



Brussels, 19.6.2023
SWD(2023) 219 final

COMMISSION STAFF WORKING DOCUMENT

**for a Regulation of the European Parliament and of the Council
on establishing a framework of measures for strengthening Europe's net-zero technology
products manufacturing ecosystem (Net Zero Industry Act)**

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EXECUTIVE SUMMARY

This Staff Working Document (SWD) underpins the Commission's Net-Zero Industry Act (NZIA) proposal and provides the explanatory information that substantiates the regulatory elements put forward in this Act. As provided for in the Commission's Better Regulation rules, for cases where an Impact Assessment could not be prepared due to the urgency of an initiative, the enclosed SWD provides the rationale and all the supporting evidence at the latest within three months of the adoption of the legislative proposal.

The support that net-zero industries have been receiving in other parts of the world has contributed to strengthening their international competitiveness stance and business case. Regulatory support measures deployed in other jurisdictions include notably apprenticeship programs, product requirements and simplified permitting. Local content requirements in procurement but also auctions for green power are used by an increasing number of countries¹. The international clean-tech race is in full swing, as the largest economies in the world, from the United States and Canada, to China, India, and Japan, have all started to significantly support their net-zero industries through comprehensive sets of measures, combining regulation and financing.

This has created an unlevel playing field putting pressure on the economic viability and growth prospects of the EU's industries manufacturing net-zero technologies across their supply chain. These global supply dynamics, coupled with EU demand side aspects within the context of EU's ambitious energy and climate targets and the resulting high ambition for net-zero technology deployment, may lead to distortions of purchasing of those technologies, and result in potentially high import dependencies.

Business environment barriers faced by EU manufacturers of net-zero technologies are to a large extent similar to those faced by other industrial sectors- a lack of access to a skilled workforce; a prudential approach to innovation; slow administrative procedures; poor access to finance. In the case of net-zero technology manufacturers these problems are however amplified by the need to quickly ramp up production in a context of fierce international action. This calls for quick and thorough regulatory action.

As a result, on the 16th of March 2023, the Commission put forward the NZIA proposal, a main pillar of the Green Deal Industrial Plan. The Green Deal Industrial Plan aims at boosting the clean technology competitiveness of the EU through a broad set of measures aimed at simplifying the regulatory environment, accelerating access to funding, enhancing skills and supporting trade. NZIA is a part of that broader effort, focused on providing a predictable and simplified regulatory framework for promoting investments and scale-up of the EU's manufacturing capacity of net-zero technologies required to meet its ambitious climate targets. It also aims to improve diversification in supply chains for which the EU is currently heavily reliant on single import sources, and as such ensure it can meet its net-zero technology deployment needs and safeguard its energy security. NZIA provides a regulatory framework that streamlines and speeds up permitting, improves net-zero technologies access to markets and promotes a range of tools such as one-stop shops, net-zero strategic projects, net-zero academies for skills and regulatory sandboxes for innovative net-zero technologies. In other words, the proposed NZIA measures aim to provide predictability, certainty, and long-term signals to incentivise investments in EU net-zero technology manufacturing.

This SWD describes in more detail the rationale and justification behind the main NZIA regulatory measures being proposed. It also explains how the technological scope of the NZIA proposal was defined by discussing both the 'net zero technologies' and 'strategic net zero technologies' categories, as well as that of 'innovative net zero technologies'. In short, strategic net zero technologies are those that are critical to attain our 2030 climate and energy objective, and they have been selected based on three main criteria: 1) they have reached a technology readiness level of at least 8 (first-of-a-kind commercial demonstration, full-scale deployment in final form); 2) they

(¹) Energy Technology Perspective 2023, International Energy Agency.

are projected to contribute significantly and competitively to decarbonisation; and 3) they help alleviate existing or potential security of supply risks (in terms of strategic dependencies that may lead to vulnerabilities). 'Net-zero technologies' represent a broader category which includes those considered strategic but covers additional technologies that were found not to pose any imminent security of supply risks or strategic import dependency prospects, and which were considered particularly relevant to reach the EU's 2050 climate neutrality objective. Whilst all net-zero technologies benefit from provisions in this regulation, strategic net-zero technologies enjoy additional benefits under some of the provisions of the Regulation.

The SWD finds that the NZIA proposal is likely to have mixed impacts on the economic, social, and environmental dimensions, although the overall positive effect outweighs the downsides. The NZIA proposal is expected to stimulate investments in EU's net-zero manufacturing capacity, spur green growth, stimulate quality jobs, and increase the competitiveness and sustainability of its net-zero industry. The NZIA proposal is expected to increase EU's resilience through stimulating the EU supply of net-zero technologies on the one hand, and on the other increase the diversification of import sources for net-zero technologies. Although it may lead to reduced imports in some sectors, especially in those where strategic dependencies on imports from overly concentrated suppliers outside the EU have been identified, negative effects are likely to be short-lived and temporary, in particular because the manufacturing of net-zero technologies and their supply chains are fast growing markets, with high potential for growth and high potential for many players to gain a share of this market.

The NZIA proposal will help develop and strengthen clean energy technology supply chains within the Single Market, with an important role for the Net-Zero Europe Platform to assist and facilitate exchange of information between public authorities and private stakeholders. The NZIA's provision on skills are particularly important for fostering the education and training needed to address the skills shortages being reported in the EU with respect to meeting the challenges of the transition to a climate-neutral economy. SMEs will also benefit from greater opportunities to directly train their staff on critical skills and competencies. This includes interdisciplinarity and skills needs for manufacturing competitive products in their respective supply chains. In addition, SMEs will be able to engage with larger industry leaders in Europe to better adapt their outputs to the overall value chain. This will result in more resilient, competitive, and agile SMEs.

Being complementary to other strong measures focused on the demand side for such technologies, the NZIA proposal is estimated to have a negligible additional impact on greenhouse gas (GHG) emissions within the EU, although it may have an indirect positive impact or knock-on effects on GHG emission mitigation in the rest of the world, in particular in those parts of the world that have in general weaker environmental standards and a higher carbon footprint associated with the manufacturing of these technologies. This is, in particular, due to the provisions on access to market, namely the requirement to take into account the environmental sustainability of net-zero technologies, which might be used to foster the production of relevant technologies with lower carbon content than the average products currently available on the market. A similar reasoning applies to other environmental impacts in that any potential adverse environmental impacts due to the NZIA-induced growth in the net-zero industry could be more easily mitigated in the EU owing to its stricter environmental regulations, with possible indirect net positive environmental impacts globally.

Importantly, the NZIA proposal is not foreseen to generate any significant net administrative burdens or adjustment costs for EU's net-zero industry. On the contrary, the proposed Regulation aims at supporting net-zero technology sectors across the single market, by encouraging, for instance, the streamlining of administrative requirements in relation to permit-granting processes (as well as the shortening of their duration) for producers of net-zero technologies, setting up regulatory sandboxes and ensuring access to information. Although the NZIA proposal is estimated to come with enforcement costs for public authorities, particularly in relation to implementing, administering, and enforcing the respective regulatory requirements, the Commission has at its disposal several tools

that can help Member States in alleviating enforcement costs arising from NZIA implementation (e.g. the Technical Support Instrument).

1. INTRODUCTION

This Staff Working Document (SWD) provides additional analysis supporting the Commission's Proposal, put forward on the 16th of March 2023, for a Regulation of the European Parliament and of the Council on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem, also known as the Net-Zero Industry Act (NZIA).²

The NZIA proposal was not accompanied by a formal impact assessment. Due to the urgency to act for the reasons explained both below and in the explanatory memorandum of NZIA, an impact assessment could not have been delivered and reviewed by the Regulatory Scrutiny Board in the timeframe available prior to the adoption of the proposal. As provided for in the Commission's Better Regulation rules, for cases where an Impact Assessment could not be prepared due to the urgency of an initiative, this document provides the rationale and all the supporting evidence at the latest within three months of the adoption of the legislative proposal.

This SWD explains and justifies the concrete policy choices made in the proposal, as well as their expected impacts. It also further provides clarifications as to why Europe needs to act now to address the increasingly challenging international geopolitical dynamics and unlevel global playing field affecting the competitiveness and resilience of EU's industries manufacturing 'net-zero technologies'. The latter are taken to mean those technologies, alongside their specific components, and specific machinery, primarily used for their production that are needed to decarbonise our economies and societies, and achieve EU's climate and energy targets, contributing to a net-zero emissions world, as per the goals of the Paris Agreement, the legally binding international treaty on climate change.

It is important to note, from the onset, that the challenges facing EU's net zero industry are larger than financing. Permitting for new manufacturing sites lasting up to 4 years increases significantly the risk and cost for project promoters and investors. While about three quarters of EU business report problems with finding appropriately qualified staff, in the case of net-zero technology sectors that problem is amplified by the need to expand capacity. Procurement and auctions based on price only do not reward the value provided by tenderers in terms of better environmental performance or resilience. Collaboration along industrial supply chains could also be reinforced, in particular for those technologies where no industrial alliance exists today. As such, the NZIA proposal is part of the EU's reply to these, in line with the Green Deal Industrial Plan, as described below in this SWD.

This document complements the SWD on the investment needs assessment and funding availabilities to strengthen EU's net zero technology manufacturing capacity.³ The latter was finalised to set the scene for the need of a regulatory framework, as per the NZIA legislative proposal, that would mobilise private and public efforts towards increased commercialisation and scale-up of the manufacturing capacity of net-zero technologies in the EU. Instead, this SWD focuses on the proposed NZIA provisions, their justification, and expected economic, social, and environmental implications. Moreover, qualitative argumentation is used throughout the document, in complement to quantitative analysis and numerical data, when those were not sufficiently available.

The next section sets out in more detail the main factors, both at the global and European levels that have spurred the fast tabling of the NZIA initiative. Section 3 summarises the existing international, EU-level, and EU Member States' level regulatory framework of relevance to manufacturing net-zero technologies and sets forth the legal context against which NZIA was put forwards. It also looks at the links, interplay, synergies, and complementarities between the NZIA proposal and other relevant EU policies and strategies. Section 4 describes the type of evidence used for this SWD, including stakeholder consultation and use of expertise. Section 5 presents the NZIA initiative and describes the rationale and justification behind the main NZIA regulatory dimensions being proposed. Section 6 looks at the expected impacts of the NZIA proposal covering the economic, social, and environmental dimensions, whereas section 7 focuses on the budgetary implications. Section 8

(²) COM (2023) 161 final, 16.03.2023

(³) SWD (2023) 68 final, 23.03.2023

discusses the monitoring and governance aspects, whilst, finally, section 9 sets out, in a nutshell, how the future might look like, should the NZIA be adopted and implemented successfully.

2. PROBLEM DEFINITION

2.1. Demand side: The EU's ambitious decarbonisation pathway and consequences for its net-zero industries

The EU's decarbonisation objectives are among the most ambitious in the world, with the aim to reduce net GHG emissions by at least 55% in 2030 relative to 1990 levels and achieve climate neutrality by 2050. This has set in motion EU policy efforts on various fronts for the massive deployment of net-zero technological and non-technological solutions to achieve its climate and energy targets. For instance, the share of renewables in the electricity mix would need to rise rapidly from around 40% today⁴ to around two thirds in 2030 according to Fit-for-55 projections, and to almost 70% in the REPowerEU context, with solar and wind covering together a share of 60% of total power generation in 2030 (as per Fit-for-55) and around 67% (as per REPowerEU)⁵. According to REPowerEU, solar energy in 2030 would be the largest electricity source in terms of capacity, with more than half of this solar capacity expected to be solar rooftop based, while wind energy would have a 31% share of installed capacity in 2030.⁶ Regarding nuclear power, REPowerEU⁷ assumes a net installed capacity approximately 4 GW higher in 2030 than in certain Fit-for-55 proposals⁸. This results from the operations of two Belgian nuclear units beyond 2025 and maintained nuclear capacity in France. All these developments are set against the background of an increase in net installed power capacity by around 50% in 2030 and around threefold in 2050 (relative to 2015), with EU electricity reaching a share of 30% in final energy consumption in 2030, and 60% in 2050, as the economy increasingly decarbonises and electrifies.⁹

The share of renewables in power generation is projected to further rise as the EU aims to achieve climate neutrality by 2050.¹⁰ The total stock of installed wind and solar PV capacity would both need to more than double and reach 510 GW (from around 203 GW today) and respectively 592 GW (from around 230 GW today) in 2030 (see *Figure 1*), whereas the stock of installed heat pumps in buildings would have to increase by around an additional 30 million units between 2021 and 2030 to meet the REPowerEU objectives¹¹. Installed nuclear capacity is projected to reach around 94 GW in 2030.¹²

(4) According to Council of the EU based on Eurostat data, in 2022, the EU produced 2641 TWh of electricity, with almost 40% from renewable sources, 38.6% from fossil fuels, and nuclear electricity over 20%; Source: "Infographic – How is EU electricity produced and sold?", Council of the European Union, 10 May 2023.

(5) In 2022, with the REPowerEU plan, the Commission proposed to raise the renewables target to 45% of renewable energy in Gross Final Energy Consumption by 2030 and an energy efficiency target of 13%. The provisional agreement on the Renewable Energy Directive sets a target of 42.5% renewable energy by 2030, and the new Energy Efficiency Directive sets an 11.7% reduction target for energy consumption by 2030.

(6) Commission Staff Working Document Implementing the REPowerEU Action Plan: Investment needs, Hydrogen accelerator and achieving the bio-methane targets; SWD (2022) 230 final, 18.05.2022

(7) Commission Staff Working Document Implementing the REPowerEU Action Plan: Investment needs, Hydrogen accelerator and achieving the bio-methane targets; SWD (2022) 230 final, 18.05.2022

(8) Excel files for MIX scenario, https://commission.europa.eu/publications/key-documents-repower.eu_en.

(9) SWD(2021) 622 final Executive Summary of the Impact Assessment Report accompanying the Proposal for a directive of the European Parliament and the Council amending Directive (EU) 2018/2001 of the European Parliament and of the Council, Regulation (EU) 2018/1999 of the European Parliament and of the Council and Directive 98/70/EC of the European Parliament and of the Council as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/65

(10) As per the *Impact Assessment for the revision of RED II, part of the Fit-for-55 package proposal, SWD(2021) 622 final*

(11) COM(2022) 108 final Communication from the Commission to the European Parliament, the European Council, the Council, The European Economic and Social Committee and the Committee of the Regions – REPowerEU: Joint European Action for more affordable, secure and sustainable energy.

(12) As per the *Impact Assessment for the revision of RED II, part of the Fit-for-55 package proposal, SWD(2021) 622 final* – note that the Fit-for-55 proposals were prepared prior to the return to grace of nuclear in the national policies of several Member States. As a result, the underlying figures tend to underestimate the generation capacity of nuclear assets in these time horizons.

The annual EU demand or deployment of technologies is projected to increase substantially by 2030 for some key net-zero technologies (see *Table 1* in *Section 2.3*). Electrolyser annual deployment is set to see a massive increase from 165 MW in 2022¹³ to annual average of around 25 GW over the period 2025-2030,¹⁴ whereas battery annual deployment is estimated to rise fourfold from 140 GWh in 2022 to 610 GWh in 2030.¹⁵ The annual deployment of wind technologies is projected to increase almost threefold (from 15 GW in 2022 to 42 GW in 2030), deployment of heat pumps more than twofold (from 26 GW in 2022 to 51 GW in 2030),¹⁶ and solar PV deployment to a lesser extent (by 30%), since this already achieved 41 GW in 2022.

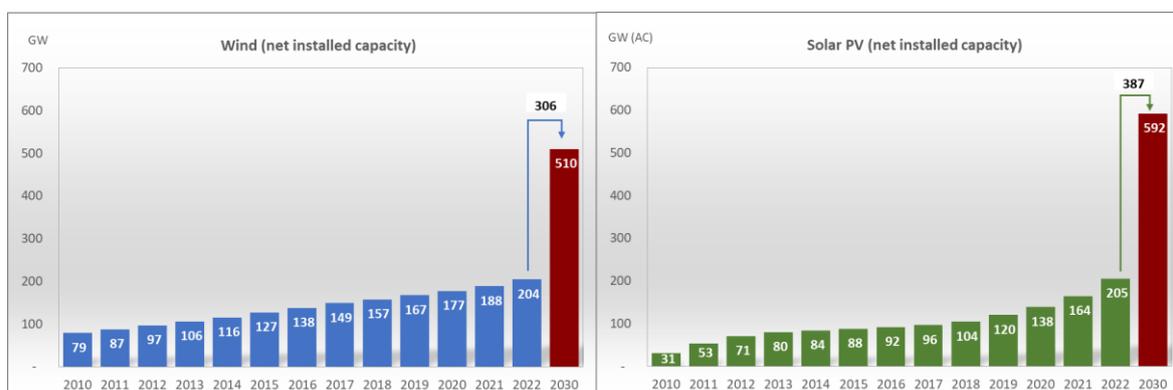


Figure 1: Net installed wind and solar PVI capacity: historical data (2010-2022) and REPowerEU 2030 projections; Source: Eurostat for 2010-2021 data, European Commission “Quarterly report on European electricity markets with a focus on price developments in 2022”, DG Energy, vol 15, issue 4, 2023 for 2022 data; and Commission Communication REPowerEU Plan COM(2022) 230 final, 18.05/2022 for 2030 projections

2.2. Supply side: A global market perspective and implications for EU industries supplying net-zero technologies

As highlighted in the EU Energy External Strategy¹⁷, the acceleration of renewables uptake worldwide also presents an opportunity to strengthen trade relations of the EU, and the EU net-zero industry is well positioned to take up this challenge. EU companies are leaders in important segments of the hydrogen, heat pump and photovoltaic industries and are catching up with Asia on battery technologies, thanks to the European Battery Alliance.

