed focus on CCS & removals to address process and residual emissions (Here the Commission is betting on a largely unproven technology)

What are the next steps?

This is the first step in devising the post 2030 framework. Three more steps will follow in the coming years:

i. **S1 2024 - Member State reactions:** Member States will give first reactions at upcoming Environment Council meetings. Unlike the 2020 and 2030 targets, European Council Conclusions are not expected to be adopted on what the target should be. From intelligence gathered by Eurelectric, given that Council conclusions require unanimity, any position on targets would likely be lower than the 90% target for 2040 recommended by the Commission.
ii. **S2 – 2024 Climate law proposal:** This will be made in S2 2024 by the new Commission.
iii. **2025 – 2029: 2040 Climate & Energy package:** The Commission will need to develop the post 2030 policy framework. The approach will be first agreeing to the ambition level and then propose the policy framework (changes to ETS, RED, etc). This approach **was used in previous cycles to set the 2020 and 2030 climate and energy targets.**

2. Key questions and answers: 20 key questions answered

Why is the Commission proposing a 90% target. What are the options analysed in the impact assessment?

Based on the criteria analysed in the impact assessment (GHG reduction, economic consequences, etc) 90% was seen as the optimal number. The impact assessment looked at three options for 2040:

I. Option 1, a reduction of up to 80% compared to 1990
II. Option 2, a reduction of 85-90% compared to 1990 (the current trajectory)
III. Option 3, a reduction of 90-95% compared to 1990

Option 3 the most ambitious scenario is assuming deployment of "novel" (i.e. unproved) technologies such as hydrogen produced by electrolysis, carbon capture and the use of industrial carbon removals between 2031 and 2040. Option 1 leaves the adoption of these technologies to the 2040s decade.

How much will it cost?

The impact assessment estimates that the annual average investment in the energy system, excluding transport, will need to increase to about 660 billion per annum in 2031 to 2050. This represents an increase compared to 2011 – 2020, rising from 1.7% of GDP to 3.2% in 2031-2050[1].

It should be noted that in terms of investments we can expect a shift in total costs from operational (linked to fossil fuel purchases) to capital costs.

Are the targets aspirational or binding?

The target, when approved, will be legally binding. The 55% target for 2030 and the climate neutrality target for 2050 are also legally binding.

Is the strategy different from previous Commission strategies?

There are no major seismic strategy shifts for getting to net-zero compared to the previous documents (Climate law, net-zero strategy, RepowerEU), however there are some changes, in particular the renewed focus on CCS and removals.

<u>What stays the same ?</u>

- Ambitious GHG reduction targets powered by renewable based electrification: Overall, we can see the focus remains to electrify the economy more and promote greatly the speed up and roll-out out of renewables.

<u>What is new ?</u>

- Increased trajectory: The EC promotes the recommended target of 90% as a slight increase in ambition. Whereas a simple application of a linear trajectory between 2030 and 2050 would translate into a 75.5/78.5% emissions reduction in 2040, the Commission considers that implementing existing policies would already lead to 88% emissions reductions. This is thus considered the baseline scenario. Such approach signifies that the heavy lifting will be done in the run-up to 2040.

[1] In the transport sector, annual investment is expected to increase to about (euro) 870 billion but to remain broadly constant as a share of GDP, at around 4.2%.

- Betting on Carbon Capture and Removals: Carbon capture and removals are more prominent than in previous strategies, the Commission dedicating a separate Communication to Industrial Carbon Management. Across the scenarios, the Commission places a huge bet on technologies that are yet to prove their efficiency in cutting emissions.

- Focus on strategic autonomy and resilience: The recent crises seem to have a high influence on the positioning, driving a more in-ward and self-sufficiency focus to reduce exposure to external volatility and supply chain bottlenecks. Compared to previous exercises (i.e. 2030 impact assessment, 2018 Clean Planet for all Strategy, etc) we can see that there is a renewed focus on security of supply. However, there is no clear methodology on how the Commission proposes to measure security of supply. Instead, it only mentions reducing reliance on fossil fuels and risk of supply disruptions.

Who are the European Scientific Advisory Board on Climate Change and what do they think about the 2040 target?

The European Scientific Advisory Board on Climate Change (ESABCC) is an independent board which provides scientific advice on EU climate targets and indicative greenhouse gas budgets. In June 2023, it published "advice" recommending a target in the range of 90-95%.

What is the carbon budget? How many megatons of CO2 do we have today and how much can we have in 2040 under a 90% target?

The GHG budget is the total volume of EU net greenhouse gas emissions that can be emitted up to 2050.

In 2021, total net GHG emissions of the EU was 3242 MtCO2eq. To deliver a reduction of net GHG emissions of 90%, the analysis in the impact assessment shows that the level of remaining EU GHG emissions in 2040 should be less than 850 MtCO2, and carbon removals (from the atmosphere through land-based and industrial carbon removals) should reach up to 391 MtCO2 by 2040. In 2050, they are compensated by industrial and LULUCF net carbon removals to converge to climate neutrality.

How is the EU doing at present in terms of GHG reductions? Is it on target to reduce emissions by 55% by 2030?

By 2022, the EU had reduced its greenhouse gas emissions by 32% compared to 1990. Throughout this period, GDP rose by 67% showing that economic growth and emissions can be decoupled.

Overall, the EU's domestic GHG net emissions are on a clear downward path, falling steadily the past 5 years. Looking ahead to 2030 and the 55% climate target, the pace of emission reductions will need to pick up and almost triple the average annual reduction achieved over the past decade. When the final, updated NECPS are submitted in June, we will have a clearer idea of how much additional effort is needed.

What level of electrification of society does the Commission expect by 2040? How does this compare with Eurelectric's projections?

The Commission Communication does not call for a specific target on electrification. Instead, it acknowledges that by 2040, electricity will cover 50% of the energy consumed in Europe. Positively, electrification is considered the main driver of decarbonisation in end-use sectors. A deeper analysis of the electrification rates per sector is given later in the document.

Electricity becomes the dominant energy vector in final energy sectors, by 2040. The share of electricity in FEC increases from 22.8 % in 2021 to 48-51 % in 2040 (3472-3583 TWh) and up to 62% (4002 TWh) in 2050.

What sectors will decarbonise most? What are the specific sectoral GHG reduction targets?

The impact assessment looks at 5 main sectors; power, industry, buildings, transport and agriculture.

Increased efforts are needed in all sectors, but the most significant cut in emissions are needed in buildings, transport and agriculture, where greenhouse reductions have stagnated and in certain cases, actually increased.

1. Power: The power sector will be fully decarbonised by 2040 with nuclear and renewables posed to represent 90% of generation.
2. Industry: Industry is likely to see a 56-84% cut in emissions against 2015 levels, due to electrification and implementation of new manufacturing technologies.
3. Transport: Transport emissions could drop by 69-78% compared to 2015 primarily due to large-scale deployment of electric vehicles. In this regard, the deployment of zero emission vehicles driven by the CO2 standards, would lead to quadrupling the electrification of the sector over 2031-2040. The shares of battery electric and other zero-emission vehicles are projected to rise to over 60% for cars, over 40% for vans and close to 40% for heavy-duty vehicles. (Communication)
4. Buildings: The buildings sector will see 75-85% drop in emissions, thanks to a rapid phase out of fossil fuels. These will account for no more than 9-15% of the consumption in 2040, with oil and coal being almost entirely phased-out by then. Natural gas is expected to be phased-out by mid-century.
5. Agriculture: Depending on the scenario, between 9% and 30% of emissions could be reduced by 2040. However roughly 65% of emissions will still be there in 2050.

In an attempt to counter the low decarbonisation pace in certain sectors, it is likely to see increased pressure on the power sector to go beyond decarbonisation and deliver negative emissions. While some applications exist in the sector, this could require a significant scale up.