Several major economies across the globe are investing substantially and providing regulatory support to their net-zero industries, so that these improve their profitability prospects and growth potential. Procurement and auctions for green power are increasingly used to support supply chain resilience. More than 20 countries, including 7 advanced economies, have implemented local content requirements for wind energy, as well as solar PV. Product requirements also play a role in supporting international competitiveness- e.g. China is quickly ramping up efficiency requirements for heat pumps to bring them up to international standards with the aim of supporting exports. Skills shortages are being addressed through dedicated programs- e.g. in the Canadian province of Alberta the government is supporting the retraining of coal industry workers for employment in other

⁽¹³⁾ Based on Clean Hydrogen Monitor 2022.

⁽¹⁴⁾ The 25 GW annual deployment in 2030 is based on SWD (2023) 68 final, derived from a pledge from industry, although according to current announcements, 53 GW/y manufacturing capacity will be reached by 2030 (Clean Hydrogen Monitor 2022).

⁽¹⁵⁾ The 2030 battery deployment figure is based on middle range of 2030 projections from VDI/VDE Innovation + Technik GmbH -Market Analysis Q4 2021

⁽¹⁶⁾ Based on SWD (2023) 68 final, whereby the GW thermal output capacity for heat pump manufacturing based on the conversion assumption of 1 heat pump unit equals 12 kW

⁽¹⁷⁾ EU external energy engagement in a changing world {SWD(2022) 152 final}

sectors, including mineral mining. Faster permitting is the focus of clean tech programs in several jurisdictions.¹⁸

The international competition for scale up net-zero technology manufacturing is increasing¹⁹ as the largest economies in the world, from the United States and Canada, to China, India, and Japan, have all started to invest massively in green innovation and deploy a wide set of measures aimed at supporting those objectives. Regarding non-regulatory measures, China, which is currently the leading global supplier of net-zero technologies and a net exporter for many of these,²⁰ has been systematically supporting its net-zero manufacturers via significant amounts of subsidies in various strategic technologies, such as electric vehicles, hydrogen production technologies, solar panels, batteries, and other energy storage technologies. An example of a longstanding support from the government in China is that of the battery industry (and electromobility). Thanks to generous subsidies, the country has managed to expand battery manufacturing significantly, resulting in Chinese cell manufacturers currently having the world's highest cell manufacturing capacity by far (their share of the global market being around 70% in 2021) and in Chinese companies also dominating the global market for electric vehicles, as well as EV component manufacturing or the supply chains for important raw materials.²¹

China appears to have a significant market position not only in the case of solar PV supply chains (for which it has steadily gained an increasing global market share over the last two decades),²² but also in the case of wind supply chains (for which the EU maintains a strong presence), demonstrating the growing pressures that China is exerting on its main trading partners including the EU, notably thanks to economies of scale but also various direct and indirect state support measures. Also in other technologies, where the is traditionally a global market leader, China strongly increased its shares in recent years (e.g. hydropower). *Annex 1* discusses in more detail the competitiveness of EU's net-zero industry from an international comparison perspective.

The United States has recently taken a strong stance in supporting its net-zero industry and provides fiscal incentives under its Inflation Reduction Act (IRA) which is estimated to mobilise over USD 369 billion by 2032 in shoring up domestic green industries. These incentives are projected to improve overall the competitiveness of the U.S. businesses, at least in the short to mid-term, by lowering energy costs by a range of around 20 to 60% depending on the energy technology being considered.²³ Production costs for the U.S.-based manufacturing of key net-zero technologies are also being reduced via the IRA subsidy effects for supported products. It is estimated that IRA subsidy effects will help push down manufacturing costs for some key net-zero technologies, such as solar PV, below those characterising the Chinese industry, bringing all the U.S. segments of solar PV manufacturing to cost parity with the lowest-cost manufacturers (see *Figure 3*). It will reduce the production costs of U.S. battery, solar, and onshore wind technology manufacturing by around 30%, 16%, and respectively, 8% (relative to a case without IRA subsidies). Moreover, the linking of subsidies fostered in the IRA, such as for the extraction of minerals, solar panel production, power generation, clean alternative fuels, clean hydrogen has the potential to create further cost savings. In fact, it is

(18) Energy Technology Perspectives 2023, International energy Agency.

(19) This is also manifested in the new wave of venture capital investments in clean energy and climate tech companies, which have surged over the past years, both in the EU and worldwide. In 2022, for example in batteries, two European venture capital companies (Northvolt and Verkor) are experiencing a rapid scale-up and have the potential to cover up to 25% of the projected EU manufacturing capacity by 2030.

(20) According to a study by the Joint Research Centre of the European Commission, China has systematically and significantly improved its competitiveness ("production progression ability") across all sectors, some of which are now significantly above the country's average (e.g. new information technology, new energy, energy conservation and environment) -. *China 2.0, Status and Foresight of EU-China Trade, Investment, and Technological Race*, Publications Office of the European Union, Luxembourg, 2022, doi:10.2760/45420, JRC131882

(21) VDI/VDE Innovation + Technik GmbH "Resilient supply chains in the battery industry", March 2023

(22) China captures 54% and 70% of the global market for solar PV components and, respectively, assemblies, and ~50% of mid-stream components and final products for wind technologies – based on *European Commission "Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study"*, JRC Science for Policy Report, S. Carrara et al, 2023

(23) *Boston Consulting Group (2022), "US Inflation Reduction Act: Climate & Energy Features and Potential estimating the levelized cost of energy (USD/MWh) per technology supported under the IRA in scenario with tax credit and without tax credit.*

estimated that should U.S. producers make use of all subsidies offered under the IRA, it would make batteries 30% cheaper in the US than in the EU, reduce production costs for solar panels by two-thirds relative to the EU, and even render renewable hydrogen cost-free by 2030.

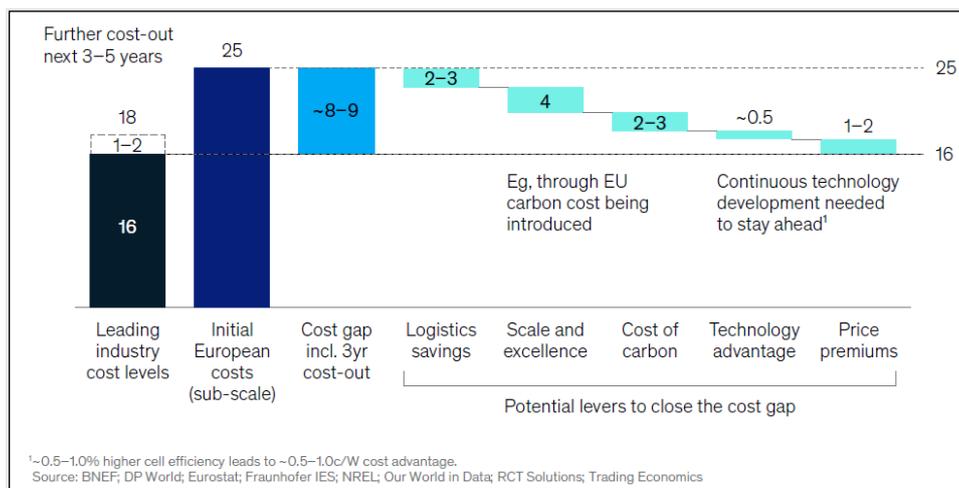


Figure 2: Manufacturing costs comparison in EU and imported from China for solar PV, USD c / W; Source: McKinsey & Company “Building a competitive solar-PV supply chain in Europe”, December 2022

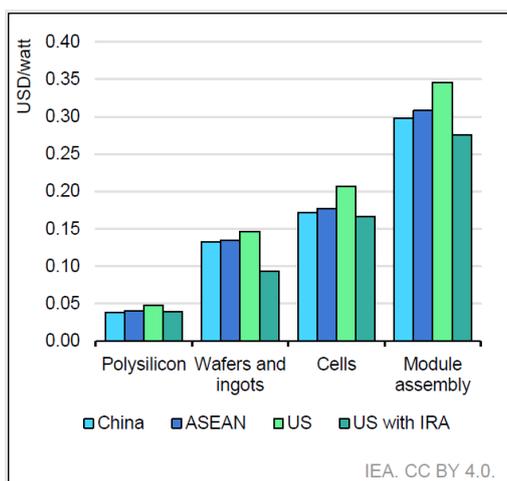


Figure 3: US solar PV c-Si manufacturing costs with and without IRA Manufacturing Production Tax Credit, compared with China and ASEAN. Source: IEA (2023) Renewables 2022: Analysis and forecast to 2027.

Due to the IRA’s local content and production requirements, there is the risk that important supply chains and green investments will locate from the EU to the US over the medium term. Some EU-based businesses have expressed their possible intentions of diverting previously planned investments from the EU to the US. The US battery manufacturing facilities are estimated to benefit largely from the IRA, and receiving the highest influx of investments, which has come at the expense of Europe’s battery industry and its value chain. For example, the US electric vehicle maker, Tesla, recently announced that although its German plant will continue to produce some parts of electric cars, priority must be given to the US due to the attractiveness of the IRA. In particular, although Tesla began assembling battery systems and prepares to produce battery cell components such as electrodes at its plant in Germany, it announced that it will focus instead on battery cell production in the United States in light of tax incentives under the Inflation Reduction Act. Another example is that of Volkswagen which decided to open a new electric vehicle battery plant in Canada and is reported to receive up to C\$13 billion in subsidies, which largely matches what the company would have got from the United States through the IRA. There is now the potential knock-on effect that several net-zero tech manufacturing investment decisions which were originally targeting the EU are

being jeopardised because of the IRA or other net-zero industry support policies around the globe, representing a challenge to EU's industry.

Moreover, in the light of EU's past dependency on Russian gas to meet its energy needs, the EU would further benefit in terms of security of supply from boosting its European net-zero technology industries and helping push forward the green energy transition as per the REPowerEU plan. Since the EU is a net importer of several key net-zero energy technologies across their supply chains, it runs the risk of replacing its dependency on fossil fuels with industrial and technological dependencies in the field of net-zero technologies. Scaling up the EU's net-zero industry manufacturing base also means strengthening the EU's resilience and open strategic autonomy.²⁴

2.3. Barriers to the acceleration of the European clean tech manufacturing sector

Regulatory and market barriers in the European Union hinder the development of net zero industry.

In particular, permitting takes up considerable time and durations are varying and unpredictable across different value chain segments in comparison with other world regions. Further, the often complicated and cumbersome rules and procedures render cross-border investments riskier and more complex, which hinders private finance mobilisation.

Besides, the scaling up of manufacturing capacities does not only need investment into physical infrastructure, but also requires additional skilled workers which implies significant investment in re-skilling and upskilling the needed workforce. Multiple Member States report relatively severe shortages in professions that essentially constitute the skills-base upon which net-zero industries depend on for large part of their value chain, or the skills-pool of candidates that would need extra sectoral specialisation and training to fulfil roles on new green technologies.²⁵ More than three quarter (77%) of companies in the EU industrial ecosystems struggled to find employees with the required skills already in 2019.²⁶

Furthermore, innovation, sustainability and resilience in the manufacturing sector can also be driven by demand-side pulling factors. As such, they will serve the purpose of delivering on wider societal values linked to environmental sustainability, innovation, energy system integration and resilience, based on a strong EU manufacturing sector. EU legislation on public procurement already allows contracting authorities and entities awarding public contracts to design award criteria as part of the most economically advantageous tender notion that may consider qualitative, environmental and/or social aspects. However, contracting authorities and entities awarding public contracts and, in the case of auctions, national public authorities, do not make wide use of the possibilities of including qualitative criteria. More than half of the public procurement contracts are still awarded based on the lowest price criteria only.

Finally, the growth potential of EU manufacturing of net zero technologies is also being undermined by significant volatility in material prices and input costs, more expensive transportation and financing, and continued supply chain bottlenecks, though these factors have also been impacting, to some extent, net-zero industries in other parts of the world.²⁷ For example, according to industry data, the fall in investments in wind energy and turbine orders in Europe (total orders for new wind turbines from EU manufacturers EU fell by almost 50% in 2022 relative to previous year), partly due

⁽²⁴⁾ However, this requires that circularity has a key role in the design and manufacturing of the EU's net-zero industry in line with the European Green Deal and the Long-term Competitiveness Strategy of the EU.

⁽²⁵⁾ Commission Staff Working document "Investment needs assessment and funding availabilities to strengthen EU's Net-Zero" SWD(2023) 68

⁽²⁶⁾ Eurofound, European Company Survey 2019

⁽²⁷⁾ More circular material use, and efficient recycling have a key role in decreasing the dependencies from imported raw materials. For example, the construction of wind turbines requires a lot of materials that need to be recycled at the end of their life cycle. Similarly, solar panels contain a lot of critical materials that are important to recycle. Circularity and recyclability must be taken into account already when designing and manufacturing net-zero industry products in the EU.

to inflation in commodity prices and other input costs have been reported to compound the problems faced by EU's wind energy supply chain.²⁸

2.4. Barriers to the development of a net zero CO₂ industrial value chain

As regards the development of a net zero CO₂ industrial value chain, the EU faces a market failure common in other emerging technology markets with limited demand and supply and heavy infrastructure capital investments, as well as uncertainty based on interdependence between operators of a future value-chain.²⁹ Despite having both an Emissions Trading System (EU ETS) and a legal framework for the environmentally safe geological storage of CO₂ in place (the "CCS Directive"), less than 2 million tonnes of CO₂ are being stored geologically per year today in the European Economic Area (none of which in the EU) and only to decarbonise natural gas. At the same time, from the 12 CO₂ capture or use projects already selected for support from the ETS Innovation Fund, a total of 4.6 million tonnes of CO₂ storage capacity per year will be required by 2029. As such, EU industrial sectors face storage capacity constraints while being incentivised to capture and store CO₂ as a mitigating measure to remove emissions in hard-to-abate sectors and limit exposure to the carbon price. The very limited supply of storage capacity results in prices that undermine the incentive to take final investment decisions to capture CO₂ instead of emitting. Analysts estimate that up to 88 capture projects could start up by 2030 and face this constraint.³⁰ European stakeholders in the paper "*Vision for Carbon Capture, Utilisation and Storage in the EU*"³¹ prepared for the EU CCUS Forum in 2022, estimate a resulting demand for annual storage services in the European Economic Area (EEA) to be as high as 80 million tonnes per year by 2030, which could grow to at least 300 million tonnes per year in 2040.

Since the first call of the ETS Innovation Fund in 2020 more than 100 industrial projects related to CO₂ capture have applied for support. This demand is underpinned by the faster reduction of the ETS cap and a faster reduction of free allocation in the revised ETS Directive, which incentivises several energy-intensive 'hard-to-abate' sectors (e.g. cement industry) to develop investment plans in CO₂ capture, to either reuse the CO₂ to produce fuels/chemicals (CCU), or permanently store the CO₂ (CCS). Such investments are increasingly expected to give positive economic returns before 2030 based on projected carbon prices. Preliminary findings of an ongoing JRC analysis of different CCUS project databases which results in capture volumes growing to around 70 million tons of CO₂ per year by 2030.³²

Despite the growing price incentive from the EU ETS, the investors in capture projects face presently a significant risk of not being able to access a storage site when they need it. This while storage operators face upfront costs to identify, develop and appraise storage sites even before they can apply for a regulatory permit that is necessary to operate. These costs are only justifiable if long-term storage customers can be secured early on. Both sides, suppliers, and customers, therefore, face a coordination challenge as they depend on each other to kick-start a nascent CO₂ service market facing significant uncertainty about size and the speed of the emerging CO₂ storage service market.

On 30 March 2023, during a knowledge sharing workshop under the ETS Innovation Fund³³, 12 prospective storage operators informed about their planned CO₂ projects in Europe, their development status, timing, their storage targets, and possible availability of storage volumes for

⁽²⁸⁾ WindEurope "Investments in wind energy are down – Europe must get market design and green industrial policy right" 31.01.2023

⁽²⁹⁾ The respective market failure consists mostly in a coordination failure between the economic operator who has to capture the CO₂ and the provider of infrastructure (who has to store the CO₂). Even the cheapest CO₂ capture project is dependent on a third party to provide the infrastructure to store it, and hence will decide to invest only if the capacity to store on commercial terms is there. Typically, infrastructure e.g. in electricity or gas are regulated assets to enable access and make the market work.

⁽³⁰⁾ Rystad Energy, CCUS Analytics "EU eyes a world-class net-zero industry – partly built on CCS", 30 March 2023.

⁽³¹⁾ <https://circabc.europa.eu/ui/group/75b4ad48-262d-455d-997a-7d5b1f4cf69c/library/655664b9-2e49-4aec-92fc-7343cee4079e/details>

⁽³²⁾ The forthcoming update of the "Study on the evolution of the extent and the investment requirements of a trans-European CO₂ transport network" will be published in August 2023

⁽³³⁾ Report and the presentation of the participants are available at: https://climate.ec.europa.eu/eu-action/carbon-capture-use-and-storage/implementation-ccs-directive_en#information-exchange-group

potential capturers. The participants discussed risk-sharing and risk-management across a value-chain consisting of different industry sectors, as well as the need for information exchanges and structured, synchronised cooperation between public and private entities and regulatory authorities at EU and Member State level to ensure investment decisions are taken based on sufficient transparency about costs and project risks. According to the statements made by the prospective CO₂ storage operators, the total planned storage capacity available in 2030 could amount to around 72 million tonnes annually in the European Economic Area, of which around 35 million tonnes in the EU. While after 2030 the planned storage capacity in the EU could reach 84 million tonnes, there is uncertainty regarding the planned Final Investment Decisions, as summarised in the graph below (see Figure 4).

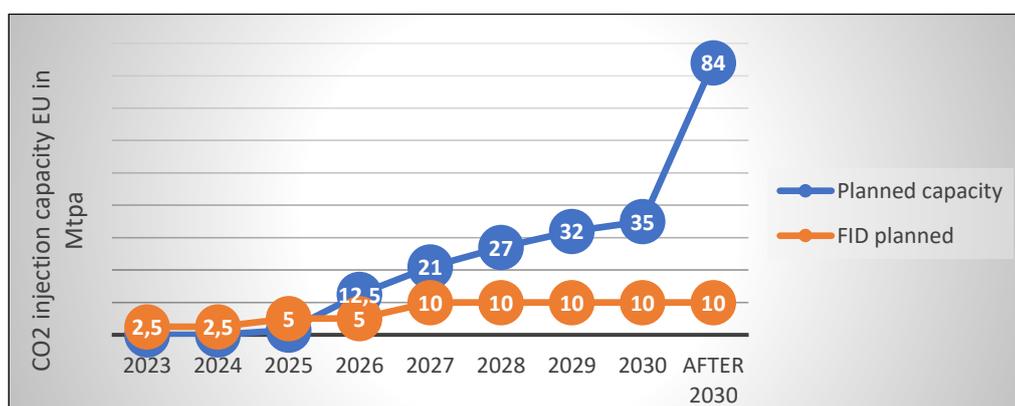


Figure 4: Planned CO₂ injection capacity compared to planned Final Investment Decisions (FID) in the EU (March 2023)

This compares to the situation where the US Inflation Reduction Act of 2022 supports the use of CO₂ storage sites until 1 January 2033 with corporate projects receiving direct payments during the first 5 years for capturing and storing CO₂, namely in industrial and power facilities (USD 85/tonne); for enhanced oil recovery (USD 60/ton) and from direct air capture (USD 180/tonne).

The support that net-zero industries have been receiving in other parts of the world has contributed to artificially lowering their costs and has resulted in the EU currently being a net importer of several net-zero technologies. As a result, strong import dependencies for certain components have been developed, as for instance in the solar PV value chain, nearly all PV modules, solar cells, wafers and ingots are being imported, mainly from China³⁴. But also, in other net-zero industry areas, such as cathodes and anodes for battery manufacturing, dependencies are high. In addition, in other technology production sectors, where the EU industry is still strong, such as wind turbines and heat pumps, its trade balance is deteriorating as EU producers face both high input costs and stronger competition from other major players. For example, the share of European production capacity in global production decreased for major wind components (nacelles, blades, gearboxes, generators) between 2010-2019.³⁵ Another example is heat pumps, in which European industry is well established and innovative, yet in 2020, a long held trade surplus turned to a trade deficit, which further increased in 2021 due to imports from China more than doubling.³⁶ Nevertheless, most heat pumps installed in the EU are still manufactured in the EU, and trade accounts for only a small share of this very rapidly growing market.

2.5. Summary of challenges

In summary, the accelerated EU demand for net-zero technologies coupled with the aforementioned supply dynamics at the global level and market and regulatory constraints to the acceleration of a European capacity risk to result in potentially high import dependencies and a share

⁽³⁴⁾ McKinsey & Company "Building a competitive solar-PV supply chain in Europe", December 2022

⁽³⁵⁾ See for instance Mackenzie for WindEurope (2020) "Wind energy and economic recovery in Europe: How wind energy will put communities at the heart of the green recovery"

⁽³⁶⁾ JRC, commissioned by DG GROW -European climate-neutral industry competitiveness scoreboard (CIndECS) (Draft, 2022).

of EU demand supplied by EU industry that is not consistent either with its competitive merits or our economic security. The high 2030 deployment needs for key net-zero technologies are illustrated in *Table 1*, with the EU manufacturing capacity for some of these being particularly challenged in terms of the production growth needed to maintain or increase the share of EU demand being satisfied by EU supply of the corresponding technologies. Challenges to scale up vary across the technologies considered.³⁷

	Annual deployment in 2022	Annual deployment in 2030	Manufacturing capacity in 2022
Solar (GW-AC)	41	53	1
Wind (GW)	15	42	13
Heat pumps (GW)³⁸	26	51	14
Electrolysers (GW, electricity input)	0	25	2
Batteries (GWh)	140	610 ³⁹	75

Table 1: Annual deployment and manufacturing in the EU of key net-zero technologies, actual figures for 2022, and REPowerEU projections for 2030 deployment figures. Source: 2030 deployment and 2022 manufacturing data are taken from various sources as per SWD in investment needs assessment COM (2023) 68 final, whereas 2022 deployment data draw on various industry reports.⁴⁰

3. LEGISLATION AND OTHER POLICY INITIATIVES TO ADDRESS THE PROBLEM WITHIN THE EU AND ELSEWHERE

3.1. International policy

Increasing EU manufacturing capacities for net-zero technologies aims to contribute to Europe and the rest of the world efforts “to limit the temperature increase to 1.5°C above pre-industrial levels” as foreseen in the Paris Agreement.⁴¹ The measures proposed in the Act are in line with international best practices promoted by international organisations, such as the International Energy Agency (IEA)⁴² and the Organisation for Economic Cooperation and Development (OECD),⁴³ especially for the choice of strategic net-zero technologies and the streamlining and speeding up of permitting procedures. They are also in line with the EU’s international commitments.

At the same time, the current geopolitical and economic context requires strengthening economic security and supply chain resilience, and avoiding strategic dependencies, while preserving the climate objectives. The proposed NZIA is also a response to the actions taken by EU’s main trading partners, such as the US, China, Japan, South Korea, Canada, Norway, and UK. Also, Japan has

⁽³⁷⁾ For instance, a Bruegel analysis estimates that EU solar manufacturers meet the smallest share of deployment needs (around 3%, 4%, and 22% for domestic producers of wafers, cells, and respectively modules); domestic battery manufacturing covers around 40% of current domestic deployment levels; heat pumps around two thirds; whereas for wind turbines the EU is well placed (e.g. EU onshore wind manufacturers are producing the equivalent of 102% and 72% of deployment needs for turbine blades, and respectively, nacelles and towers), whereas water electrolyser manufacturing capacity is many times more than the current level of installed capacity, the latter being very low compared to the objectives the EU has set forth. “The wide disparity between the current manufacturing capacity and deployment for water electrolyser manufacturing capacity is explained by delays between investment decisions and operational deployment, lack of hydrogen demand compared to supply capacity, and regulatory bottlenecks.” – Sgaravatti G, Tagliapietra, S. and Trasi, C. “Clean tech manufacturing: where does Europe really stand?”, Bruegel study, 17 May 2023.

⁽³⁸⁾ Deployment and manufacturing figures for heat pumps in 2022 refer to all types of heat pumps, whereas 2030 deployment refer to heat pumps in buildings. A conversion factor of 1 unit heat pump equalling 12 kW was used based on SWD (2023) 68 final.

⁽³⁹⁾ There is a high uncertainty attached to this projection in the literature. For instance, the European Battery Alliance estimates the demand to be much higher than what the literature typically finds, i.e. about 1000 GWh per year in 2030 - European Battery Alliance Discussion Paper for the 7th High-Level Meeting of the European Battery Alliance. Published 1 March 2023

⁽⁴⁰⁾ For solar: SolarPower Europe “European Solar Market Outlook for Solar Power 2022-2026”; for wind: WindEurope “EU wind installations up by a third despite challenging year for supply chain”, 11 January 2023; for heat pumps: European Heat Pump Association “Heat pump record: 3 million units sold in 2022, contributing to REPowerEU targets”, 20 February 2023, for electrolysers Clean Hydrogen Monitor 2022, for batteries based on European Battery Alliance estimates.

⁽⁴¹⁾ [The Paris Agreement | UNFCCC](#)

⁽⁴²⁾ [The world is entering a new age of clean technology manufacturing, and countries’ industrial strategies will be key to success - News - IEA](#)

⁽⁴³⁾ [An industrial policy framework for OECD countries: Old debates, new perspectives | en | OECD](#)

established economic security and supply chain decarbonisation as a key topic of its Presidency of the G7, whilst the G7 countries are committed to jointly empower low- and middle-income countries to play bigger roles in global value-chains.⁴⁴ Further detail on relevant legislation in non-EU countries is provided in *Annex 2*

3.2. EU current and proposed policy initiatives

3.2.1. EU-level legislation and policies

The EU has committed to achieve climate neutrality, i.e. net-zero greenhouse gas emissions, by 2050, mainly by cutting emissions, investing in green technologies, and protecting the natural environment. This objective is at the heart of the European Green Deal⁴⁵ and in line with the EU's commitment to global climate action under the Paris Agreement, the Climate Law⁴⁶ and the Fit-for-55 package.⁴⁷ NZIA addresses the net zero technologies essential to our decarbonisation objectives. These technologies will also play a key role in the Union's open strategic autonomy, ensuring that citizens and businesses have access to clean, affordable, secure energy and key components. NZIA will simplify the regulatory framework for the manufacturing of these technologies and therefore help increase the competitiveness of the net-zero technology industry in Europe. It will also accelerate the capacity to store CO₂ emissions. This is in line with the objectives defined in the EU industrial strategy,⁴⁸ the Single Market framework,⁴⁹ the public procurement⁵⁰ rules and the new standardisation strategy⁵¹ to tackle climate change, build up a clean and secure energy and materials supply, and support the digitalisation of our economy.⁵²

The question of skills is also fundamental to the functioning of NZIA; skills are key to empowering people to respond to the needs of net-zero industries and to develop a responsive and resilient workforce. NZIA aims to both complement and support ongoing action on skills including the European Skills Agenda which sets out a five-year plan to help individuals and businesses develop more and better skills and to put them to use, among others, by strengthening the European Green Deal. Actions within the EU Skills Agenda, such as the Pact for Skills, demonstrate the facilitating role the EU can play in connecting Member States, education and training providers, industry and social partners to effectively identify skills and learning pathways, which has inspired the element on Net Zero Industry Academies described below.

The latest developments linked to Russia's invasion of Ukraine, the energy crisis, and the labour shortages the EU is currently facing, are pushing skills, and more specifically skills for the green transition, to the top of the EU's political agenda. This priority was confirmed by the announcement

⁽⁴⁴⁾ See the "[G7 Finance Ministers and Central Bank Governors's Statement](#)" 12 April 2023

⁽⁴⁵⁾ [The European Green Deal \(europa.eu\)](#) COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A Green Deal Industrial Plan for the Net-Zero Age COM(2023) 62 final

⁽⁴⁶⁾ REGULATION (EU) 2021/1119 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law')

⁽⁴⁷⁾ COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS 'Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality COM/2021/550 final

⁽⁴⁸⁾ [Updating the 2020 industrial strategy: towards a stronger single market for Europe's recovery \(europa.eu\)](#) COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe's recovery {SWD(2021) 351 final} - {SWD(2021) 352 final} - {SWD(2021) 353 final} COM(2021) 350 final

⁽⁴⁹⁾ [30th anniversary \(europa.eu\)](#) COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Single Market Act Twelve levers to boost growth and strengthen confidence "Working together to create new growth" /* COM/2011/0206 final */

⁽⁵⁰⁾ [Public procurement \(europa.eu\)](#) Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC (Text with EEA relevance); Directive 2014/25/EU and Directive 2014/23/EU

⁽⁵¹⁾ [Standardisation strategy \(europa.eu\)](#) COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS An EU Strategy on Standardisation Setting global standards in support of a resilient, green and digital EU single market COM(2022) 31 final

⁽⁵²⁾ The EU Space programme also offers satellite services that can help the independent worldwide monitoring of emissions and accelerate green transition.

of the European Year of Skills taking place in 2023 by President von der Leyen at the State of the Union speech on 14 September 2022, where skills needed for the green transition will also play a key role, and where a mindset of reskilling and upskilling is being promoted to support European companies grappling with staff shortage. NZIA's proposed articles on enhancing skills for quality job creation would further support Commission's efforts in fostering a mindset of reskilling and upskilling. Further information on EU action on skills, including the actions within the EU Skills Agenda can be viewed in Annex 2. Information on the European Year of Skills can be found on the dedicated website.⁵³

Following the European Council Conclusions of 15 December 2022, on 1 February 2023 the Commission put forward a Green Deal Industrial Plan (GDIP)⁵⁴ to enhance the competitiveness of Europe's net-zero industry and support the fast transition to climate neutrality. This is of the highest importance and relevance for the NZIA proposal and is composed of four pillars:

- (1) A simplified regulatory environment that would encourage the scale-up of EU's net-zero industry. This GDIP pillar takes the form of the NZIA proposal.
- (2) Speeding up financing including a temporary and targeted adjustment of EU State aid rules to facilitate public investments for the green transition, as well as utilising REPowerEU, InvestEU and the Innovation Fund as bridging solution to provide fast and targeted support. For the mid-term, the Commission intends to give a structural answer to the investment needs, by proposing a European Sovereignty Fund in the context of the review of the Multi-annual financial framework before summer 2023.
- (3) Enhancing skills: This includes Net-Zero Industry Academies to roll out up-skilling and re-skilling programmes, a 'Skills-first' approach, measures to facilitate access of skilled third country nationals and the creation of additional large-scale skills partnerships under the EU Pact for Skills, and
- (4) Open trade for resilient supply chains that aims to facilitate open and fair trade for the benefit of all, both through an ambitious trade agenda and using all EU tools to deal with unfair practices and ensure strong and resilient supply chains needed for the twin transition.

The GDIP builds on previous initiatives and relies on the strengths of the EU Single Market, complementing ongoing efforts under the European Green Deal and REPowerEU. The GDIP was discussed in the European Council on 9 February 2023. Based on its Conclusions, the Commission has translated the Plan into concrete proposals before the March European Council.

In March this year, the NZIA proposal as well as the proposals for the **Critical Raw Materials Act (CRMA)**⁵⁵ and the **Electricity Market Design (EMD)**⁵⁶ were adopted by the Commission. During the same month, the Commission also adopted a new **Temporary Crisis and Transition Framework**⁵⁷, which allows State aid to accelerate investments in sectors that are strategic for the transition towards a net-zero economy, in a temporary and targeted manner. The TCTF delivers on the second pillar of the GDIP and allows Member States to provide aid in support of certain net-zero technologies, identified consistently with the list of strategic net-zero technologies listed in the Annex of the NZIA proposal. The TCTF allows MS to provide aids for the decarbonisation of industrial production processes via schemes, as well as via individual ad hoc aid to specific undertakings:

⁽⁵³⁾ https://year-of-skills.europa.eu/index_en

⁽⁵⁴⁾ COM(2023) 62 final, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions "A Green Deal Industrial Plan for the Net-Zero Age", 01 February 2023

⁽⁵⁵⁾ COM(2023) 160 Proposal for a regulation of the European Parliament and of the Council establishing a framework for ensuring a secure and sustainable supply of critical raw materials, 16 March 2023

⁽⁵⁶⁾ Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Regulations (EU) 2019/943 and (EU) 2019/942 as well as Directives (EU) 2018/2001 and (EU) 2019/944 to improve the Union's electricity market design COM/2023/148 final

⁽⁵⁷⁾ Communication from the Commission Temporary Crisis and Transition Framework for State Aid measures to support the economy following the aggression against Ukraine by Russia 2023/C 101/03 (OJ C 101, 17.3.2023, p. 3).

schemes provide support capped at a certain percentage of the investment costs and nominal amounts, depending on the location of the investment and the size of the beneficiary; higher support to individual companies, can be provided through individual ad hoc aid, where there is a real risk of investments being diverted away from Europe.