Will electricity generation grow and by how much?

According to the IA, electricity generation is likely to increase from 2905 TWh in 2021 to about 4565 TWh in scenario 1 (80% reduction), 4900 TWh in scenario 2 (85-90%) and 5210 TWh in scenario 3 (90-95%) in 2040. A 13% higher demand for electricity between S1 and S3, is explained by the substantial differences in the production of RFNBO and industrial removals (DAC). These technologies are expected to require 600TWh more electricity in S3 compared to S1.
With regards capacity, due to high penetration of renewables and due to the relatively low full load hours of wind and solar PV generation, total installed capacity is projected to grow more than two times between 2022 and 2040.

In terms of decarbonising the Power Sector, what does the Commission foresee? How does this compare with the Eurelectric numbers?

The power sector is expected to be fully decarbonised around 2040 and operate mostly on renewables. Nuclear and renewables are poised to cover 90% of the generation.

Renewables are expected to cover up to 87% of the mix, depending on the scenario, while the share of fossil-fired power generation steadily decreases by 2040, from 36% in 2021 to 8% in S1 and 3% in S3. Gas coupled with carbon capture and storage (CCS) will deliver the remainder.

In comparison, Eurelectric's decarbonisation speedways study expects renewables to cover 80 % of the generation while nuclear contributing 16 % with remaining power from fossil fuels. Elsewhere, Eurelectric's Decarbonisation Speedways study expects renewables to represent between 80-85% of the total installed capacity 2040, whereas nuclear would maintain a stable 4 % share, and gas would have between 10-13%.

How will the power system be balanced?

To balance the power system, new flexibility technologies and storage solutions will be increasingly required. Storage technologies will be dominated by pumped hydro and batteries. Although not the main driver, electrolysers may also provide some form of storage in the form of power-to-power.

Total capacity from technologies that may provide such storage solutions is multiplied by 10 (from 50 to 350-530 GW) between 2020 and 2040 in the S1-S2-S3. Out of this, 275 GW is going to come from pumped hydro and batteries. Demand-side measures, including demand management technologies like DACC (Dynamic Line Rating with Advanced Communications and Control) and electrolysers, are likely to play a role. Overall, the role of flexibility seems to be somewhat underestimated. In particular, the role of demand side measures is not well described in the report.

What does the document say on hydrogen?

On hydrogen, the Commission is less bullish than in previous strategies. The hydrogen production in the EU is in the range of 60 to 100 MTOe (698 TWh to 1163 TWh) for 2040. This is between 21 to 35 million tonnes of hydrogen produced in the EU. In comparison, in 2022 hydrogen demand in the EU was 7.4 million tonnes used mainly for the refining and ammonia sectors. Hydrogen production share in gross available energy is growing from 1 % in 2030 to 10 % in 2040 and 18 % in 2050.

In 2022, EU had a hydrogen production capacity of 10.4 million tonnes/year. But only 4 % of this capacity is from electrolysis and more than 90 % is from steam methane reforming using natural gas. By 2040, the 21-35 million tonnes of hydrogen have to be produced from renewable hydrogen. This means most of this should come from electrolysis and a tiny fraction from steam methane reforming with CCS which is a full reversal of the current situation.

What is the future for fossil fuels?

The consumption of fossil fuels for energy by 2040 is expected to reduce by approximately 80% compared to 2021 and coal will be phased out. The impact assessment argues that frontloading the decarbonisation on our path to climate neutrality by 2050 will significantly reduce fossil fuel imports (by 80% in 2040) and hence provide greater protection against price shocks and create a lead market in clean technologies, strengthening the EU's open strategic autonomy and competitiveness.

What about electricity prices?

The impact assessment models an average electricity production cost of 94-97 euros/MWh. In the most ambitious scenario, the capital cost is 7 percentage points higher than in the least ambitious scenario, whereas the O&M is the same, and the fuel cost in 10 percentage points lower.

- The average electricity price for industry remains stable towards 2040-2050, with values between, 130 and 133 euros/MWh, whereas in the service sector, it will be situated around 249-255 euros/MWh.
- In private transport (S2), electricity prices would have a minimal variation between 2030 and 2050, which the lowest level being expected in 2040 (222 euros/MWh), before increasing to 225 euros/MWh, by mid-century. By comparison, gasoline would be 11 euros/MWh cheaper in 2030, but 55 euros/MWh more expensive from 2040 onwards.

The Communication only notes that "once fossil fuels are permanently displaced of the power mix over the next two decade and necessary investments are made on grids, storage and batteries, power prices might start to significantly decrease in the EU".

Does it say anything on the role of the ETS post 2030?

The package remains vague on the role and future of ETS. Carbon pricing, under ETS 2, is expected to contribute to establishing a level playing field between electricity and fossil carriers and thus drive the electrification of transport and buildings.

The Communication on Industrial Carbon Management assumes that ETS1 will continue to drive the decarbonisation of hard-to-abate sectors and incentivise the uptake of CCS thanks to favourable provisions (i.e. no need to surrender allowances). On the other side, under its current design, the ETS does not provide incentives for removals. This is likely to change during its upcoming review in 2026.

It should be noted that without a change to the current rules, the cap under ETS 1 will reach zero in 2040. The cap in ETS 2 reaches zero in 2044.

The Impact Assessment notes on page 22 that "in the absence of a review, the current design of the EU ETS also applies beyond 2030". However, this assessment of the 2040 target does not assume a prolongation of unrevised ETS provisions after 2030 within the default post-2030 policy framework.

Should the Commission take into account the responses to the consultation, we could expect an additional expansion of scope and a potentially joining of ETS 1 and 2, to cover all fossil fuel uses and non-CO2 GHG emissions. By the same logic, the Commission is likely to include removals in the ETS.

What is LULUCF? How is it contributing?

The land use, land use change and forestry (LULUCF) sector, is considered to play an important role in achieving the EU's goal of zero net emissions by 2050. The LULUCF Regulation sets an EU-level net removal target of 310Mt CO2e by 2030. Based on Member State projections submitted in 2023, the current implemented and planned measures will not suffice to meet the target, falling short by 50 Mt CO2e.

In the absence of a strong policy for LULUCF beyond 2030, modelling shows that LULUCF net removals would be limited to -218/-317 MtCO2-eq in 2040, falling short of their expected contribution.

Interestingly, across the scenarios, we observe a smaller contribution of nature-based removals compared to the baseline year (2015), when they were offsetting 322 MtCO2-eq.

Only through ambitious policies that restore the potential of LULUCF sector, nature-based solutions would be able to capture 333 $MtCO_2$-eq in 2050, which is a minimal increase from the baseline.

What are negative emissions? How do they contribute?

Practices or technologies that remove CO_2 are described as achieving 'negative emissions'. There are two main types:

i. Either enhancing existing natural processes that remove carbon from the atmosphere (e.g., by increasing its uptake by trees, soil, or other 'carbon sinks')
ii. Using chemical processes to, for example, capture CO_2 directly from the ambient air and store it elsewhere (e.g. underground).
iii.

All methods are at different stages of development, and some are more conceptual than others, as they have not been tested at scale. Reaching climate neutrality by 2050 requires resolving the uncertainty around the tools available to scale negative emissions. Although the LULUCF sector can generate a net carbon sink, its future evolution is uncertain.

With regards to CCS and CCUS, it should be noted that there is currently no industrial solution deployed at scale for the capture, transport, utilisation and storage of carbon. The level of ambition for 2040 will depend on the ability of hard-to-abate sectors to decrease their emissions and the development and deployment of carbon removals, for both nature-based and industrial solutions. However, high demand for capturing is also envisaged in the power sector, where the use of CCS to run fossil-fuelled plants coupled with expectations on "the biomass + DACC", would lead to similar needs as industrial processes.