As laid down in the Communication on the Green Deal Industrial Plan, the technologies identified by the NZIA may go beyond the strategic net-zero technologies that are eligible for the specific type of support available under the TCTF. That's because with the TCTF and its new section 2.8, the Commission enables Member States to further accelerate investments in key sectors for the transition towards a net-zero economy which are at risk of relocation because of the US IRA or other subsidies offered by third countries.⁵⁸ The NZIA complements the CRMA by focusing on the manufacturing of net-zero technologies in terms of final products, key components, and specific machinery used to produce these. The CRMA focuses instead on the upstream part of the supply chain, particularly critical raw materials, and processed / refined materials, and on the downstream part in terms of increased recycling and use of recycled materials. These are indispensable for a wide set of strategic sectors including the net zero industry, the digital industry, aerospace, and defense sectors. By following the same logic of nurturing a business case, upgrading, and providing adequate skills, and supporting investments, the NZIA and CRMA work together to create regulatory support synergies across the entire supply chain of net-zero technology manufacturing in the EU.

Further EU legislation and policy initiatives relevant for the NZIA proposal are discussed in more detail in *Annex 2*.

3.2.2. *Specific legislation and other policies in EU Member States*

All the Member States will have a central role to play to ensure an effective implementation of the measures proposed in the NZIA, for the selection of projects, the streamlining of permitting procedures, the reskilling and upskilling of the workforce, and the assistance to gather the financial means and share the financial risks.

Several mechanisms are already in place to drive such new approaches. Among them, we can mention the following ones:

- On 25 April 2023, the energy ministers of nine European countries signed the Ostend declaration,⁵⁹ an agreement committing to jointly install at least 120 GW of offshore wind capacity by 2030, and at least 300 GW by 2050. They will jointly develop The North Seas as a Green Power Plant of Europe, an offshore re-newable energy system connecting the respective countries with a particular focus on joint hybrid/ multi-purpose and cross-border offshore projects and hubs, offshore wind, and renewable hydrogen production at massive scale as well as electricity and hydrogen inter-connectors and national projects, including the possibility for co-financing by countries without direct access to the sea. As the green transition, which will lower energy prices in the EU in the long run, is a cornerstone for maintaining global competitiveness, the leaders emphasised the importance of promoting European value chains in green tech and diversifying sources of critical raw materials for wind turbines and batteries, through import diversification, increased European output, and the enhanced circularity of offshore renewable energy and grid infrastructure.
- The French government⁶⁰ presented in April 2023 a new legislative proposal supporting green industries. It aims at decarbonising the industry and developing clean technologies.

⁽⁵⁸⁾ The TCTF covers the following list of technologies: (i) the production of relevant equipment for the transition towards a net-zero economy, namely batteries, solar panels, wind turbines, heat-pumps, electrolysers, and equipment for carbon capture usage and storage (CCUS), as well as (ii) the production of key components designed and primarily used as direct input for the production of the equipment defined under (i); or (iii) the production or recovery of related critical raw materials necessary for the production of the equipment and key components defined in (i) and (ii) above.

⁽⁵⁹⁾ <https://www.northwindresearch.no/wp-content/uploads/2023/04/ostend-declaration-energy-ministers-north-seas-europes-green-power-plant.pdf> and [Ostend Declaration on the North Seas as Europe's Green Power Plant | Alexander De Croo \(premier.be\)](#)

⁽⁶⁰⁾ [Industrie verte : les principales mesures qui vont alimenter le projet du gouvernement | Les Echos](#)

Key measures include: accelerating permitting process for factories; taking into account environmental criteria in public procurement procedures; developing skills for the green transition; supporting financially the green industries and the green transition of industry, either by granting public support (for instance in the form of tax credit), or by encouraging private financing for the green industry.

- German Trade and Investment (GTAI)⁶¹ has a dedicated mission to attract new investments in Germany to grasp new business opportunities related to net-zero technologies.
- One-stop shops for permitting procedures relevant to NZIA's scope exist already in a few Member States, such as Belgium⁶², Denmark⁶³, the Netherlands⁶⁴ and, for instance, in Germany at a regional/cluster level.⁶⁵ In addition, Member States may choose to build upon the existing one-stop shops or on the experiences with setting up one-stop shops for e.g. for the deployment of renewable energy projects as required under the Renewable Energy Directive, where best practices have already been established in various Member States.⁶⁶
- Both Denmark and the Netherlands already have dedicated regulatory conditions and public support programmes in place (a) to help energy-intensive 'hard-to-abate' sectors to decarbonise their operations with CO₂ capture and (b) to develop the necessary CO₂ infrastructure and storage capacities which could qualify as Net Zero Strategic Projects for CO₂ storage and contribute to reach the EU target.

3.2.3. *Public-private and private-led initiatives*

Some of the proposed measures in NZIA aim at making the best use of existing financing mechanisms, such as the Recovery and Resilience Facility, InvestEU or the Innovation Fund. Furthermore, the Commission and Member States may under the Net-Zero Europe Platform foster cross-country contacts between undertakings active in net-zero sectors within the European Union, by making use of the work of industrial alliances. Under the umbrella of the Platform, for instance, the Commission and Member States may bring together manufacturers and off-takers⁶⁷ of net-zero technologies, also making use of the industrial alliances, the Industrial Partnership for Biomethane, the Clean Energy Industrial Forum, and the Strategic Energy Technology Plan (SET Plan). The idea is to maximize the synergies between all actors involved in the net-zero technologies. This should be an effective mix between bottom-up and top-down approaches to maximize the use of resources at EU, Member State, and private levels.

Additionally, in compliance with competition rules, NZIA proposes to bring Member States and the Commission together with relevant financial institutions in the Net-Zero Europe Platform to discuss private sources of financing, investment needs and existing financial instruments and EU funds. To achieve this, one of the proposed actions is the Commission's work with the European Investment Bank and other InvestEU implementing partners to seek ways to scale up support to investment in the net-zero industry supply chain, including via the setting up of blending operations. Private investment by companies and financial investors will be essential.

Regarding industrial alliances, NZIA proposes to ensure cooperation and coordination between the Platform and "existing industrial alliances". The latter refer to industrial alliances, which were established by the Commission recent years, and that cover net-zero technologies, such as the European Clean Hydrogen Alliance, the European Solar Photovoltaic Industry Alliance, the European

⁶¹) [Climate Action \(gtai.de\)](https://gtai.de)

⁶²) [Le permis d'environnement \(wallonie.be\)](https://www.wallonie.be/le-permis-d-environnement)

⁶³) [one-stop_shop_oct2020.pdf \(ens.dk\)](https://ens.dk/one-stop-shop-oct2020.pdf)

⁶⁴) <https://business.gov.nl/regulation/applying-for-all-in-one-permit-physical-aspects/>

⁶⁵) <https://www.cleantech-ost.de/>

⁶⁶) SWD/2022/0149 final.

⁶⁷) Off-takers are buyers of the upcoming net-zero technological products according to an offtake agreement, whereby a producer and a buyer agree to sell/purchase the producer's upcoming goods often in advance of the construction of a factory/facility and before the production has begun to help the seller secure project financing and guarantee a revenue stream for its future output.

Battery Alliance, the Alliance for Zero Emissions Aviation as well as the Renewable and Low-Carbon Fuels Value Chain Industrial Alliance. The Commission's objective is to ensure consistency and prevent redundancies in initiatives aimed at promoting net-zero manufacturing. In case no industrial alliance exist, e.g. for onshore and offshore wind, the new work-strands described above may take place under the Platform. The recommendations provided by the Biomethane Industrial Partnership (BIP) may further inform the work of the platform on strategic net-zero technologies. In the context of the CCUS Forum, industry stakeholders are working towards establishing a new industrial partnership for the emerging CCUS value chain in Europe.

4. CONSULTATION AND USE OF EXPERTISE

The evidence basis of this SWD relied on stakeholder inputs, expertise and studies, as well as related EU institutional work and reports, such as the conclusions of the special meeting of the European Council (9 February 2023).⁶⁸ It makes use of mostly secondary data sourced from a variety of databases, studies, and reports that have been published in the last years on the net-zero technology manufacturing sector, though it also draws, to a much more limited extent due to time constraints, on primary data collected via questionnaires targeting industry stakeholders.

4.1. Stakeholder consultations

The first meeting of the Net-Zero Europe Platform (initially labelled the Clean Tech Europe Platform), which was organized by the Commission on November 30, 2022, involved a high-level discussion and initial consultation with Member States and stakeholders in the net-zero industry. The meeting was attended by representatives from 23 Member States and various industries in the value chain of wind, batteries, electricity grid, heat pumps, and solar PV. Participants emphasised the urgent need to increase the manufacturing capacity of net-zero technologies in response to Russia's aggression against Ukraine and global regulatory competition in the sector, such as the United States Inflation Reduction Act. Industry representatives highlighted certain bottlenecks in the Union, such as lengthy permitting procedures for constructing or expanding net-zero manufacturing capacity, as well as a shortage of qualified staff, which could hinder private investment mobilization.

In addition to this meeting and long standing regular exchanges with relevant stakeholders, in February 2023, a targeted additional survey was conducted with a selection of net-zero industrial stakeholder organisations from the wind, solar, battery, heat pump, and hydrogen/electrolyser industries to provide additional insights on bottlenecks for scaling up manufacturing capacity for key net-zero technology sectors.⁶⁹ The questionnaire asked stakeholders to provide written input on the main bottlenecks for the clean tech supply chain scale-up and the relevant policy avenues aimed at removing those bottlenecks, with the questions being structured along six main dimensions: (1) Market-size; (2) Industrial footprint; (3) General bottlenecks, constraints, and barriers; (4) Permitting; (5) Financing; and (6) Public procurement, auctions, and demand-support measures. More details and findings relating to this targeted survey are discussed in *Annex 4*. Overall, the survey provided a valuable additional analysis of the 2023 state of play regarding barriers in the European net-zero technology supply chain in key strategic sectors and supporting the identification of policy avenues to overcoming barriers on the way to transition to a net-zero future.

Input was also provided by the relevant stakeholders to the Commission as part of the work in the industrial alliances, such as in the Clean Hydrogen Alliance, Battery Alliance, and the Solar PV Industry Alliance. The different working groups and roundtables organised under the industrial alliances provided a setting to discuss the main bottlenecks and explore potential actions to overcome the main barriers in boosting the respective clean tech industries. Thus, these exchanges as part of the Alliances have fostered the identification of potential policy avenues in view of providing a regulatory

⁶⁸ Special meeting of the European Council (9 February 2023), - Conclusions, EUCO 1/23, CO EUR 1, CONCL 1

⁶⁹ The questionnaire had 37 questions the European Associations of the net-zero technology final products of the sectors mentioned above, namely the European Heat Pump Association (EHPA), HydrogenEurope, RECHARGE, SolarPower Europe, and WindEurope. The questionnaire had a short deadline of five working days and was sent on 2 February 2023.

environment to support the clean tech manufacturing industries. More concretely, the European Clean Hydrogen Alliance developed a report on barriers for large-scale deployment of clean hydrogen in the EU,⁷⁰ where cumbersome permitting for electrolyser manufacturing plants was identified as an obstacle and suggested to support fast-tracking permitting procedures. The European Electrolyser Summit held in May 2022 with its consecutive Joint Declaration also helped to identify the necessary electrolyser manufacturing capacities to meet our REPowerEU hydrogen objectives.

Moreover, in late 2021 the Commission established ‘The Carbon Capture, Utilisation and Storage Forum (CCUS Forum)’ as a multi-stakeholder advisory group comprising representatives from the EU institutions, EU Member States and third countries, NGOs, business leaders and academia to facilitate the deployment of CCUS technologies in the EU. As a result, the first plenary meeting established three working groups to ensure an ongoing stakeholder dialogue, organised by the Commission and moderated and supported by co-chairs selected from participating stakeholders, ensuring balanced representation (NGOs, think tanks, public administration, and industry associations). The working groups meet regularly throughout the year and are composed of a wide range of stakeholders. In late 2022 two stakeholder papers were endorsed in the plenary meeting and transmitted to the Commission. The papers address the prevailing lack of CO₂ infrastructure development (WG1) and formulated a joint stakeholder vision for the role of CCUS in decarbonising energy and industry, emphasising the importance of CCUS technologies for achieving the EU climate targets and outlining clear actions the Commission should take to promote their implementation, including setting annual storage capacity targets in the EEA. In 2023 the stakeholder work continues, with working groups on CO₂ infrastructure; industrial partnership for CCUS; public perception and CCUS Strategy.

Several comments were also received from various stakeholders via the “Have your say” portal associated with the NZIA proposal, which served as guiding inputs into the drafting this SWD and providing further clarifications of the NZIA proposal, as put forward in the next sections (a brief summary of these is also included in *Annex 4*).⁷¹

4.2. Collection and use of expertise

The SWD makes references and use of various studies already published, as well as on the findings of a new study commissioned to partly support the findings put forward in this document. Some of the key studies are enumerated in *Annex 5*.

5. PRESENTATION OF THE NET ZERO INDUSTRY ACT PROPOSAL

5.1. Options considered and justification of the measures

The SWD focuses on the option of putting forward and implementing the NZIA proposal. The assessment of this proposal is undertaken by comparing it to a base-case (default) option of not implementing NZIA and following the regulatory framework in the EU that is currently in place. Under this scenario, no additional policy action to boost and scale up the manufacturing of net-zero technologies. This is labelled as the **‘business-as-usual option’**, in which the EU does not take any explicit additional policy action to boost and scale-up its net-zero industry base.⁷² The other option

⁽⁷⁰⁾ European Clean Hydrogen Alliance, October 2021 “Reports of the Alliance roundtables on barriers and mitigation measures” [ECH2A RTs reports on barriers and mitigation measures FINAL.pdf \(europa.eu\)](#)

⁽⁷¹⁾ This stakeholder feedback on the NZIA proposal is available at: [Net Zero Industry Act \(europa.eu\)](#)

⁽⁷²⁾ It is important to note here that this “business-as-usual” option differs in its concept to that of the “status-quo scenario” as presented in the SWD on the investment needs assessment and funding availabilities to strengthen EU's Net-Zero technology manufacturing capacity (SWD(2023) 68 final). This is because in the latter, the “status-quo” scenario assumed that those net-zero technology industries that have a significant presence in the EU (e.g. wind, heat pumps) will maintain their shares of meeting EU’s deployment needs up to 2030, which would translate in some additional policy action, and public and private investment efforts to expand their manufacturing capacity such that they meet the technology deployment needs and thus maintain their respective shares. In the “business-as-usual” scenario option qualitatively discussed in this SWD, it is assumed on the contrary that there is no new or additional EU policy action supporting EU’s net-zero industry> Under this scenario option, there would be a gradual decline in the extent to which EU’s net zero industry (without further growing its output) can capture a fast-growing demand for the respective technologies.

considered, and which is the central focus of this SWD is that of acting and putting forward and implementing NZIA. This is labelled the '**NZIA policy option**'.⁷³

The main conclusion of the analysis is that without NZIA, the EU runs into a higher risk of facing challenges to meet its objectives under the European Green Deal. As the need to act to curb greenhouse gas emissions becomes more urgent, many countries are stepping up their efforts and investments, both in manufacturing and deployment. When not sufficiently diversified, global supply chains for clean energy technologies are vulnerable to shocks, such as those witnessed during the COVID-19 crisis, leading to a slow-down in deployment. At the same time, it is also an opportunity for the EU to benefit from a rapidly-growing global market for clean energy technologies and drive the innovation and quality improvements in the technologies needed. In a business-as-usual option, the EU would lose a unique opportunity to strengthen the EU's competitiveness, diversify its imports, and lead in producing key net-zero technologies, which are fast growing sectors and can secure mass-production and quality jobs. In a business-as-usual option, the resilience of the EU's future energy system would be weakened by not being able to considerably de-risk its net-zero industry supply chains and not sufficiently securing access to key technologies key to decarbonise and power our economies.

The undertaken analysis in combination with the received stakeholder feedback on the main bottlenecks for scaling up manufacturing capacity to key net-zero technology sectors reaffirm the need to act. In the consultation, key bottlenecks were identified regarding permitting, supply chain, infrastructure, access to markets, skills, costs, access to funding, and standards. These bottlenecks influenced the development of the NZIA policy option.

With permitting taking up considerable time and with unpredictable and varying durations across different value chain segments, and up to 4 years or more when projects are in sensitive sites, the EU is currently not competitive with other world regions in this regard. For instance, in the case of solar PV manufacturing investments, lead times in the EU and the United States have been noted to be considerably longer, than in other countries, due to lengthier permitting and construction timelines, amongst others (see below *Figure 5*).⁷⁴ Further, the complex and cumbersome rules and procedures render cross-border investments more risky and complex, but also complicate the work of national, regional, and local authorities who may not be sufficiently prepared to ensure efficient permitting for net zero technology manufacturing projects.

A less secure supply of these clean energy technologies can slow down the energy system transformation, limit access to renewable energy supplies and/or energy efficiency technologies, and in turn negatively affect economic growth prospects, create uncertainty, and weaken investor confidence. Furthermore, a business-as-usual option would not solve or possibly worsen the risk of strategic import dependencies and create new ones, which will weaken EU's resilience. In other words, the NZIA policy option that aims to scale up EU's net-zero industry manufacturing base also has the potential to significantly contribute to strengthening the EU's resilience, energy independence, and competitiveness. Finally, without the NZIA proposal, there is a high risk that there are insufficient skills developments, that the current lack of appropriate skills would put Europe at a critical competitive disadvantage in the medium and long term, in addition to the risk of not being able to achieve its green and digital transitions.

⁽⁷³⁾ In this case there are overlaps between the NZIA policy option as presented in this SWD and the eponymous scenario deployed in the SWD assessing the investment needs and funding availabilities to strengthen EU's Net-Zero technology manufacturing capacity (SWD(2023) 68 final), particularly in relation to the 2030 targets that have been described in NZIA's recital 17 with reference to five net-zero technologies (solar PV, wind, heat pumps, batteries, and electrolysers) and that described in NZIA's recital 14 and article 16 with reference to EU's CO₂ injection capacity.

⁽⁷⁴⁾ IEA "Special Report on Solar PV Global Supply Chains", International Energy Agency, July 2022

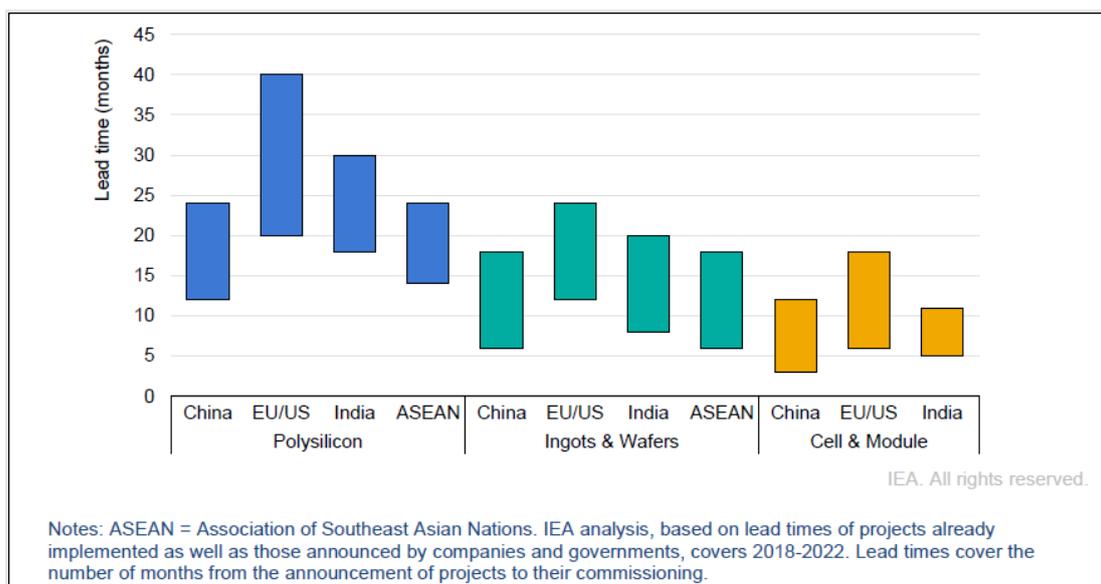


Figure 5: Lead times for expanding solar PV manufacturing capacity by country/region and main components;
Source: IEA “Special Report on Solar PV Global Supply Chains”, July 2022

5.2. Choice of legal instrument and legal basis

The main reason why the NZIA proposal takes the form of a regulation is to provide a sufficient harmonisation of the legal framework that would help Member States foster the Single Market for net-zero technologies. A regulation has been found to be the most suitable legal instrument, as only this, with its directly applicable legal provisions, can provide the necessary degree of uniformity needed for the establishment and operation of a Union Initiative aiming at supporting net zero technology sectors across the single market. In addition, a regulation does not require transposition through national measures and is directly applicable, responding to the urgency for ensuring competitiveness and resilience of net zero technology supply chains. For example, the proposed articles on streamlining administrative and permit-granting processes can help address the existing fragmentation of the single market on essential elements regarding permit granting processes for producers of net-zero technologies.

The appropriate legal basis for the NZIA proposal is Article 114 of the Treaty on the Functioning of the European Union (‘TFEU’), which enables the EU to adopt approximation measures that have as their object the establishment and functioning of the single market. Indeed, the main object of the NZIA proposal is to take measures that increase harmonisation to create a level playing field within the Union in which net-zero technology manufacturing can flourish, which is conducive to innovation and facilitates the green transition. Supporting the development of the manufacturing of net-zero energy technologies without risking a regulatory fragmentation of the internal market is the primary objective of NZIA’s proposal and therefore the Commission considers that Article 114 TFEU alone is a sufficient legal basis in this case.

5.3. Description of the proposed regulation (preferred option)

5.3.1. Material scope of application

The NZIA proposal takes a two-pronged approach to shaping its scope of net-zero technologies: a **horizontal** (i.e. technologies) and a **vertical** (i.e. supply chain) approach. From a horizontal perspective, the NZIA proposal distinguishes between two categories: ‘**strategic net-zero technologies**’ and ‘**net-zero technologies**’, with the former being a subset of the latter. Strategic net-zero technologies are granted extra benefits under the provisions of this Regulation, relative to those covering net-zero technologies only.

5.3.1.1. Horizontal scope

Technologies listed in the Annex of the NZIA proposal

The Annex of the NZIA proposal lists the strategic net-zero technologies, critical for EU's path towards its 2030 climate and energy objectives. These technologies are as follows:

- (1) *Solar photovoltaic and solar thermal technologies*
- (2) *Onshore wind and offshore renewable technologies*
- (3) *Battery/storage technologies*
- (4) *Heat pumps and geothermal energy technologies*
- (5) *Electrolysers and fuel cells*
- (6) *Sustainable biogas/biomethane technologies*
- (7) *Carbon Capture and Storage (CCS) technologies*
- (8) *Grid technologies*

The choice of these technologies was based on the three criteria: 1) technology readiness level; 2) contribution to decarbonisation and competitiveness; and 3) security of supply risks (in terms of strategic imports dependencies).

The first criterion of technology readiness level (TRL) refers to a method of estimating the maturity of technologies and draws on the classification used by the International Energy Agency (IEA). The scope of this Regulation generally refers to those net-zero technologies that fall under TRL 8 (first-of-a-kind commercial – commercial demonstration, full-scale deployment in final form) or above. The second criterion of decarbonisation and competitiveness identifies those net-zero technologies that are projected to deliver a significant contribution to the 2030 Fit-for-55 target of reducing net greenhouse gas emissions by at least 55% relative to 1990 levels. Finally, the third criterion relates to security of supply ensuring the technological and industrial resilience of the Union's energy system by increasing the manufacturing capacity of a component or part primarily used in the net-zero technology value chain for which the Union heavily or growingly depends on imports, particularly those coming from a single third country.

Based on these criteria, 8 groups of net-zero technologies were selected. In addition, the respective net-zero technology groups refer not only to the final technological product or assemblies, but also to the main upstream components primarily used for the respective technologies (e.g., ingots, wafers, and solar cells for solar modules; nacelles, towers, and blades for wind turbines, etc). The choice of these technologies (and in particular the extent to which they fulfil the criteria (1), (2) and (3) above) was already explained in the Commission's Staff Working Document on the investment needs assessment published in March 2023,⁷⁵ accompanying the NZIA proposal. *Table 2* provides a summary of the main reasons and the main arguments developed in this Staff Working Document as to why each one of these technologies was considered responsive to each of the three criteria described above.

⁽⁷⁵⁾ See particularly Annex 4 of the Commission's Staff Working Document on Investment needs assessment and funding availabilities to strengthen EU's Net-Zero technology manufacturing capacity (SWD(2023) 68 final).

Technology	Description	TRL ⁷⁶	Contribution to decarbonisation and competitiveness	Security of supply risks
Solar photovoltaic and solar thermal technologies	Conversion of solar radiations into electricity or heat.	At least 8	Very strong: As part of the REPowerEU plan, the European solar energy strategy communication aims to bring online over 320 GW of solar photovoltaic by 2025 (more than doubling compared to 2020) and almost 600 GW by 2030.	Very strong for PV: (90-95%). Considerable imports from Asia. There is a significant shortfall in EU manufacturing capacity in relation to solar PV deployment needs as envisaged in REPowerEU and EU's Solar Strategy, particularly for the ingot, wafer, and cell segments of the supply chain, but also for the overall assembled PV modules.
Onshore wind and offshore renewable technologies	Use of different forms of wind turbines to generate electricity + offshore renewable energy technologies (as defined in the EU strategy on offshore renewable energy (COM(2020)741) of 19 November 2020.	At least 8	Very strong: REPowerEU calls for the faster installation of wind energy capacities, with 510 GW of wind to be installed by 2030, projected to correspond to a 31% share of EU installed power production capacities. Member States have concluded in January 2023 non-binding agreements on offshore renewable goals per sea basin, giving a cumulative result for the EU of 109-112 GW by 2030, 215-248 GW by 2040 and 281-354 GW by 2050. Offshore renewables include bottom-fixed offshore wind as well as floating offshore wind, wave and tidal which are currently at TRL 8-9.	Strong: The EU wind sector is one of the strongest players on world markets and the EU market is still led by domestic companies. However, Chinese manufacturers/providers/developers have been recently making in-roads and started to win auctions in Europe, and the EU wind industry is finding itself in an increasingly difficult financial position. Chinese market share vs Europe is growing comparing the 2020 ⁷⁷ and the 2023 ⁷⁸ foresight reports on strategic values chains, the EU share in global production of wind turbines has decreased from 58% to 34%, while the Chinese share has increased from 23% to 52%. China is dominant in the entire rare-earth supply chain, from raw materials to permanent magnets.
Battery/storage technologies	Storage of electricity or energy	At least 8	Very strong: Electric vehicles are the main available technology for the decarbonisation of the transport sector. In addition, the stationary battery energy storage systems are key for high penetration of the intermittent renewable energy sources.	Strong: The global leaders in batteries production are Chinese, Korean and Japan companies. Gigafactories are under construction in Germany, Sweden and France. There is also a strong dependency on supply of battery production materials themselves (Li, Co, Ni, natural graphite; both, extraction and purification). In addition, Europe is today almost entirely dependent on import of manufacturing equipment, which generates

⁽⁷⁶⁾ IEA scale

⁽⁷⁷⁾ European Commission, "Critical Raw Materials for Strategic Technologies and Sectors in the EU – A Foresight Study", Bobba et al., 2020

⁽⁷⁸⁾ European Commission, "Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study", JRC Science for Policy Report, S. Carrara et al, 2023

				additional trade dependencies and bottlenecks to the upscaling of giga factory production in the EU.
Heat pumps and geothermal energy technologies	Heat pump: transfer of thermal energy from the outside to the inside using a refrigeration cycle. Geothermal energy: exploitation of the thermal energy in the Earth's crust	At least 8	Very strong: REPowerEU called for a doubling of the 2020 deployment rate of individual heat pumps, which would result in deployment of an additional 10 million heat pumps over the next 5 years and 30 million by 2030.	Medium – around 30-40%. Most EU heat pumps are made (i.e. assembled) in the EU. Many but not all components are also made in the EU. Refrigerants are most often imported. However, EU manufacturers mostly serve the EU market and the trade deficit in this growing market has been deteriorating. Imports from China doubled in 2021. The EU trade deficit in heat pumps was EUR 390 million in 2021 as compared with EUR 40 million in 2020, with 2020 being the first year in which the EU trade surplus turned into a deficit.
Electrolysers⁷⁹ and fuel cells	Electrolysers: industrial installation producing hydrogen from water. Fuel cell: device use to produce electricity from hydrogen	At least 8	Very strong: Hydrogen is critical for decarbonizing harder-to-abate sectors like steel manufacturing, fertilizer industries, heavy-duty mobility, and aviation. REPowerEU plan sets 2030 targets for domestic production of renewable hydrogen up to 10 Mt and 10 Mt of imports. The Commission and leading EU electrolyser manufacturers committed themselves to increasing installed manufacturing capacity tenfold to 17.5 GW in hydrogen output (or at least 25 GW electricity input) by 2025. In addition, the Member States' RRP allocate around EUR 12 billion specifically to hydrogen technologies and two IPCEIs were already approved by the Commission in 2022 (July and September), for EUR 5.4 and 5.2 billion of investments, involving 15 and 13 Member States respectively. There are no EU policy objectives for fuel cells, and for cars the EU's policy is promoting electric vehicles, but considering it is the 'reverse process' of an electrolyser many components are the same. Also, fuel cells are expected to be important for energy storage and for a number of transports used (e.g. trucks, shipping, aviation). Development of fuel cells technologies for aviation is supported under the Clean Aviation join	Strong: In 2022, Chinese companies had around half of the world's alkaline electrolysis manufacturing capacity, and American companies had most of the world's PEM electrolysis manufacturing. Fuel cells markets are dominated by mobility applications and manufacturing is mainly dominated by Japanese car manufacturers. Asia is the main global supplier of fuel cells and China has the largest manufacturing capacity for fuel cells trucks. The EU relies for both technologies on critical raw materials (in particular for platinum group metals, PGMs) and components supplied from elsewhere and has strong dependencies on Africa and Asia.

⁽⁷⁹⁾ For the production of (renewable) hydrogen

			Undertaking and the Industrial Alliance on Zero-Emission Aircraft. For these two reasons it is proposed to include them in the NZIA scope	
Sustainable biogas/biomethane technologies	Production of gas/methane from biomass	At least 8	Strong: The REPowerEU plan identifies, in particular, biomethane, as key to diversify EU gas supplies by increasing its production twice above the EU 2030 target, putting biomethane on top of renewable energy priorities, this new target of 35 bcm biomethane represents around 20% of natgas imported in EU from Russia in 2021. To reach this target it is estimated a need to add 5000 biomethane facilities in EU, with a total capital investment of EUR 83 billion. In comparison, the number of biomethane plants in Europe reached 1067 in 2021. The production of biomethane reached 3.5 bcm in 2021 (37 TWh), out of a total combined biogas and biomethane production of 18.8 bcm (196 TWh).	Currently low for the technology itself, but limited availability of feedstock might be an issue. Economic viability of biomethane production depends on investment costs and operation costs but also on the availability of low-cost feedstock. Technologies are available and demonstrated from small to large scale. Subject to adequate investments in gas networks and injection points, the biogas produced in the EU can effectively substitute natural gas imported from outside the EU. For instance, the targeted of 35 bcm of biomethane production in the EU by 2030 represents 20% of the amount of natural gas imported in the EU from Russia in 2021. Biomethane can replace natural gas on short term in hard to electrify industries, such as chemical and steel, as well as in transport.
Grid technologies	Cables and smart technologies for electricity network management. EV charging stations.	At least 8	Very strong: By 2030 some €584 billion need to be invested in electricity grids – particularly at distribution system level – to reach the Fit for 55 and REPowerEU objectives. Development of the electricity grid is a priority to effectively integrate the increase of renewable energy penetration as provisionally agreed by the European Parliament and the Council in the framework of the negotiations for the revision of the EU Renewable Energy Directive. Moreover, rapid network expansion is also needed to cope with electrified demands such as EVs or heat pumps. Over 7 million kilometers of lines need to be renewed by 2050 at all voltage levels ⁸⁰ (from HVDC and HVAC	Strong: Supply bottlenecks of HVDC systems (cables) delay grid development, thus blocking PV and wind installations. The global HVDC market is led primarily by three companies, namely Hitachi ABB Power Grids, Siemens, and GE. The first two have around 50% of the market in most market segments, whereas cable companies (Prysmian, Nexans, and NKT Cables are the three major European cable companies) make up around 70% of the market in the EU, and the main competitors are Japanese. In China, a further vendor, China XD Group, dominates the market. (CPR 2020).

⁽⁸⁰⁾ <https://iea.blob.core.windows.net/assets/830fe099-5530-48f2-a7c1-11f35d510983/WorldEnergyOutlook2022.pdf>

			<p>transmission lines, high-voltage distribution lines, down to low and medium voltage power cables) and over 43 000 km of additional cables and lines are required at transmission level.⁸¹ Moreover, grids shall rapidly evolve to incorporate more advanced capabilities, especially through the large deployment across Europe of smart electricity grids and applications that enable a more efficient operation of the networks.</p> <p>Furthermore, smart meters and controls are essential to reduce the energy demand and EV charging stations are critical for the uptake of EVs. The recharging infrastructure is facing critical shortages and problems in supply chains.</p>	<p>EV charging infrastructure (in particular fast charging) is a sector where European companies are leading on global markets (Siemens, ABB, Evbox, Schneider Electric to name a few).</p>
<p>Carbon Capture and Storage (CCS) technologies</p>	<p>Capture (and subsequent storage) of CO₂ from industry and energy production sector emissions or from the atmosphere</p>	<p>At least 8</p>	<p>Strong: Green Deal Industrial Plan defined carbon capture and storage technologies as a key sector to meet the EU climate neutrality objectives. The CCS technologies represent a solution for hard-to-abate sectors such as energy-intensive industries and energy production facilities. Additionally, emissions that will be impossible to remove will have to be captured directly from the atmosphere and transported to permanent storage.</p> <p>12 CCS projects have been selected for EU support from the Innovation Fund. The 2022 revised Trans-European Energy Infrastructure Regulation refers to cross-border carbon dioxide networks and storage as a priority thematic area. Six relevant CO₂ network projects are included in the 5th PCI (Projects of Common Interest) list (2021) (one project was cancelled meanwhile).</p>	<p>Strong uncertainties: Only one EU company ranks among the top nine companies present worldwide along the full CCS value chain, and the EU remains behind other geographical areas, and in particular the US and Canada, when it comes to transport, storage, and the full value chain. Moreover, while early-stage venture capital investments in CCS increased in the US (currently world leader with investments amounting to EUR 277 million between 2016-2021), these have decreased in several EU countries (and in particular Germany) in 2016-2021 compared to the 2010-2015 period. The situation is a threat of deterioration, as the US Inflation Reduction Act of 2022 includes important enhancements to tax credits available for CCS.</p>

Table 2: Justifying the list of strategic net-zero technologies as put forward in the Annex to the NZIA proposal

⁽⁸¹⁾ TYNDP 2022 <https://eepublicdownloads.blob.core.windows.net/public-cdn-container/tyndp-documents/TYNDP2022/public/high-level-report.pdf>

Strategic net zero technologies are those that are critical to invest in to attain our 2030 climate and energy objectives. This explains why the list of strategic net zero technologies is narrower relative to the list of net zero technologies in Article 3 (1) of the NZIA, which covers a vast range of energy supply-side, demand-side, grid, storage, and CCUS technologies with a technology readiness level ('TRL') of at least 8. Annex 6 of this Staff Working Document includes a brief explanation of the reason(s) for not including those net-zero technology in the list of strategic net-zero technologies.