What does the Commission want to do on CCS?

The Commission wants CCS to play a key role. For sectors such as cement which has process emissions, this is the only option.

An accompanying communication released the same say as the impact assessment sets out a roadmap to deploy the necessary CCS and CCU technologies for hard-to-abate sectors. The ultimate objective is to create a single market for CO_2 in Europe. In order to do so, a regulatory framework for the injection and transport of CO_2 needs to be created.

What happens to the carbon once it's captured?

It will either be stored or reused. The split between re-use and storage depends on the scenario analysed. As opposed to S1, where there is a fifty-fifty split between storage and re-use (i.e. e-fuels), S2 and S3 assess that roughly one third will receive a second life, whereas two-thirds will be injected underground. This ambition of the Commission is that this will drive extensive infrastructure development projects – including the build-out of CO_2 transport systems.

3. Five priority issues: Targets, power sector, investments, prices & costs and electrification

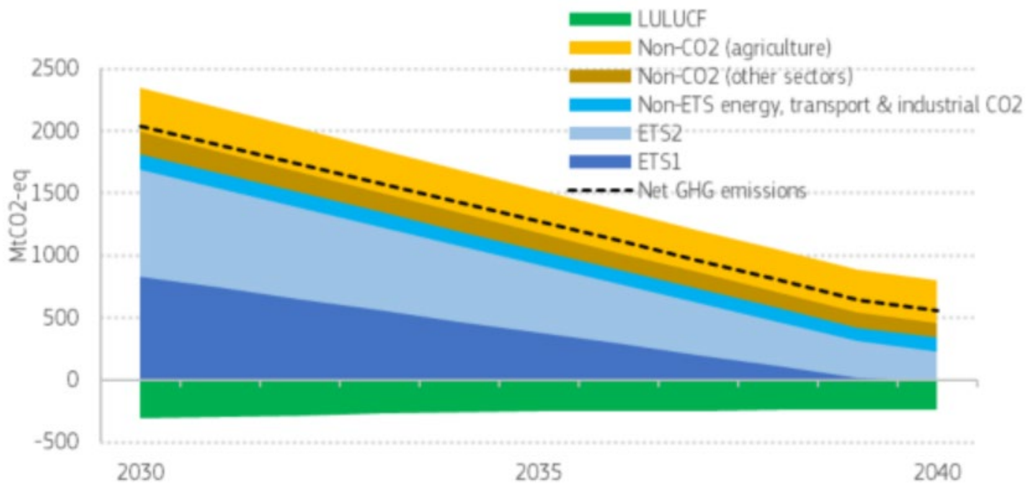
A. Targets

In line with the requirements of the Climate Law, the European Commission presented an intermediary target for 2040. The Communication recommends a **90% net emissions reduction target by 2040**. This target brings under the same umbrella the abatement efforts (via phase out of fossil fuels, electrification etc) and the contribution of natural and technological removals. This is the same approach as for the 2030 and 2050 targets.

However, the stakeholder consultation conducted in 2023, as well as the impact assessment explore the value on setting separate targets and provide ranges, rather than fixed figures. Here, the impact assessment notes the preference of stakeholders for separate targets (one for emissions reductions, one for natural sinks and one technological sinks). These recommendations have not been considered in the Communication.

The target wes developed with regards to the ability to deliver the following seven specific objectives corresponding to the 13 requirements outlined in Article 4 (5) of the Climate Law[2].

Figure 3: Theoretical 2030-2040 GHG emissions with the current policy framework



Impact assessment breakdown

The Impact Assessment analyses three option targets and three scenarios, with an additional variant (LIFE) that implies wider societal changes. They range from 80% (S1) to 85-90% (S2) and 90-95% (S3). The first scenario is considered to follow a linear decarbonisation trajectory and be below the recommendations of the Scientific Advisory Board. This would imply the lowest level of effort and cross-economy transformations.

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[2] Examples of factors considered are;

I. Ensure climate neutrality is achieved
II. Minimise the EU's GHG budget
III. Ensure the transition is just
IV. Ensure the long-term competitiveness of the EU economy is maintained
V. Provide predictability for the deployment of best-available, cost-effective, and scalable technologies
VI. Ensure the security of supply of energy and resources
VII. Ensure environmental effectiveness

The second and third scenarios are aligned with scientific recommendations to a certain extent, as well as the answers submitted to the public consultation. The delivery of these objectives relies on the ability to implement the current policies (i.e. Fit for 55 and REPowerEU, the Electricity Market Design, Clean Energy Package etc).

The most ambitious scenario, which assess a 90-95% emissions reduction target, relies on an ambitious deployment of innovative capturing technologies, and assumes a fully decarbonised electricity sector before 2040. This is recommended as a preferred option, due to its implication in reducing reliance on fossil fuel imports and the build out of more resilient internal market. Moreover, this is the scenario which is in line with the 1.5-degree climate target. This scenario works with a GHG budget of 16 GtCO2-eq which is in the range (11-16 GtCO2-eq) recommended by ESABCC to achieve global climate target.

Certainly, such ambition would provide the best outcome in terms of carbon budget. However, it has a huge reliance on technologies that haven yet to prove scalability, profitability and most importantly, efficiency.

Moreover, it fails to provide additional solutions for financing a scaled-up effort, marking a reliance on private funding, coupled with support from a fluctuating ETS budget. The envelope of the Innovation Fund is linked to the carbon price and dependent on a liquid, well-functioning carbon market. In addition, the Fund is widely oversubscribed, and its support for projects is insufficient, when considering the capital expenditures of new installations. While the performance of competitive bidding under the Hydrogen Bank (financed through the Innovation Fund) is yet to be proven, a similar approach is vehiculated to provide support for capturing projects.

Furthermore, it seems to consider that the revenues collected through the Social Climate Funds, after the implementation of ETS2, would suffice for mitigating its distributional impacts. This relies on the good will of Member States to re-distribute the funds in a socially just manner, without providing additional safeguards that would prevent societal backlash.

Similarly, the cost pressure on industrial customers seems to be underestimated, with expectations on PPAs (power purchase agreements) to offer the solution, without addressing the challenge of firming costs. As opposed to the leaked document, the final Communication does not recognise the need for additional measures to complement CBAM, in order to help industries remain competitive vis-a-vis other constituencies with laxer climate policies.

B. Power System Analysis

I. Overall demand

In the impact assessment, the gross electricity generation increases from 2,905TWh today, to 3,357 TWh by 2030 to, depending on the scenario, between 4563 TWh and 5212 TWh by 2040. This represents an increase of 57-80% compared to today.

Fossil fuels use decreases and renewable energy increases (in particular, wind and solar power). Indeed, in 2040, the consumption of fossil fuels for energy would reduce by approximately 80% compared to 2021 Coal is almost completely phased out by 2040.

Simulation with the JRC-GEM-E3 model of a stylised shock resulting in doubling of fossil fuel prices (coal, oil and gas), without knock-on effects on electricity prices, shows that the negative impact on GDP, private consumption and employment is halved if it takes place in an economy with a largely decarbonised energy system projected for 2040, compared to the same shock taking place in 2025 (GDP impact of -0.4% vs. -0.8% and private consumption impact of -1.3% vs. 2.6%).