Net-zero technologies

'Net zero technologies' are defined in Article 3 (1) a) of the NZIA proposal as *"renewable energy technologies;⁸² electricity and heat storage technologies; heat pumps; grid technologies; renewable fuels of non-biological origin technologies; sustainable alternative fuels technologies;⁸³ electrolysers and fuel cells; advanced technologies to produce energy from nuclear processes with minimal waste from the fuel cycle, small modular reactors, and related best-in-class fuels; carbon capture, utilisation, and storage technologies; and energy-system related energy efficiency technologies. They refer to the final products, specific components and specific machinery primarily used for the production of those products. They shall have reached a technology readiness level of at least 8."*

Net zero technologies take a broader perspective and look at all the technologies needed to reach EU's net zero objective by 2050.⁸⁴ As stated above, net zero technologies cover a vast range of energy supply-side, demand-side, grid, storage, and CCUS technologies with a technology readiness level ('TRL'⁸⁵) above 8. The list was designed to be as broad and technology neutral as possible in the identification of key technologies that are needed to reach EU's net zero objective by 2050, without specific exclusion criteria, to the exception of the considerations outlined below.

⁽⁸²⁾ 'renewable energy' means 'renewable energy' as defined in Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources.

⁽⁸³⁾ 'sustainable alternative fuels' means fuels covered by the Proposal for a Regulation of the European Parliament and of the Council on ensuring a level playing field for sustainable air transport, COM/2021/561 final and by the Proposal for a Regulation of the European Parliament and Council on the use of renewable and low-carbon fuels in maritime transport COM/2021/562 final.

⁽⁸⁴⁾ See chapter "Framework of the proposal/initiative" page 6: "The increase in uptake of clean energy and net-zero technologies is essential in helping the EU meet its objective of achieving its Fit for 55 commitments for a climate-neutral EU by 2050"

⁽⁸⁵⁾ IEA scale

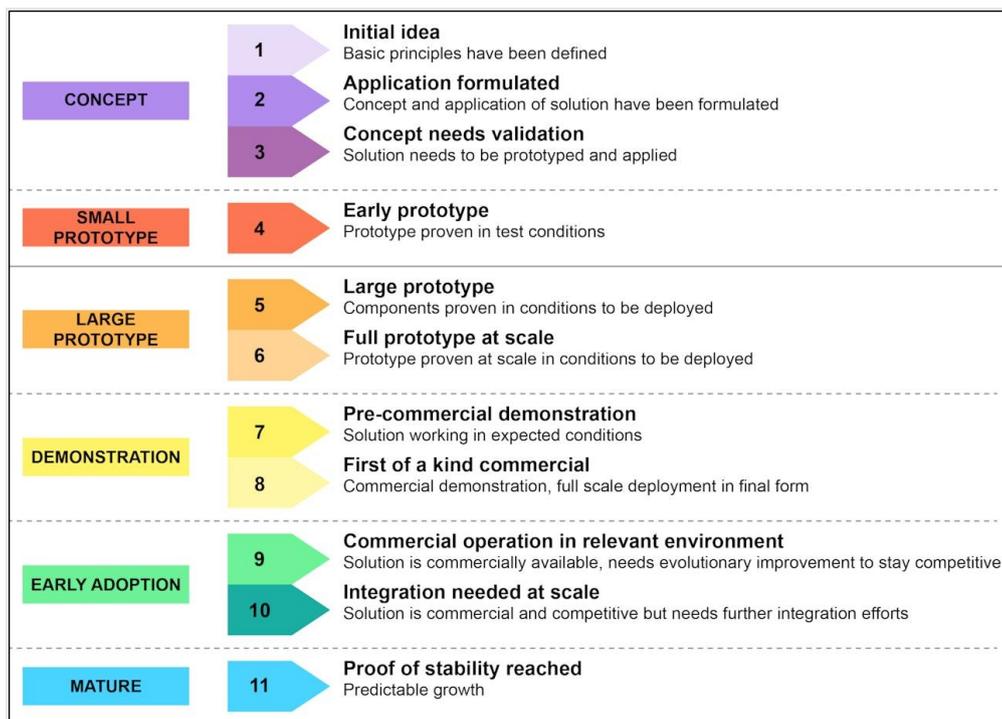


Figure 6: The classification of net-zero technologies according to their Technology Readiness Level (TRL) as per the international Energy Agency

The criterion of technology readiness level (TRL) refers to a method of estimating the maturity of technologies and draws on the classification used by the International Energy Agency (IEA) – see Figure 6). The scope of the NZIA proposal refers to those net-zero technologies that have reached at least a TRL 8 (first-of-a-kind commercial – commercial demonstration, full-scale deployment in final form).⁸⁶ The reason for this is that the NZIA (to the exception of its Chapter VI) contains a set of measures aimed at supporting and scaling up the manufacturing capacity of the net-zero industry in the EU. As a result, the net-zero technologies covered by NZIA would need to have reached a degree of maturity sufficient to enter an industrial production stage.

It is important to note that an additional category is the one of “innovative net-zero technologies.” These are technologies which are listed in article 3(1) of the NZIA proposal but have not reached a technology readiness level of at least 8, and that comprise genuine innovation which are not currently available on the market and are advanced enough to be tested in a controlled environment. They benefit from Article 26 on Net-Zero regulatory sandboxes as explained in section 5.2.2.7 of this SWD.

Since the TRL criterion is to be assessed at the time the technology will need to benefit from relevant provisions from NZIA, it can be considered to some extent dynamic. For instance, within solar PV technologies, some perovskites technologies may not be considered to have yet reached the required TRL of 8. However, once they have, they will be able to benefit from relevant provisions of NZIA. The assessment of TRL levels can therefore be made and updated on a continuous basis, relying on scientific consensus, such as the yearly Competitiveness Progress Report, which is based on the Clean Energy Technologies Observatory (CETO)⁸⁷ that provides information on TRL levels for different energy generation technologies and sub-technologies.

Nuclear technologies stand out among all those technologies because of their very centralised aspect (contrary to solar or wind energy generation as well as other net zero technologies such as electrolyzers or heat pumps, nuclear technologies usually rely on a very small number of assets, each

⁽⁸⁶⁾ <https://www.iea.org/reports/innovation-gaps>

⁽⁸⁷⁾ The CETO reports can be found in the website of the SET Plan Information System (SETIS): https://setis.ec.europa.eu/publications/clean-energy-technology-observatory-ceto/ceto-reports-2022_en

of these assets producing very important amounts of energy), the fact that they consume nuclear fuel (and related waste management issues), as well as the very long lead times characterising the industry, with construction times sometimes exceeding ten years, and service times well above 30/40 years. Light Water Small Modular Reactors (LW-SMR) may become available in the next 10 years, expected to have a 3 year construction time. Alternative options which may have consisted in restricting the list of technologies were excluded to give the widest possible reach to NZIA provisions and maximise its impact. Conversely, some non-generation/storage technologies were included as well, namely “*best in class nuclear fuels*”, “*energy-system related energy efficiency technologies*”, “*grid technologies*” and CC(U)S.

The presence of “*best in class nuclear fuels*”⁸⁸ is justified by the fact that nuclear fuel is a manufactured product with high technological value added. Secondly, while NZIA will support the factories that will manufacture equipment for the production of biomethane (fermentation tanks) or H₂ (electrolysers), there is no equivalent of fermentation tanks or electrolysers for nuclear fuels, which are a high added value product whose production directly takes place at a very centralised and large factory. Thus, in the absence of this ‘intermediate step’ (between the large manufacturing plant and the production of the fuel itself, at a smaller, more decentralised, scale), it is justified to include the production of these fuels directly in the scope of NZIA.

Lastly, energy-system related energy efficiency technologies were included due to their crucial expected contribution to the EU’s decarbonation objectives, not only from a product perspective but also from a whole system one. European energy policies have a long-standing commitment towards energy efficiency, inter alia through eco-design and energy-labelling policies. Since 2021, the “Energy Efficiency First” principle has become a cornerstone of EU energy policies.⁸⁹ In the context of NZIA, the targeted energy efficiency technologies are the ones which are considered “energy-system related”, and whose main function is to improve energy efficiency, i.e. the ratio of output of performance, service, goods, or energy, to input of energy. This excludes energy efficiency of products (e.g. highly efficient fridges, washing machines, etc.), but includes all technologies that optimise energy flows in the energy system, thus allowing better system integration of various sectors and better adjustment of demand and supply. Examples of such technologies are energy management/control systems including building automation and control systems, heat pumps, industrial automation and control systems, and Variable Speed Drives (VSD). It is important to ensure some manufacturing of these components in the EU as well as mitigating some import dependencies.

5.3.1.2. Vertical scope

NZIA’s scope covers not only the final technological products but also parts of its supply chain covering specific components and specific machinery ‘primarily used’ to produce those products. ‘Components’ are defined in article 3.1 (b) of the NZIA proposal as a small part of a net-zero technology that is manufactured and traded by a company starting from processed materials. Moreover, under Art 2 of NZIA, those processed materials or components falling under the scope of the Critical Raw Materials Act proposal will be excluded from the scope of NZIA.

The NZIA proposal does not provide an exhaustive list of the components primarily used in each final technological product, system, or assembly. This is because of the complexity of the supply chains for each net-zero technology and the difficulties in mapping exactly the components that are primarily used into the manufacturing of the final product. An example of the complexity of supply chains is shown in [Figure 7](#), which applies to the case of battery cell manufacturing (from the raw material to refined and intermediate products to the precursors and material components of a battery cell). Nonetheless, an indicative non-exhaustive list of the main components that are part of a selected set of the net-zero strategic technologies covered by NZIA is provided in see [Table A6.1](#) in [Annex 7](#).

⁽⁸⁸⁾ Recital 9 of the NZIA proposal indicates that best-in class fuels refer to those described in recital 8 of Commission Delegated Regulation (EU) 2022/1214 – i.e. the Taxonomy Complementary Delegated Act.

⁽⁸⁹⁾ See Commission Recommendation on energy efficiency first: from principles to practice (C/2021/7014)

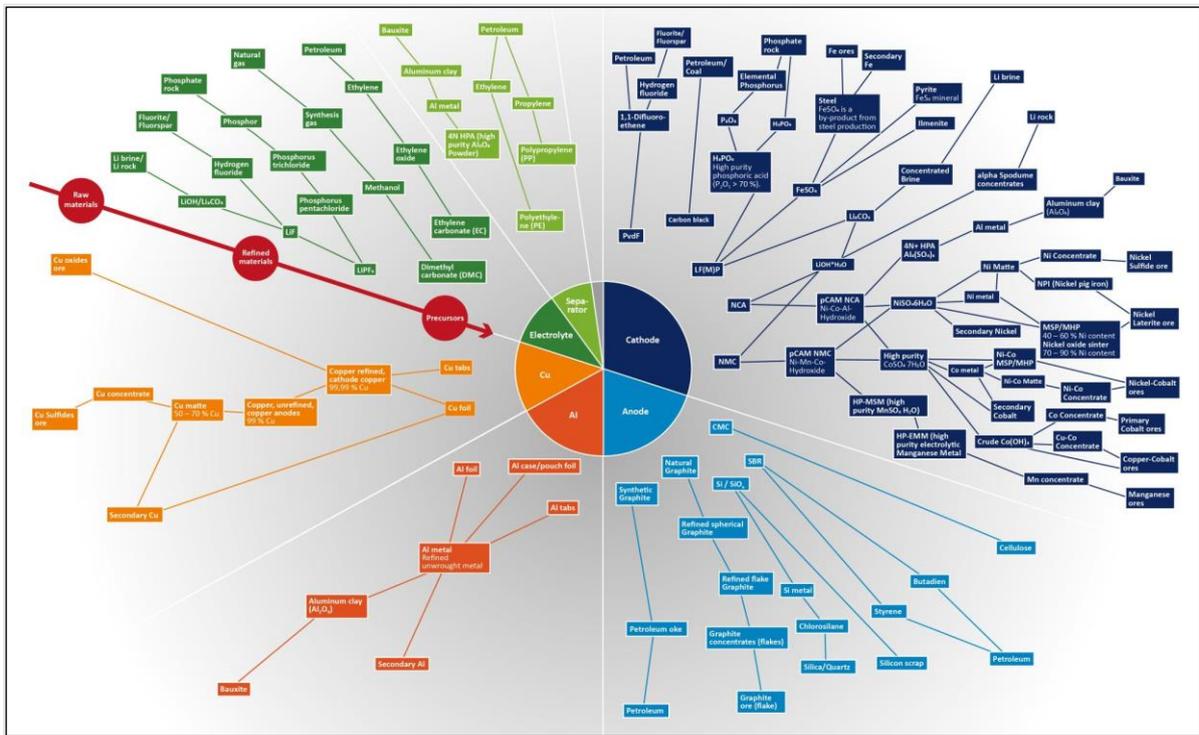


Figure 7: Graphical overview of the complexity of supply chains in battery cell manufacturing. Source: VDI/VDE Innovation + Technik GmbH “Resilient supply chains in the battery industry”, March 2023

Furthermore, since the NZIA proposal presents strong complementarities with the Critical Raw Materials Act (CRMA) proposal, it is important to provide additional clarity as to the differences between the two proposals when it comes to the vertical scope.

- Those activities and projects that deal with the extraction, processing or recycling of critical raw materials fall under the CRMA. This means essentially projects that involve any form of material processing, where a critical raw material is transformed from its original form (ore, waste, etc.) into pure metals, alloys or other economically usable form. For strategic raw materials, this final form is specified in Annex I of the proposed CRMA, which lists for example “Lithium – battery grade”.
- Those activities and projects dealing with the manufacturing of net-zero technologies, from components including processed materials (as per Art. 3(1)(b) of the proposed NZIA) to final products and systems, fall under NZIA. However, raw materials, processed materials or components falling under the scope of the CRMA are excluded from the scope of NZIA.
- For example, insofar as precursor cathode active materials (pCAMs) and cathode active materials (CAMs) are critical raw materials, in particular in such forms as specified in Annex I of the proposed CRMA for the strategic raw materials, their production would fall under the CRMA. In any other case, since they are certainly components (considering that processed materials are included) used for a net-zero technology and as such would fall under the NZIA proposal.

5.3.1.3. Main measures proposed

The NZIA proposal provides for different type of measures depending on the category of technology:

Net-zero technologies:

- Permitting: One-stop shop, online access to information, streamlined procedures, fixed time-limits (12-18 months depending on size of project)
- For innovative net-zero technologies: Access to Regulatory Sandboxes

- Skills: Access to net-zero academies

Strategic net-zero technologies:

- Permitting: One-stop shop, online access to information, streamlined procedures, fixed time-limits (9-12 months if strategic project and depending on size of project)
- For innovative net-zero technologies: Access to Regulatory Sandboxes
- Skills: Access to net-zero academies
- Headline benchmark: EU manufacturing capacity benchmark of 40% of 2030 deployment needs for the corresponding technology (incl. specific components)
- Public schemes (public procurement, auctions) to include enhanced sustainability and resilience criteria
- Overriding public interest: Yes, if a strategic project, on a case-by-case basis
- Priority status for projects: Yes, if a strategic project
- Financing: if a strategic project, discussion and advice on financing from the Net Zero Europe Platform

5.3.2. The seven pillars of the NZIA proposal

In addition to monitoring and governance, which are discussed in section 8 of this SWD, the NZIA proposal is structured along seven main pillars (see *Figure 9*). These are described and justified in detail in the following sections.