II. Electricity consumption by end-use sectors

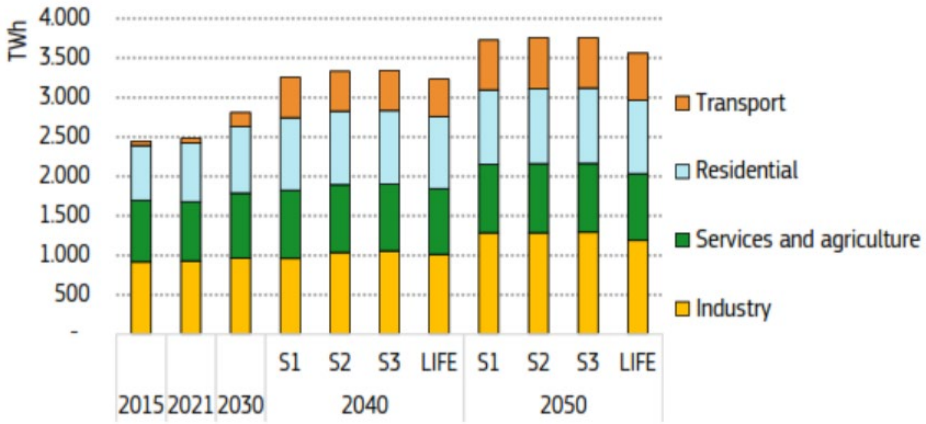
Electrification of the economy drives final electricity demand in the transport, services, agriculture, industry and residential sectors. Total final electricity consumption increases from 2485 TWh in 2021 to 2810 TWh in 2030 and 3255-3340 TWh in S1-S2-S3 in 2040.

In the **residential sector,** overall electricity demand will increase by 23-25% between 2021 and 2040 due to an increased uptake of heat pumps replacing oil and gas-based heating systems to 920-935 TWh.

Industry, agriculture and services show a similar picture. In those sectors, the share of electricity in the final energy demand is rising sharply due to the increase in electricity demand and the overall drop of final energy consumption. As a result of the interplay of electrification and energy efficiency, electricity demand in these sectors increases by 12% (industry) and 15% (services and agriculture) between 2021 and 2040(S2).

The **transport sector** undergoes the strongest growth in final electricity consumption between 2021 and 2040, attributed to the large development of electric transport. Overall, final electricity demand in the transport sector will increase over the period 2021 to 2040 by a factor of 8 with no major differences between scenarios. In absolute terms, final electricity demand in transport increases from 60 TWh in 2021 to 180 TWh in 2030 and 505-510 TWh in 2040, respectively.

Final electricity consumption by end-use sector

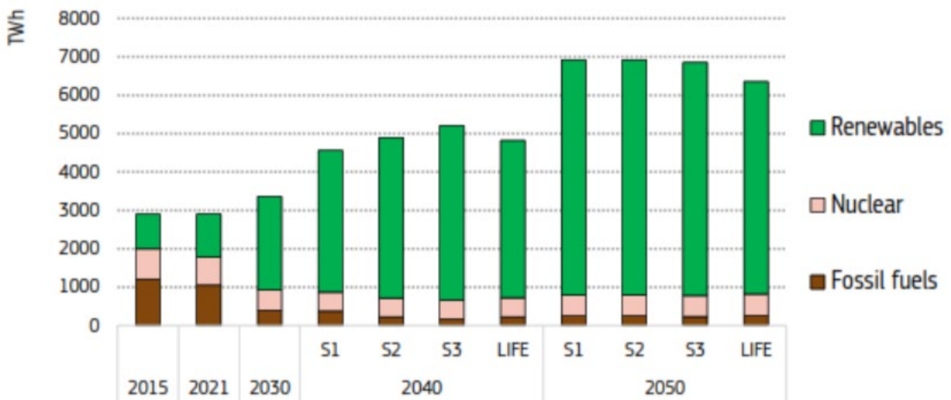


III. Electricity generation by energy carrier

Gross electricity generation increases from 2905 TWh in 2021 to 3360 TWh in 2030 and then to 4565-5210 TWh in 2040. This is an increase of 57- 80 % compared to 2021. The difference in gross electricity generation across the three scenarios is due to the difference in the electricity production for hydrogen and electricity for Direct Air Capture (DAC). In 2040, electrolysers, RFNBO (renewable fuels of non-biological origin) synthesis processes and DAC combined consumes approximately 490 TWh more electricity in the S3 scenario than in S1 (a 51% increase). The S2 scenarios consumes approximately 225 TWh more than S1 for the same purposes (23% increase).

The share of fossil-fired generation is projected to steadily decrease from 36% in 2021 to 3-8% in 2040. The residual fossil-fired generation in the last decade before 2050 is projected to consist almost solely of gas-fired power plants, with and without CCS. The plants that do not use CCS will act as peak power plants. Share of renewables in the power mix will grow from 39 % (1125 TWh) in 2021 to 81-87 % (3700-4540 TWh) in 2040. Share of nuclear power will decrease from 25 % (730 TWh) in 2021 to 10-11 % (490 TWh) in 2040 based on the capacity assumptions in line with the member state policies in 2019 NECPs.

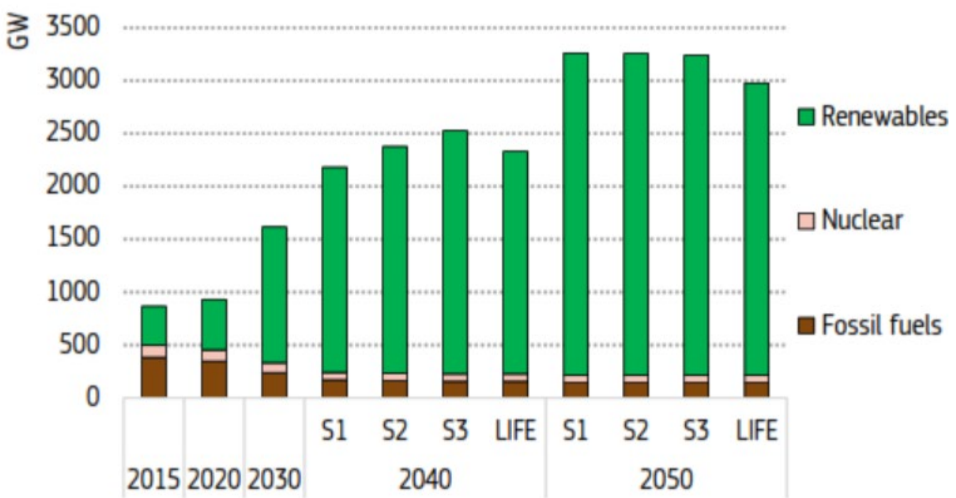
Electricity generation by energy carrier



IV. Installed capacity

Due to high penetration of renewables and due to the relatively low full load hours of wind and solar PV generation, total installed capacity is projected to grow more than two times between 2022 and 2040. The net capacity increases from 1015 GW in 2022 to 2 180-2 525 GW in S1-S2-S3 in 2040. The installed fossil-fuel capacity will decrease from 328 GW in 2022 to 155-170 GW in 2040. 90 % of this fossil fuel capacity will be from the gas-powered plants. A small amount of coal and oil-fired capacity remains during this period. The nuclear capacity is projected to decline from 101 GW to 70 GW in 2040. 10-20 GW of power plants will have CCS equipped with them.

Net installed capacity by energy carrier



Average annual deployment of wind and PV (historic and needed)

Note: Blue line: average 2016-2020; Green line: max historical deployment (occurred in 2022).

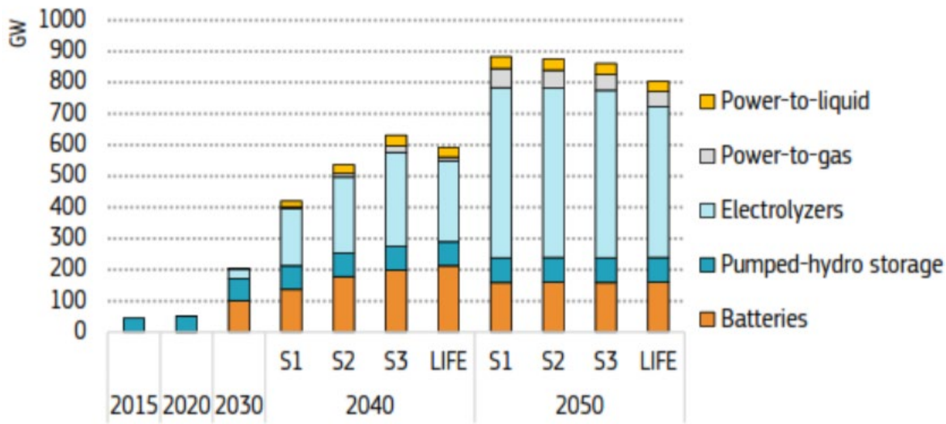
V. Storage and flexibility

The increasingly high share of variable renewable electricity generation will increase flexibility requirements. These flexibility needs will increasingly be addressed by new flexibility technologies and storage solutions.

Storage technologies will be dominated by pumped hydro and batteries. Although not the main driver, electrolysers may also provide some form of storage in the form of power-to-power.

Total capacity from technologies that may provide such storage solutions is multiplied by 10 (from 50 to 350-530 GW) between 2020 and 2040 in the S1-S2-S3. Interestingly, only pumped-hydro storage capacity is significantly present in the EU in 2020. Pumped-hydro storage capacity is projected to grow from 50 GW in 2020 to 75 GW in 2040. Deployment of battery storage is projected to accelerate after 2030, from 100 GW to 135-200 GW in S1-S2-S3 in 2040 enabling mostly the daily and weekly storage of electricity. Electrolyser capacity increases from 30 GW in 2030 to 185-300 GW in 2040.

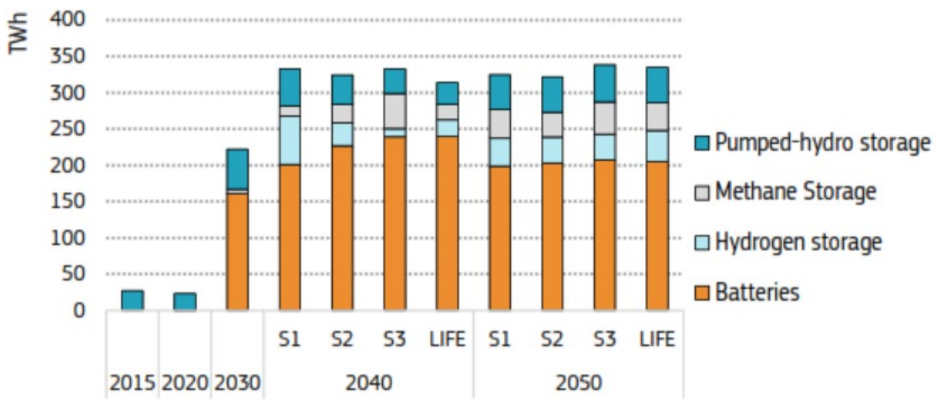
<u>Net installed storage and new fuels production capacity</u>



Power-to-X technologies provide additional flexibility in the future by adjusting production levels to match the pattern of variable electricity generation. Installed power-to-gas and power-to-liquid capacities remain relatively low amounting to 5-20 GW and 20-35 GW, respectively, by 2040. Power-to-X capacity further increases from 55 GW in 2040.

Storage needs are currently met by pumped hydro storage and increasingly batteries. The electricity stored in pumped hydro is projected to grow from 25 TWh in 2020 to 35-50 TWh in 2040. Batteries are expected to surpass pumped hydro storage as the main source of providing storage between 2025 and 2030, reaching 160 TWh in 2030. By 2040, electricity stored in electrolysers (10-70 TWh) plays a minor role in providing storage to the electricity system than that stored in batteries (200-240 TWh), as the available electrolyser capacity to produce hydrogen will be used in sectors other than the power sector. In 2040, methane storage, i.e., clean gas, will play a minor role covering 4-15% of stored electricity in S1-S2-S3.

Stored energy by technology



Eurelectric's Decarbonisation Speedways study foresees storage and flexibility of 357 GW by 2040.

VI. How the Commission numbers compare with Eurelectric's

2040 DATA	S1	S2	S3	Eurelectric Repower EU (EU27) 2040
Gross Electricity Generation in 2040 (TWh)	4563	4899	5212	5292
Final Electricity Demand in 2040 (TWh)	3472	3570	3583	4003
Net installed power capacity (GW) 2040	2181	2377	2525	2672
RES (GW)	1939	2142	2298	2233
Fossil (GW)	172	164	156	328
Nuclear (GW)	71	71	71	111
Storage and flexibility (GW)	350		530	357
RES share in generation (%)	81%	84%	87%	80%
Fossil share in generation (%)	8%	5%	3%	4%
Nuclear share in generation (%)	11%	10%	9%	16%
GHG emissions from power & district heating (MtCO2)	119	8	-10	121
carbon captured from fossil fuel power plants (MtCO2)	26	41	32	
Hydrogen produced in the EU (TWh)	698	884	1163	242
Direct electrification (electricity share in FEC)	48%	50%	51%	49%
e-Fuels share in FEC	1%	3%	5%	
Final Energy Consumption (TWh)	7234	7141	7025	8259
Final Energy Demand (TWh)				9231
FEC reduction vs 2015	-34%	-34%	-35%	

Among EC's scenarios, its S3 scenario is most ambitious in terms of electrification. S3 scenario seems to be comparable with Eurelectric's RePowerEU scenario in terms of gross electricity generation in 2040 with Eurelectric projecting 70 TWh additional electricity generation. However, when it comes to final electricity demand, the electricity used by end consumers, two scenarios are diverging further with EC's S3 scenario projecting 420 TWh lower than Eurelectric's final electricity demand. This is because indirect electricity demand, the electricity demand for P2X (including hydrogen and its derivatives) in EC's S3 is much higher. EC projects a hydrogen production of 1163 TWh (which would need 1661 TWh electricity to produce) whereas Eurelectric foresees only a hydrogen production of 241 TWh (needs 345 TWh power) in 2040.

In terms of generation mix, EC's S3 scenario has 87 % renewables, 4 % fossil fuels and 9 % nuclear whereas Eurelectric has 80 % renewables, 4 % fossil fuels and 16 % nuclear. With regards to installed power capacity, EC seems to be less demanding in terms of firm capacities like fossil and nuclear compared to Eurelectric. Renewables capacities are at comparable level to Eurelectric whereas storage and flexibility capacity in less ambitious scenario of EC is comparable to Eurelectric's. The most ambitious scenario S3 demands around 180 GW higher storage and flexible capacities than Eurelectric's RePowerEU. There is no load factor or any insights about hourly simulation to comment on the adequacy of the power system foreseen by EC's S3 scenario.

When it comes to CO2 emissions, power sector is carbon neutral by 2040 in the S3 scenario whereas Eurelectric RePowerEu scenario's power system has residual emissions of 121 MtCO2 in 2040. This is majorly because Eurelectric's scenario didn't consider an intermediate emission reduction target for 2040 and didn't explicitly assume any carbon capture for power plants in 2040. S3 scenario achieved carbon neutrality with carbon capture and removal technologies. 32 MtCO2 must be captured in 2040 from the fossil-based power production in the S3 scenario.

Commissions numbers for 2050 vs Eurelectric RePowerEU scenario for 2050

	2050 IA scenario s3	Eurelectric Repower EU (EU27) 2050
Gross Electricity Generation in 2050 (TWh)	6922	5964
Net installed power capacity 2050 (GW)	3256	3206
RES (GW)	3027	2731
Fossil (GW)	142	371

	2030 EC IA	Eurelectric Repower EU (EU27) 2030
Gross Electricity Generation in 2030 (TWh)	3357	4099
Net installed power capacity (GW) 2030	1627	1929
RES (GW)	1292	1558
Fossil (GW)	241	265
Nuclear (GW)	94	105

Elsewhere, net imports of electricity from outside the EU remain very small (around current levels).