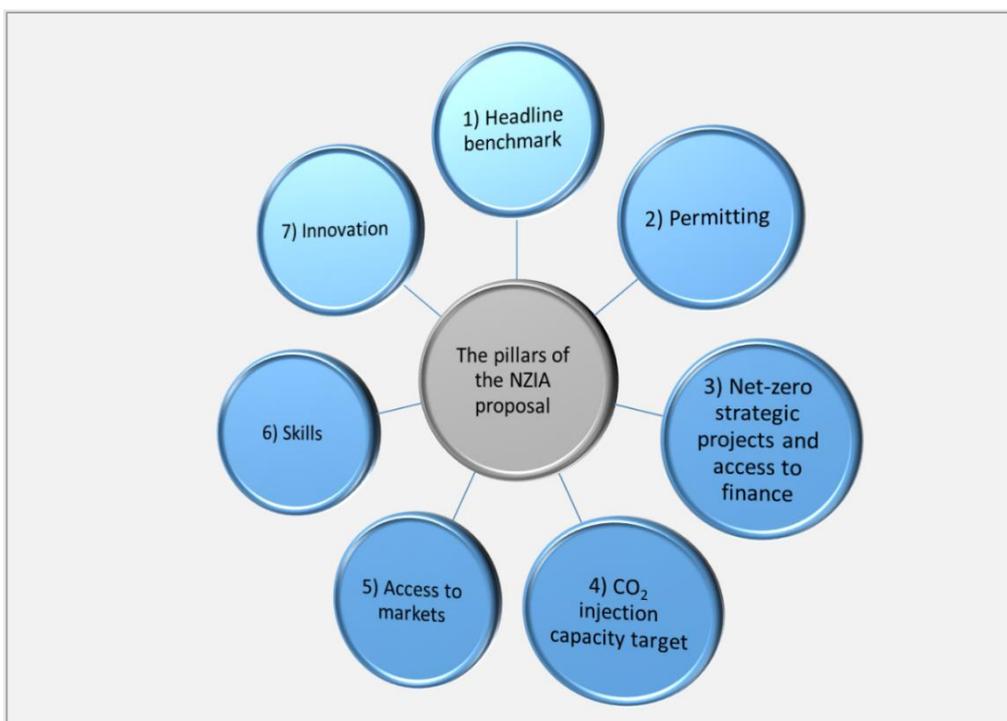


Figure 8: The seven pillars of the NZIA proposal (not including monitoring and governance)

5.3.2.1. Setting a headline benchmark

Headline benchmark

NZIA puts forward an overall headline benchmark of “at least 40%” applicable to strategic net-zero technologies, for which substantial increases in deployment are expected by 2030. More specifically, NZIA’s proposed article 1.2 a) stipulates “that by 2030, manufacturing capacity in the Union of the strategic net-zero technologies listed in the Annex approaches or reaches a benchmark of at least 40% of the Union’s annual deployment needs for the corresponding technologies necessary to achieve the Union’s 2030 climate and energy targets”. It is important to note that the headline benchmark

objective applies across the range of the eight groups of strategic net-zero technologies (discussed in section 5.2.1), including their mid-stream supply chains (e.g. specific components) covered under NZIA.

Due to the heterogeneity in net-zero technologies and their components, the benchmark represents an overall political ambition of achieving high resilience across strategic net-zero technologies and the overall energy system, while considering the need to pursue that ambition in a flexible and diversified way. The reasoning behind this benchmark is the current market situation for the strategic net-zero technologies, and the extent to which EU manufacturers of these technologies can meet the demand for these, as per EU's needs to achieve its REPowerEU objectives, and overall 2030 climate and energy targets (see also the section below on technology-specific indicative objectives as they appear in Recital 17 of NZIA). Furthermore, the benchmark takes as a point of reference, the technology for which the EU performs most poorly or is most vulnerable in manufacturing terms, i.e. solar PV. The European solar PV industry alliance has the ambition to reach an EU manufacturing capacity that would translate into the industry meeting around 45% of EU's solar PV deployment needs in 2030 (see further below for explanations), and since for some parts of the EU solar PV supply chain, EU manufacturing is in a very precarious position (e.g. currently only 3% of solar cells demanded in the EU are manufactured in the EU),⁹⁰ the benchmark takes the value of "at least 40%".

Technology-specific indicative objectives

Although the NZIA proposal does not propose setting up technology-specific objectives, the recitals recall pre-existing industry-led objectives, primarily on the basis of work within relevant industrial alliances. With a view to expanding EU's net-zero industrial base, NZIA's recital 17 refers to pre-existing aspirational objectives - some set at the level of industry alliances - for five strategic technologies: solar PV, wind, heat pumps, batteries, and electrolyzers. These objectives are calculated based on physical units (GW for all technologies except for batteries which is in GWh)⁹¹ and are expressed in share (%) terms, representing the extent to which EU manufacturers of net-zero technologies can produce and meet EU's annual installation or tech deployment needs in 2030. In the case of those net-zero industries for which the EU is weak (solar PV) or for which the market is currently emerging (batteries, electrolyzers), the tech-specific objectives aim at increasing the respective EU manufacturing shares based on the political objectives that the Commission and net-zero industrial alliances have announced in this respect. In the case of those net-zero industries for which the EU is strong (wind, heat pumps), the tech-specific objectives aim at maintaining the respective market shares, implying nonetheless an increase in their production capacity given the high demand or deployment needs expected by 2030.

EU's solar PV industry needs to significantly increase its market share: In the case of solar photovoltaic, the European Solar PV Industry Alliance⁹² (supported by the EU's Solar Energy Strategy)⁹³ aims to reach at least 30 GW of operational solar PV manufacturing capacity by 2030 across its supply chain,⁹⁴ an objective that would be extremely difficult to achieve without the NZIA proposal. This translates into a share of around **45%**, meaning that EU solar PV manufacturers would

⁽⁹⁰⁾ See SWD(2023) 68 final

⁽⁹¹⁾ A battery will always deliver the same amount of energy regardless of where the battery is used, and as such the storage capacity of (stationary or mobile) batteries is expressed in GWh (and not GW).

⁽⁹²⁾ Information on the European Solar PV alliance is available at: [About Us - European Solar PV Industry Alliance \(solaralliance.eu\)](https://solaralliance.eu)

⁽⁹³⁾ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: EU Solar Energy Strategy, SWD(2022) 148 final, 18.05.2022.

⁽⁹⁴⁾ Although, the European Solar PV Industry Alliance refers to the 30 GW within the 2025 timeframe, it relates to when financial decisions have been allocated, which would translate to the respective manufacturing capacity becoming operational by 2030 (although the timeframe might be shorter for some producers). Furthermore, solar panels are producing DC (direct current) but most of the time the power needs to be transformed into AC (alternating current) before being used, this transformation relates to a certain loss in power. As such, the 30 GW target, which is expressed in DC Wp (Watt-peak, the nominal capacity of the produced but not yet connected solar PV modules or the maximum electrical power under standard conditions), which, for deployment purposes, is equivalent to around 24 GW in AC terms (based on a correspondence with industry, the loss in power is of around 20% when translating DC into AC). The respective 24 GW AC manufacturing capacity objective for 2030 does not consider the additional capacity that might be needed for replacement of updated solar PVs as well as the early failures and factory defects.

need to produce (across their supply chain falling under NZIA's scope) 45% of the EU's annual installation or deployment needs by 2030.⁹⁵

EU's battery industry needs to ensure its market leadership: EU manufacturers of batteries would need to actively contribute to shaping this emerging market and take advantage of their technology leadership potential. The European Battery Alliance (EBA) has the political objective of making sure that European manufacturers produce **90%** of the EU's annual battery deployment needs in 2030,⁹⁶ An objective that would be extremely difficult to achieve without the NZIA proposal.

EU's electrolyser industry needs to ensure its market leadership: EU manufacturers of electrolysers need to actively contribute to the creation of this new market. The Electrolyser Joint Declaration of the Commission and the European Clean Hydrogen Alliance⁹⁷ envisages not only a technology leadership of EU manufacturers in this area, but also their commercial leadership. It means that EU electrolyser producers need to boost their manufacturing capacity, such that they provide the technology needed to produce 10 million tonnes of domestic renewable hydrogen by 2030 as envisaged in the REPowerEU plan. This translates into the EU electrolyser industry meeting **100%** of EU's deployment needs for this technology, an objective difficult to reach without the NZIA proposal.⁹⁸

For the case of **wind and heat pump technologies**, **EU manufacturers** need to consolidate their competitive edge and **maintain or expand their current market shares** throughout this decade, in line with the EU's REPowerEU technology deployment projections that meet its 2030 energy and climate targets.⁹⁹ Since it is estimated that EU manufacturers currently produce around 85% of EU's annual wind deployment needs¹⁰⁰ and around 60% of EU's heat pump deployment needs,¹⁰¹ the NZIA envisages to keep these shares throughout this decade.

The shares that the respective EU industries would need to meet in terms of satisfying EU annual demand or deployment needs in 2030 based on industry-led aspirational objectives are visualised in *Figure 10*.

⁽⁹⁵⁾ The 45% share results from taking the ratio of 24 GW manufacturing capacity (that translates the 30 GW manufacturing capacity political objective from DC in AC terms) and the REPower EU projection of annual installed solar PV capacity in 2030 of 53 GW.

⁽⁹⁶⁾ According to EBA, the aim is to increase EU's manufacturing capacity per annum for lithium-ion batteries from 75 GWh in 2022 to 885 GWh in 2030. EBA together with InnoEnergy project a battery demand in Europe of around 1000 GWh in 2030, which would mean that EU manufacturers of battery technologies would need to cover around 90% of the EU demand for by 2030

⁽⁹⁷⁾ The Electrolyser Joint Declaration was signed on May 5, 2022. It puts forward the objective of "electrolyser manufacturers in Europe to have in place by 2025 a combined annual electrolyser manufacturing capacity in Europe of 17.5 GW [in terms of hydrogen output], and to further increase that capacity by 2030 in line with projected demand for renewable and low-carbon hydrogen" The Joint Declaration mentions that according to industry estimates, producing 10 million tonnes of renewable hydrogen in the EU would require an installed electrolyser capacity of 90-100 GW in terms of hydrogen output (or around 140 GW if measured in terms of electricity input assuming an average electrolyser utilisation factor of 43% and electrolyser efficiency of 70%).

⁽⁹⁸⁾ This would require an installed electrolyser capacity of around 105-140 GW, expressed as electricity input, depending on efficiency losses and the extent of variable load), REPowerEU projects a further up to 10 million tonnes of renewable hydrogen imported by 2030 but this is assumed to be achieved via electrolysers manufactured and deployed abroad.

⁽⁹⁹⁾ As per REPowerEU objectives set out in the REPowerEU Plan, COM/2022/230 final, and accompanying Commission Staff Working Document Implementing the Repower EU Action Plan: Investment Needs, Hydrogen Accelerator and achieving the Bio-Methane Targets Accompanying the Document : Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions REPowerEU Plan, SWD/2022/230 final, 18.05.2022

⁽¹⁰⁰⁾ Based on *Wood: Mackenzie for WindEurope (2020) "Wind energy and economic recovery in Europe: How wind energy will put communities at the heart of the green recovery" which mentions that European wind turbine manufacturers command 85% of the European market. Although "Europe" in their report covers a larger region than the EU, we take this to proxy EU's share in the lack of other reliable source.*

⁽¹⁰¹⁾ Based on email correspondence with the heat pump industry.

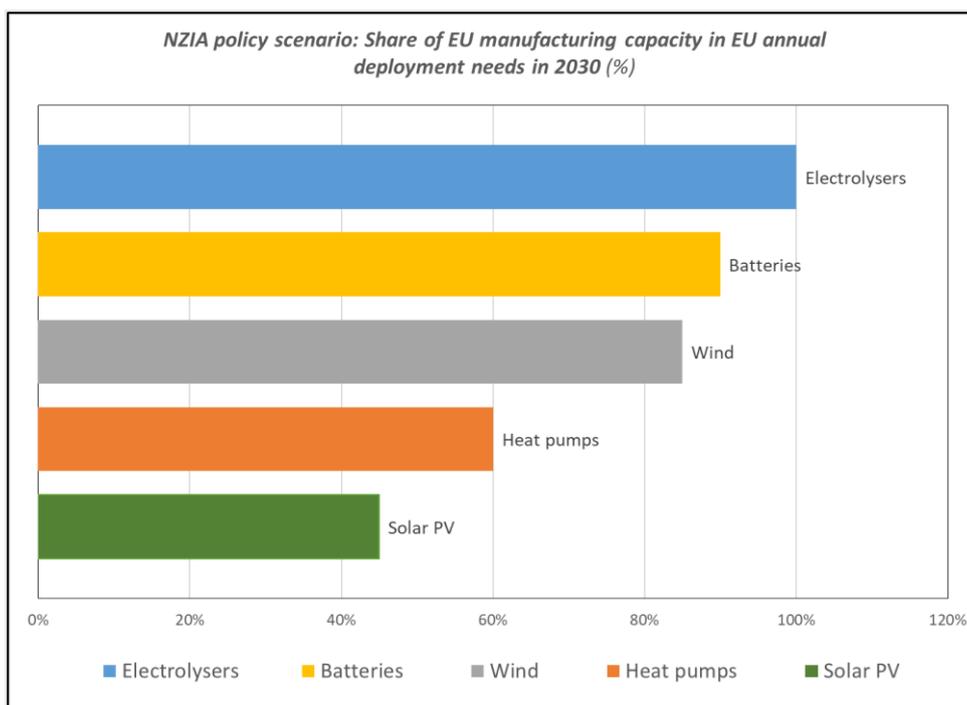


Figure 9: Technology-specific objectives as per NZIA recital 17, expressed in terms of the share of EU manufacturing capacity in EU annual technology deployment needs in 2030

It has been assessed that the NZIA, through its regulatory measures, will contribute to achieving the overall benchmark and the technology-specific 2030 objectives, which are further actively supported by other relevant policy measures, including industrial alliances and financing (such as through the REPowerEU window of the Recovery and Resilience Facility, the Innovation Fund, and support in line with EU’s State aid rules, including the Temporary Crisis and Transition Framework). In other words, all the remaining six dimensions of the NZIA proposal further discussed in this chapter, aided by NZIA’s governance and monitoring mechanisms are required to achieve these high-level objectives.

5.3.2.2. Enabling conditions: Permitting

Background

The unpredictability of permitting procedures has a serious negative impact on investors, which are deterred from developing projects due to increased costs and risks. Barriers to more streamlined permitting are not only problematic for renewable energy deployment projects such as utility-scale solar and wind farms as highlighted most recently in the REPowerEU plan¹⁰² and the European Semester 2022 Spring Package,¹⁰³ but also for the construction and operationalization of the manufacturing facilities that produce net zero technologies such as solar panels and wind turbines. In both respects, inefficient permitting poses a significant risk to achieving the REPowerEU objectives. National permit-granting processes can be unpredictable and, in certain cases, excessively lengthy, undermining the planning and investment security needed for an effective development of net-zero technology manufacturing projects in the EU. Several net-zero technology projects have recently or are currently experiencing significant setbacks related to permitting, in particular in the batteries value chain, due to uncertainties over final approvals due to lengthy delays and/or complexity around the environmental impact assessments.

In consultation with stakeholders from across several net zero technology value chains, it was found that many of the same barriers and challenges exist for permitting in relation to net zero technology

⁽¹⁰²⁾ COM/2022/230 final

⁽¹⁰³⁾ COM(2022) 600 final

manufacturing projects as they do for permitting in relation to deployment of renewable energy projects. With regards to the latter, the Commission presented an in-depth study on permitting barriers for solar and wind energy deployment on 18 May 2022,¹⁰⁴ which identified the most common permitting barriers in Member States: process-related barriers (bureaucracy, transparency, staffing, spatial planning), conflicting public goods issues (environmental, land use) and third-party issues (lack of public acceptance for individual manufacturing projects). Thus, during the drafting of NZIA, the findings of this study and the assessment of relevant permitting provisions from existing EU legislation were considered. The NZIA permitting provisions are inspired by existing provisions as follows:

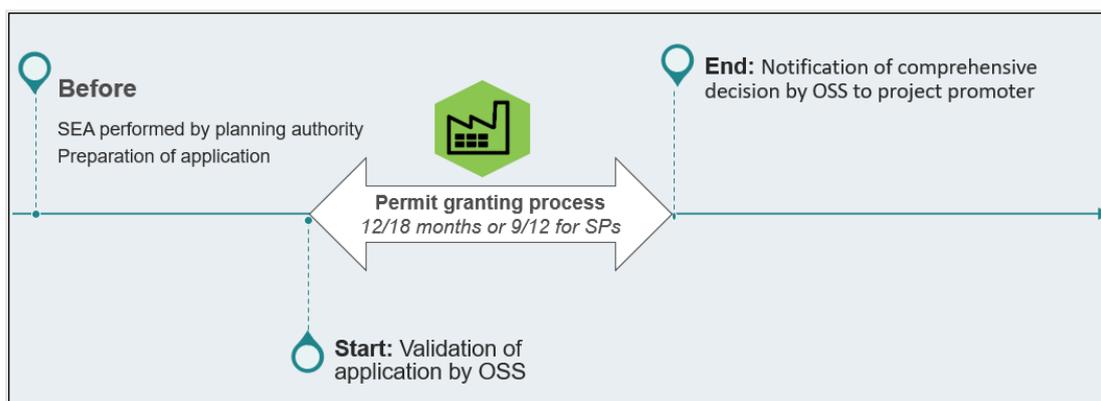
NZIA provisions	Based on
Art. 12(3) (overriding public interest)	Art. 7(8) TEN-E Regulation
Art. 4(1) to (3) (OSS designation)	Art. 8(1) and (2) TEN-E Regulation
Art. 4(4) (electronic submission)	Art. 16(2) RED II
Art. 4(5) (take into account studies, no duplication)	Art. 10(4) TEN-E Regulation
Art. 4(6) (access to dispute settlement)	Art. 16(5) RED II
Art. 4(7) (OSS staffing)	Art. 16 Environmental Crime Directive proposal
Art. 9(1)(2) and (4) (SP priority status)	Art. 7(2) to (4) TEN-E Regulation
Art. 6 and 13 (duration, and exceptions)	Art. 16b(1) RED II revision proposal + Art. 10(9, 10 and (2) TEN-E Regulation
Art. 13(4) (tacit approval)	RED III compromise agreement
Art. 6(6) (validation of application)	Art. 16(2) RED II revision proposal
Art. 6(7) (detailed schedule)	Art. 10(6)(b) TEN-E Regulation

Art. 7(1) (mandatory scoping)	Art. 16b(2) RED II revision proposal
Art. 7(2) (bundling assessments)	Art. 2(3) EIA Directive (made mandatory)
Art. 7(3) (timeline reasoned conclusion)	Art. 3(6) EIA Directive revision proposal (2012)
Art. 7(4) (timeline consultation)	Art. 6(7) EIA Directive revision proposal (2012)
Art. 8(1) (planning)	Art. 15(3) RED II
Art. 8(2) (SEA bundling)	Art. 11(2) SEA Directive (made mandatory)

Clear scope including all relevant permits

The NZIA proposal contains rules that seek to facilitate and accelerate the entire permit-granting procedure. First of all, to create legal, planning and investment certainty, the NZIA proposal sets a clear scope to capture the entire permitting process. The definition in Article 3(1)(f) means that the permit-granting process covered by NZIA encompasses all relevant administrative permits to plan, build, expand and operate net-zero technology manufacturing projects starting, and importantly, clarifies that it is all permits and authorisations required as from the acknowledgment of the validity of the application by the national competent authority (or “one-stop shop”) and ending with the final comprehensive decision on the outcome of the procedure that is also communicated by the national competent authority. This provides a clear indication on start and end of the process.