C. Investment

The transition requires significant investment needs for the energy system over the period 2031-2050. All three scenarios analysed imply annual energy system investment needs above **3% of GDP for the period 2031-2050**. This is an increase of 1.5 to 2 percentage points of GDP compared to average investments in 2011 to 2020. It is comparable to the level of investment that will be needed in the current decade to reach the set 55% GHG reduction target.

The impact assessment is clear that "the electricity sector (generation and grid) dominates investments on the supply side given the increasing electrification in the economy". On the demand side, the residential sector accounts for the largest share of investment needs at about two-thirds of the total (excluding transport).

With regards technology, the investment needed to build EU manufacturing for five key net-zero technologies are estimated at 23 billion for the decade 2031-2040). These are i) batteries, ii) wind, iii) solar, iv) electrolysers and v) heat pumps. Two thirds are for battery manufacturing, one fifth to one quarter for wind technologies. Wind, electrolysers, solar PV and heat pumps each represent between 2% – 6% of the total.

From the grid investment figures of the EC, the estimated annual investment requirement for distribution grid is 67-68 billion euro. Compared to the 35 billion euro invested in 2022 this is a 2-fold increase. On power plants, EC foresees an annual average investment of 142 billion which is a 1.5 times increase compared to the 95 billion annual investment in 2022.

<u>How the power sector investments of EC compares with Eurelectric's</u>

	S1			S2			S3			Eurelectric RePowerEU
Investment (Bn Euro)	2031-40	2041-50	**2031-50**	2031-40	2041-50	**2031-50**	2031-40	2041-50	**2031-50**	**2021-50**
Distribution Grid	63.2	70.4	**67.2**	70.4	64.8	**68**	76.8	60	**68**	**65**
Power plants	97	187	**142**	128	157	**142**	151	133	**142**	**100**

S3 scenario prefers frontloading of investment during 2031-50 compared to S2 and S1. And this creates lower level of investment requirement in S3 scenario in the next decade compared to the other scenarios.

The investment requirements for distribution grid are at similar levels in EC's scenarios and requirement communicated by Eurelectric. However, the investment requirements in power plants in EC's scenarios are more than 40% above the RePowerEU scenario of Eurelectric. This is counter intuitive as the capacity requirements of Eurelectric and EC are at same level. Even the Radical action scenario of Eurelectric stays low compared to EC's powerplant investment requirements. Radical action scenario requires an annual investment of 117 bn Euro whereas EC requires an annual average of around 140 billion Euros across all scenarios. A comparison with the investment requirement projected in the IEA's Announced Pledge scenario indicates that EC's investment projection is higher, staying on the upper end of the spectrum.

D. Energy and Power System Prices & Costs

The impact assessment presents results on energy system costs for the whole economy. Specifically, it evaluates electricity production costs which is transitioning from an energy purchases system towards a capital-based system, less exposed to fossil fuel prices. Costs are comparable across scenarios, estimated between 94-97 $€_{2023}$/MWh in 2040 and 87 $€_{2023}$/MWh in 2050.

The study also provides average final price of electricity for households, services and industrial customers. The figures are contrasted across sector but with similar patterns across scenarios and stable in the long run:

- Household final price of electricity: 288 $€_{2023}$/MWh in 2040 and 290€ $€_{2023}$/MWh in 2050.
- Services final price of electricity: 249 $€_{2023}$/MWh in 2040 and 255 $€_{2023}$/MWh.
- Industry final price of electricity: 130 $€_{2023}$/MWh in 2040 and 131 $€_{2023}$/MWh. In the long run, the share of energy related costs in total industrial/manufacturing costs represents around 11% for energy intensive industries and around 1.6% for non-energy intensive industries.
- Private transport final price of electricity: 223 $€_{2023}$/MWh in 2040 and 2050.

E. Electrification rates & breakdown of sectoral electrification

The Commission Communication does not call for a specific target on electrification. Instead, it acknowledges that by 2040, electricity will cover 50% of the energy consumed in Europe. Positively, electrification is considered the main driver of decarbonisation in end-use sectors.

Electricity becomes the dominant energy vector in final energy sectors, by 2040. The share of electricity in FEC increases from 22.8 % in 2021 to 48-51 % in 2040 (3472-3583 TWh) and up to 62% (4002 TWh) in 2050.

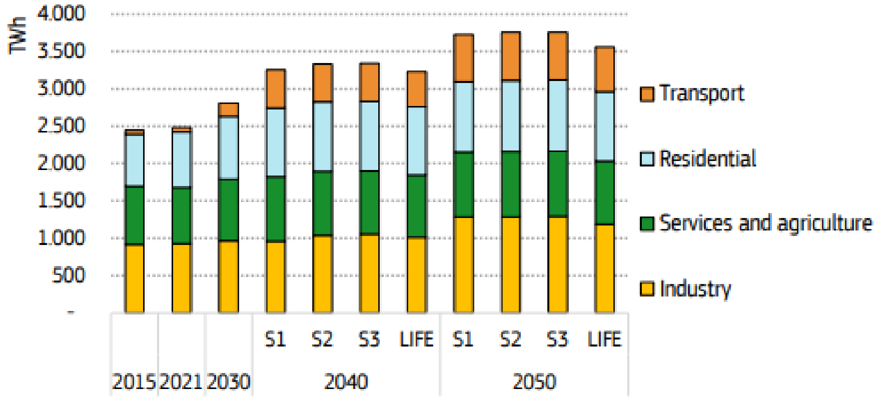
In terms of sectoral breakdown, we have the following:

- Transport:
    - Overall, final electricity demand in the transport sector will increase over the period 2021 to 2040 by a factor of 8 with no major differences between scenarios. In absolute terms, final electricity demand triples by 2030 (from 60 TWh in 2021 to 180 TWh), and then almost triples again (505-510 TWh) by 2040.
    - The electrification in the transport sector increases from around 1% in 2015 to 19% in 2040 and 27-28% in 2050. This is 30% in 2040 and 60% in 2050 in Eurelectric's RePowerEU scenario.
    - Electrification is more dominant in the road transport sector. The share of BEVs increases to 57-58% in 2040 and 79-80% in 2050 in EU's car stock. In terms of share of electricity in energy consumption of passenger cars, it is around 31-33 % by 2040 and 60-70% by 2050. In Eurelecrtric's RePowerEU scenario, in 2040, there is around 30 % electrification and in 2050 there is 80 % electrification in passenger road transport sector. EU's scenarios have given considerably higher importance to hydrogen (6-7 % in 2040 & 18-21 % in 2050), e-fuels* (10-18 % in 2040 & 23-25 % in 2050) and biofuels (21-23 % in 2040 & 22-23 % in 2050) in the transport sector.

- Buildings:
  - The IA assumes that in the residential sector, overall electricity demand will increase by 23-25% between 2021 and 2040 due to an increased uptake of heat pumps replacing oil and gas-based heating system.
  - The electrification pattern is quite different between the residential and services sectors. In the residential sector, the share of electricity is projected to grow from one fourth today to just above 40% in 2030, reaching 53-56% across scenarios in 2040 and up to 60% in 2050.
  - In services, the electricity share today is already much higher: almost 50% and would increase to around two-thirds in 2030, more than 75% in all scenarios in 2040, until achieving almost 80% in 2050.

- Industry:
  - Electrification share reaches around 48% in 2040 and 62% in 2050 from around 21% in 2021, in line with figures of around 50% in 2040 and 60% in 2050 projected by Eurelectric. To note that the EC figures account for direct & indirect electrification.

Figure 18: Final electricity consumption by end-use sector



Note: Total electricity consumption consists of final electricity consumption from end-use sectors (hereby shown), own consumption of the energy sector, RFNBOs production and transmission/distribution losses.

Source: PRIMES.

4. Other Issues

I. Buildings

In terms of buildings, electrification of heating and cooling through heat pumps and more renovations to reach higher levels of energy efficiency seem to be the main drivers for reducing emissions. Residential and service emissions decrease by 77-85% compared to 2015, depending on the scenario, driven by a sustained deployment of heat pumps and renovation of building envelopes. There is an expectation that, existing buildings are used more effectively, and new ones are designed more efficiently. As result, there are lower needs for carbon-intensive end-user products, while the same level of services is maintained.

Energy efficiency in buildings consists in two main types of action:

i. For existing buildings, it implies renovating the building envelope - in order to reduce the demand for space heating and cooling while ensuring high comfort levels – and deploying renewables and energy efficient equipment for heating, cooling, cooking and appliances.
ii. For new buildings, it implies sticking to the minimum energy performance standards, as outlined in the Energy Performance of Buildings Directive (EPBD).

II. Transport

Transport emissions drop by 69-78% compared to 2015, primarily due to large-scale deployment of electric vehicles in road transport in all scenarios, along with a further switch from fossil fuels to e-fuels and advanced biofuels in maritime, aviation and road transport. Importantly, e-fuels are clearly pointed to aviation and maritime.

The emission standards for cars and vans with the notorious internal combustion engine ban from 2035 onwards seems to be the main driver for electrification, and the same goes for HDVs where the newly adopted target of 90% emission reduction by 2040 is the key element.

III. Agriculture

In the Impact Assessment a 90% CO2 reduction target (S3) implies a 30% emissions reduction in the agriculture sector. Given that this sector represents roughly 10% of the EU's greenhouse gas emissions, the ESABCC acknowledged the critical role agriculture must play in net-emission reductions. Especially since there has been a severe "lack of substantial progress in recent years", the assessment stressed that there must be a significant "gear change". It acknowledges that this sector will not be able to cut their GHG emissions to zero in the coming decades because they deliver necessary goods and services, making the role of carbon removals particularly crucial. In fact, a 90% CO2 reduction (S3) would expect to see a developed carbon management industry by 2040, with carbon capture covering all industrial process emissions and delivering sizable carbon removals.

However, in light of recent political demonstrations taken by farmers in countries like France, Germany, the Netherlands, and Belgium, the official 2040 Communication released by the Commission on 6 February did not maintain the ambitious CO2 reduction target for agriculture. Instead, vague language was used to describe how a decrease in GHG emissions can be achieved, stating that a more holistic approach must be implemented since "many decisions with a large mitigation potential are taken outside the farm gate". Policies, such as boosting the availability of low-carbon alternatives and circular applications, with the right support to address trade-offs and decrease costs, are referenced as having great potential to contribute to solutions.

That being said, specific and ambitious CO2 reduction targets for the agriculture sector were removed from the Commission's final 2040 Communication, while the 90% CO2 reduction target was not adjusted. Thus, this new scenario implies serious effort-sharing implications for the power sector, potentially requiring CO2 emissions for the sector to be negative by 2040.

IV. Impact on energy intensive industries

The Impact Assessment notes that the impact on the output of energy intensive industries is somewhat larger with more ambition. The effect under S3 is relatively small with a decline of at most 0.2% (relative to S2) in 2040 and 2050. However, when modelling a higher mitigation ambition in the rest of the world the output under option 1 is 2.3% lower than under option 2, with option 3 almost at the same level as option 2. This is due allegedly to first-mover advantages that would benefit EU industries.

In this regard, the Commission is likely to propose additional measures to further complement and strengthen the carbon leakage tool (the Cross-Border Adjustment Mechanism).

When it comes to the share of energy related costs in the total production of industries, the modelling shows that a higher climate ambition is translating into mildly higher costs, for the industrial sector as a whole. The difference across scenarios in 2031-2040 is limited.

The development of an industrial carbon management system will require the development of a full supply chain and of the necessary infrastructure to link CO2 emitting energy supply and industrial sites to carbon storage or usage sites (notably to produce e-fuels). The territories with strong presence of energy intensive industries (e.g. cement production, chemicals industries, etc) will have to anticipate and develop the corresponding capacities.

Lastly, while the production of hydrogen is expected to increase exponentially, i.e. from 9 Mt Mtoe (3 Mt) in 2030 to 100 Mt Mtoe (35 Mt) in 2040 and 185 Mt Mtoe (65 Mt) in 2050 (table 9 page 43) the narrative does not mention industry as a key H2 up-taker (no exact figures seem to be available for consumption). This indicates possibly a higher expectation on the electrification of the industrial sectors, and a targeted use of hydrogen for aviation/maritime/fertilisers.

V. Hydrogen

The hydrogen production in the EU is in the range of 60 to 100 MTOe (698 TWh to 1163 TWh) for 2040. This is between 21 to 35 million tonnes of hydrogen produced in the EU. In 2022, hydrogen demand in the EU was 7.4 million tonnes used mainly for the refining and ammonia sectors.

In 2022, EU had a hydrogen production capacity of 10.4 million tonnes/year. But only 4 % of this capacity is from electrolysis and more than 90 % is from steam methane reforming using natural gas. By 2040, 21-35 million tonnes of hydrogen have to be produced from renewable hydrogen. This means most of this should come from electrolysis and a tiny fraction from steam methane reforming with CCS which is a full reversal of the current situation.

<u>Eurelectric Assessment</u>

The communication appropriately acknowledges the pivotal role of electrification and recognises the significance of indirect electrification, specifically through the use of hydrogen, particularly in cases where it is neither feasible nor efficient to directly electrify (such as in the production of e-fuels and decarbonisation of hard-to-abate sectors). In the variability in hydrogen deployment across different scenarios, as highlighted in the communication and its Annex, the absence of a fully-fledged market for this product at present should be highlighted. Nevertheless, deployment will occur after the expected adoption in March/April of the Hydrogen and Decarbonised Gas Market Package. Consequently, the demand for hydrogen and its applications remains subject to rapid changes.

VI. Carbon capture (usage) and storage (CC(U)S)

The role of carbon capture and carbon removals is an important differentiating factor for the 2040 climate ambition. Overall, CCS/CCUS play a prominent role throughout the strategy.

While annual capture remains at 86 MtCO2 in S1, it reaches 222 MtCO2/year in S2, and 344 MtCO2/year in S3. Their role would become evident only after 2030 for two main reasons:

i. Lack of existing framework to support their development. This will be tackled with the Communication on Industrial Carbon Management, and subsequent strategy/policy framework.
ii. Low technology maturity levels. While DAC have a TRL of 7, BECCS have a TRL of 5.5. This means they could potentially come into play only between 2030 and 2040, but uncertainty persists.

While the Communication does not present a separate target for removals, it notes that a 90% target entails an earlier deployment of carbon capture and a contribution up to 400 Mt CO2/year. This is above the most ambitious scenario and raises expectations that are most likely impossible to achieve.

Positively, the Communication alludes to a mitigation hierarchy, as it encourages the use of such carbon capture technologies for emissions not related to energy combustion (i.e. process emissions).

The impact assessment shows that the higher the decarbonisation target, the greater will be the role played by carbon capture and storage, as well as removal technologies.

CCS will be distributed across sectors.

- In **fossil-fuelled power** CCS is expected to capture around 26 and 41 MtCO2/year in 2040 and increase to 55 MtCO2/year in 2050. In addition, biomass+ DACC would capture between 16 and 153 MtCO2/year. When combining these 2 applications, the power sector seems to contribute to 62% of the captured CO2 expectations.
- In **industry CCS** is expected to capture between 37 and 137 MtCO2/year in 2040 and 136 MtCO2/year in 2050.

<u>What happens to the captured carbon?</u>
As opposed to S1, where there is a fifty-fifty split between storage and re-use (i.e. e-fuels), S2 and S3 assess that roughly one third will receive a second life, whereas two-thirds will be injected underground. This ambition is likely to drive extensive infrastructure development projects – including the build-out of CO2 transport systems.

VII. LULUCF

The land use, land use change and forestry (LULUCF) sector, is considered to play an important role in achieving the EU's goal of zero net emissions by 2050. The LULUCF Regulation sets an EU-level net removal target of 310Mt CO2e by 2030. Based on Member State projections submitted in 2023, the current implemented and planned measures will not suffice to meet the target, falling short by 50 Mt CO2e.

The impact assessment has modelled changes to the current state of play, ranging from a small increase in forest coupled with a decrease in grassland (S1) to higher land-use change with bigger increase of forest land, and additional wetland and cropland with stronger decrease of grassland (S2 & 3). These are essential steps as the current state of play indicates a decrease in nature's contribution to offset emissions.

Importantly, across the scenarios, LULUCF contributions remain significantly higher than the technological removals: 50 times higher in S1, with a narrowing difference of six times in S2, and four times in S3.

Table 7: Industrial removals and net LULUCF removals

	2040			2050
	S1	**S2**	**S3**	**S3****
Gross GHG emissions (MtCO2-eq)	**1273**	**943**	**748**	**411**
Total Removals (MtCO2-eq)	**-222**	**-365**	**-391**	**-447**
Industrial Removals (MtCO2)	-4	-49	-75	-114
LULUCF net removals (MtCO2-eq)	-218	-316	-317	-333

*Note: **S1 and S2 values for 2050 are similar to S3 and represented in more details in Annex 8.*

Source: PRIMES, GAINS, GLOBIOM.

In the absence of a stronger policy for LULUCF beyond 2030, modelling shows that LULUCF net removals would be limited to -220/-240 MtCO2-eq, falling short of their expected contribution.

Uncertainty remains regarding the calculation of the contribution of sinks versus technological removals in achieving the 90% net emissions reduction target, potentially linked to disagreements regarding the feasibility of such approaches.

VIII. Raw materials

It is clear that the manufacturing and deployment of net-zero technologies will significantly increase Europe's need for raw materials. The extent of this increase would differ, however, on whether scenario 1, 2, or 3 is pursued. In S1 and S3, raw material needs would be lower and higher than in S2, respectively, as in 2040 net installed renewable power capacity is lower by 8% in S1 and higher by 6% in S3 compared to S2.

Here, the Impact Assessment borrows heavily from two IEA reports produced last year on raw materials. According to these reports, the global copper demand in 2022 was 26 million tonnes and the global supply of copper is already projected to exceed 30 million tonnes by 2030. Notably, scenario 3 of the 2040 Impact Assessment would imply a need for up to 500,000 tonnes of copper each year from 2031-2040. Whereas batteries for electric vehicles and stationary batteries would create needs of up to 80,000 tonnes of lithium and 60,000 tonnes of cobalt per year by 2040. Thus, the global supply for lithium and cobalt are expected to be as high as 721,000 and 380,000 tonnes, respectively.

The EU's dependency on energy imports is undeniable. In 2019, the EU imported 60.6% of the energy it consumed, which also proved to be the highest level in 30 years. Although the prices of renewables have decreased substantially in the last decade, the question is whether Europe is willing to trade one energy dependency for another, leaving it forever vulnerable to geopolitical volatility.

Currently, more than 90% of the EU's supply of critical minerals like nickel, copper, lithium come from a third country, with China alone accounting for 100% of heavy rare earth elements. Thus, in the report carried out by the European Scientific Advisory Body on Climate Change (ESABCC), import dependences for critical raw materials were listed to be major hurdles for the EU to achieve its 2040 target while also maintaining its strategic autonomy and role on the global stage.

In order to reduce this dependency, the ESABCC insists that circular economy strategies be implemented alongside 2040 climate policies. If properly implemented, reducing demand for primary materials through various circularity measures has the potential to reduce GHG emissions from industry in the EU by almost 300 Mt/year by 2050. In addition, implementing circular economy strategies could reduce GHG emissions globally by 3.6 Gt CO2eq per year.

Section 4.3 on Industry Decarbonisation in the Communication on the 2040 Framework amplifies the ESABCC assessment and details how the EU must secure a conducive regulatory and financing environment to attract investment and production in Europe. In this respect, both the Critical Raw Materials Act (CRMA) and the Net Zero Industry Act (NZIA) are outlined as crucial legislation to implement that geostrategic framework.

As proposed by the ESABCC, the circular economy business models are referenced as an important solution to become less reliant on critical raw materials outside the EU. The Commission emphasises that not only will this circularity make the EU less reliant on imports of critical raw materials, but also reduce the environmental pressures associated with natural resource extraction. Reducing input through re-use and recycling also has the power to "boost growth and create up to 580,000 high-quality jobs in the EU, with upgraded knowledge and skills".

Therefore, the circular economy is expected to play a larger role moving forward to tackle the EU's import reliance for critical raw materials, and the Commission would like the implementation of the Second Circular Economy Action Plan to be accelerated in order to achieve a doubling of the circular material rate by 2030.

IX. Strategic autonomy

In terms of energy security, the Commission argues that climate policy and energy security go hand in hand as the decline of fossil fuels has profound consequences for the EU's energy dependence. In the Communication, the Commission commits the EU to continue to develop and diversify its strategic partnerships with reliable international suppliers, which it argues will reduce external dependencies while derisking supply chains.

Beyond these strategic partnerships, the Commission emphasises the role of developing the domestic clean tech manufacturing market as a way to reshore some industrial competitiveness in Europe and prevent delaying the necessary climate action to 2041-2050.

In the Impact Assessment, import dependency (the share of imports in GAE) decreases from 61% in 2019, to between 34 to 26% depending on the scenario. Net fossil fuel imports would be reduced by a cumulative €2.8tn between 2031-2050 compared to the average yearly net imports from 2011-2020. Furthermore, they estimate that the cost of stylised shocks in terms of lost output and employment would be halved if taking place in a significantly decarbonised society (by 2040 target standards). It is worth noting that option 3 (reduction target of at least 90% and up to 95%) scores highest in terms of maintaining energy security and strategic autonomy objectives for Europe.

X. Impact on employment and regions in transition

The Impact Assessment marks that regions with a relatively high share of employment in sectors significantly impacted by the transition are prone to experience higher levels of negative impacts. This is due to i. closures of mines/extraction facilities and related production/manufacturing facilities and ii. transformation of industries (namely because they will have to produce different goods).

In 2020, only two EU regions (NUTS-2 level) had employment shares of more than 1% of direct employment in coal and lignite mining, as well as crude petroleum, and natural gas extraction The local impact on regions reliant on these sectors is significant as the sectors have a central role in their economies, also driving indirect employment. The employment and social consequences of the decline in extraction activities in these areas will need to be mitigated.

5. Next steps

The key next step is the election of the new European Parliament and of the upcoming EC leadership.

The incoming Commission will present a legislative proposal that will be discussed by the co-legislators.

The European Council – in Environment Ministers format – has already started discussions, in both informal and formal meetings. No general approach will however be established under the Belgian Presidency (namely until June) and possibly no position will be presented under the Hungarian Presidency either.

The framework (the individual pieces of legislation to support the target) will likely be proposed in 2025/2026 and will go through co-decision. They should be in place in 2027/2028

Annex

6. Documentation

a. Securing our future Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society
b. IMPACT ASSESSMENT REPORT Accompanying the Communication
c. Towards an ambitious Industrial Carbon Management for the EU

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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