⁽¹⁰⁴⁾ European Commission, Technical support for RES policy development and implementation – Simplification of permission and administrative procedures for RES installations (RES simplify): interim report, 2022, <https://data.europa.eu/doi/10.2833/239077>



In addition, the definition provides indicative examples by citing that such permits include also building, chemical and grid connection permits. One reason for unpredictable timelines currently is that the procedure for performing the necessary environmental assessments is not consistently implemented, within and across Member States, especially regarding the timing. Importantly in this regard NZIA clarifies that it also includes environmental assessments and authorisations, thus ensuring that NZIA can provide certainty to project promoters with regards to the entire permit-granting process. Furthermore, NZIA includes a definition on what constitutes the final “comprehensive decision”.

One-stop shop

A central element to the permitting chapter of NZIA is the requirement for Member States to set up a national competent authority (or one-stop shop) similar to the provisions on one-stop shops of the Renewable Energy Directive¹⁰⁵ and the TEN-E Regulation.¹⁰⁶ The national competent authority that acts as a one-stop shop or a single point of contact for project promoters, with the main aim of increasing efficiency and transparency. Examples exist in a variety of sectors where the introduction of one-stop shops has in the past reduced time and cost invested in permitting procedures in the EU¹⁰⁷. The experience of introducing a one-stop shop for industrial projects requiring environmental (“ICPE”) permits in seven French regions in 2014 shows the effects of a one-stop shop on permitting times: the one-stop shops reduced the average permitting duration for ICPE projects to 259 days compared to 431 days for projects without this measure.¹⁰⁸

The national competent authority in NZIA is responsible for facilitating and coordinating the entire permit-granting process, and for issuing a comprehensive decision within the applicable time limits. National experiences vary on one-stop shops, hence NZIA as well as the other above listed EU legislation allow Member States to set these up as best suits the national context, in line with the subsidiarity principle. NZIA requires that the national competent authority communicates the final comprehensive decision to the project promoter, independently on whether it issued it itself or it was issued by another authority. Importantly, the proposal also allows Member States to designate more than one such one-stop shop: these can also be regional or local, as long as any one-stop shop remains the single point of contact for any given project.

While similar to the provisions on one-stop shops in RED and TEN-E, the models of one-stop shop in these two pieces of legislation differ, with NZIA proposing a middle way between the two. RED allows Member States to set-up as many one-stop shops as necessary, whilst TEN-E obliges to have a single authority that may delegate to further authorities. The NZIA approach rests on the TEN-E model to have first one central contact point, with the possibility like in RED to have many more. NZIA leaves

⁽¹⁰⁵⁾ Article 16 of Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast).

⁽¹⁰⁶⁾ Article 8 of Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure

⁽¹⁰⁷⁾ From Red Tape to Smart Tape: Administrative Simplification in OECD Countries | Cutting Red Tape | OECD iLibrary https://www.oecd-ilibrary.org/governance/from-red-tape-to-smart-tape_9789264100688-en

⁽¹⁰⁸⁾ SWD/2016/0418 final

more flexibility than TEN-E in that besides the delegation, it does not prescribe further obligations specific to the first central contact point. For instance, unlike the TEN-E Regulation which prescribes how the comprehensive decision is to be issued (integrated, coordinated, or collaborative approach) NZIA leaves it open to Member States on how to organize this final step.

Under NZIA, in practical terms, it is possible that a project promoter, in a regional context, contacts first the national competent authority, which then either acts as single point of contact for the project or may redirect the project to another single point of contact, as available. As a reminder, in TEN-E, while it is possible to create additional one-stop shops besides the national competent authority, Member States have so far not made use of this possibility. Under RED, the project will most likely seek a local/regional contact point in the first place. The NZIA approach to the one-stop shop, identical to the one proposed under the Critical Raw Materials Act proposal, rests on retaining a degree of overview and control over the projects which are fewer and economically more significant than in RED, yet more numerous and both geographically and by type more varied than those under TEN-E.

The one-stop shop is a central aspect around which to organise compliance with the NZIA permitting provisions. In order to do this effectively, NZIA requires that Member States provide their national competent authority, or any authority acting on their behalf, with sufficient personnel and resources. The extent of resources, or additional resources, to be allocated is to be determined by Member States and would need to be proportional to the number of announcements of new net-zero technology manufacturing projects in their territories. A first assessment by Member States could build on the information on net zero technology manufacturing projects that Member States are obliged to inform on by mid-2023 as part of the updated National and Energy Climate plans, where reporting on such projects is a new requirement stemming from the revised Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action.

Importantly, NZIA requires that within one month of receiving the project application, the one-stop shop must validate the application and the start of the permitting process (Article 6(6)), then following the validation it must within one month draw up in close cooperation with the project promoter and other authorities concerned a detailed schedule (Article 6(7)) for the permit granting process. The one-month time-limits are set to create further certainty on process. In addition, the one-stop shop ensures that previous studies, permits and authorisations must be considered, to cut red tape.

Furthermore, to leverage the digital transition and address the potential labor shortage factor in national permitting authorities, there is a need to make use of digital tools. NZIA requires that one-stop shops are capable of handling documents in electronic form and obliges Member States to facilitate access to information on administrative procedures and business assistance services online and in a centralized manner. By amending the Single Digital Gateway (NZIA Article 37), any one-stop shops will be accessible via the YourEurope portal and benefit from the Once-Only-Technical-System,¹⁰⁹ which will reduce admin burden both for project promoters but also for administrators.

⁽¹⁰⁹⁾ <https://ec.europa.eu/digital-building-blocks/wikis/display/DIGITAL/Once+Only+Technical+System>

Case Study: Oxford PV



Oxford PV is an innovative SME net zero technology manufacturer at the brink of commercializing high-efficiency perovskite-on-silicon tandem solar cells, which can be integrated within the conventional silicon solar supply chain. While the full permit-granting process for its new production facility in Germany took 12 months, and despite the good intentions from the permitting authorities, the process was considered particularly burdensome due to cost, non-transparency, and uncertainty, for the following reasons:

- Different regional authorities were not aware of the relevance of net-zero technology manufacturing and there was thus a lack of urgency and immediate interest. The permitting process was not standardized and seemed tailor-made.
- Both the company and local permitting authorities needed to hire third party consultants for guidance on process and on which other authorities to involve and when. Oversight on the lack of some data caused extra delay, which as later advised by the consultant, could have been avoided by simply modifying the initial application.
- Oxford PV technology requires new processes and materials. These are less common in existing permit procedures and hence the path to approval became highly dependent and time-consuming on the interpretation of current regulations.

In this case, the existence of a one-stop shop designed to cater to net-zero technology manufacturing projects would have increased the project's investment and planning certainty and increased the efficiency of the permit-granting process. The lengthy back and forth with authorities and the hiring of costly third-party consultants could have led to project cancellation.

Permitting time-limits

In terms of time-limits, NZIA creates a clear and legally binding obligation on the duration of the permit-granting procedure. This is seen as an important tool by which to create planning and investment certainty. Besides existing in the other above cited EU legislation, several Member States such as Germany and the Netherlands already have binding time-limits for permitting of net zero technology manufacturing projects, and Member States such as France have only recently proposed such time-limits in the framework of the recently presented *Loi Industrie Verte*. NZIA provides that the permitting procedure for Net zero technology manufacturing projects must not exceed 18 months for gigafactories, and 12 months for smaller projects. In addition, for strategic projects the time-limits must not exceed 12 months for gigafactory projects and 9 months for smaller projects. While certain Member States such as the Netherlands already have shorter time-limits, or like France propose similar time-limits, the time-limits set at EU-level via NZIA are necessary to ensure a minimum level of harmonization, planning and investment certainty across the EU. Article 6(9) clarifies that NZIA is without prejudice to any shorter time-limits set by Member States. Equally, NZIA foresees that for the expansion of production lines in existing net zero manufacturing facilities, the above-cited time-limits will be halved.

The policy choice for differentiated permitting time-limits for smaller and larger projects is twofold. The first reason for setting shorter time-limits is to cater to projects that are SMEs and/or of a smaller size and therefore potentially less likely to be of a complex nature. The requirements on permitting processes are equal for all companies regardless their size. This is an additional burden on resources for SMEs, posing a risk for the success of starting businesses. NZIA takes this into account by

providing shorter time-limits to projects smaller than 1 GW production capacity, placing an additional level of prioritization on projects that are more likely to be SMEs, or likely less complex in nature. The second reason is that to become competitive, European production in certain net zero value chain segments needs to aim for economies of scale. Gigafactories are an essential building block in this regard. These are very large industrial projects spanning up to dozens or even hundreds of hectares in size. A differentiated time-limit for projects with a production capacity of 1 GW or above ensures that such projects are considered per definition to be covered by an own regime, by an own level of priority. Gigafactory projects, when of a more complex nature and/or due to their sheer size and for instance, having to be located in a greenfield site, may require more time to carry out assessments or gather further permits than a smaller projects of a less complex nature. The differentiated time-limits therefore prioritise projects in the following order: (1) strategic projects below 1GW production capacity that can be deployed fast as they are likely less complex and possibly SMEs, (2) large strategic projects that are potentially more complex, (3) projects that can be deployed fast that are likely less complex and possibly SMES, and (4) large potentially more complex projects.

The choice of time-limits has been set for all value chains and technologies covered in NZIA, and by assessing permitting times and lead times of the more complex batteries value chain (chemical permits, greenfield sites due to size, etc.) and the solar PV value chain which typically has shorter lead times. The time-limits are based on the assessment of individual cases and are under normal circumstances considered to be realistic, achievable and of added value for all technologies. Setting longer time-limits would have risked creating time-limits that are either unambitious, represent the status quo or are even longer than they currently are. This would send the wrong signal and is not in the interest of the objectives of the EU's Green Deal Industrial Plan. Setting the same time-limit for large (more likely complex) projects and small (less likely complex) projects would have the same consequence, for instance, in the case of the project case study on p.48 this project could be even de-prioritised by national permitting authorities and thus endure a loss in competitiveness if the time-limit is set as longer than 9-12 months, for instance at 15 months.

Importantly, Article 6(4) foresees that the time-limits can be extended by 1 month in case that the nature, complexity, location, or size of a project so requires. This is an important provision insofar as that it caters to the differentiated time-limits when the circumstances require it, for example, in the case of a strategic project of less than 1 GW production capacity that may not be able to meet the 9 month time-limit due to its more complex nature (e.g. the project requires chemical permits and seeks to be situated in a greenfield site for which it would require a full environmental impact assessment). In addition, NZIA also allows Member States to extend the time-limits by 6 months in cases where it is found that the project may cause exceptional risks for the health and safety of workers or of the general population. Finally, any administrative appeal procedures and judicial remedies before a court or tribunal are not part of the time-limits, in order to respect and safeguard Member States judicial autonomy, however, one-stop shops must in this regard also ensure that applicants have easy access to information on and simple procedures for the settlement of disputes.

Streamlining environmental assessments

NZIA crucially also proposes provisions to streamline environmental impact assessments (EIAs), which typically are the procedures that can take the longest during permitting. Shorter EIAs which at the same time fulfill the highest environmental protection standards are possible. The NZIA approach rests on the large procedural margin for organizing the environmental assessments granted inter alia in the Environmental Impact Assessment Directive,¹¹⁰ through the possibility of performing joint or coordinated assessments, when the obligation to perform such an assessment arises simultaneously. The subsidiarity principle allows Member States to attain the proposed time-limits of NZIA by adapting their assessment procedures to ensure the best efficiency and effectiveness without prejudice to their compliance with respective EU environmental obligations.

⁽¹¹⁰⁾ Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codification) Text with EEA relevance

The actual duration of EIA procedures varies depending on the size and complexity of the project and the environmental sensitivity of the project location. The EIA process for smaller, simpler projects can take less time, while for large complex projects the process can take longer, up to three years in exceptional cases.¹¹¹ The study conducted for DG Environment in this regard showcases that in six Member States the average total duration for the overall EIA procedure is 7.5 months or below. This data was collected at a time when the EIA directives had not yet been revised and many best practices were not yet applied. Recent experiences in the batteries value chain and in the EU solar photovoltaic manufacturing sector show that gigafactory sized projects can complete EIAs within 6-8 months, including on greenfield sites. A large 23-hectare integrated gigafactory in Italy producing solar cells and solar PV modules located in a brownfield site recently completed the EIAs within 8 months.

Moreover, Strategic Environmental Assessments (SEA) carried out by Member States at planning level, as well as planning considerations and available and recent assessments of suitable sites in existing industrial clusters, on built surfaces, or brownfield sites, can further speed up the permitting procedures at project level. Additionally, Member States benefit from EU Space technology, namely Copernicus datasets and imagery, as readily available input for EIAs when analysing land cover, land use and biodiversity value of suitable sites.

Case Study: Northvolt Skellefteå



An example provided by the European Batteries Alliance shows how coordination and open dialogue with authorities can lead to issuing permits and completing the procedure in a timely manner, including when a project can be considered as complex, for instance, where it is to be located in a greenfield site and requires chemical permits and full environmental assessments:

- 4 July 2017: Skellefteå selected as preferred site for construction of Northvolt's first gigafactory. The selected site was a greenfield site, no SEA had been carried out previously, and the authorities did not do any pre-approvals or assessments of the site.
- 7 June 2018: Northvolt granted the environmental permit, which covers both construction and operation, by the Land and Environment Court in Umeå less than six months after their final application was submitted.
- 8 June: 2018: Construction phase for the first section of the factory of eight GWh cell capacity annually started, completing the permit-granting process from start to finish in less than 12 months.

The scope of the permit encompassed operations, onsite materials and chemicals, emissions, facility effluent and safety measures. Crucially, in this case, the submission was preceded by an intense and supportive dialogue of the applicant and the granting authorities. This early dialogue was considered as necessary for Northvolt to write an application compliant with all requirements – and made it easier for the granting authorities to process the applications, a lot of question marks and open questions had already been addressed in this iterative process.

⁽¹¹¹⁾ Collection of information and data to support the Impact Assessment study of the review of the EIA Directive, A study for DG Environment, A Final Report submitted by GHK, 30 September 2010

Further streamlining of EIAs in line with the NZIA permitting provisions can reduce their duration even further. NZIA Article 7(1) provides that projects can request a scoping opinion from a one-stop shop, to be provided within 30 days, to clarify the scope of the EIA report and to avoid any further, extended exchanges on what is required. In several Member States, such a scoping study is already a mandatory part of the EIA procedure (Bulgaria, Czechia, Denmark, Estonia, Finland, Luxembourg, Romania), with NZIA in addition setting a clear deadline to clarify and speed up the certainty of the process. Mandatory scoping helps improve the quality of the EIA process and contributes to its streamlining, as the developer can rely on having appropriate information at hand early on in the process.

Where several different environmental assessments are needed for a single project, stemming from obligations from EU environmental legislation,¹¹² NZIA requires these assessments to be bundled and carried out at the same time. Importantly, the one-stop shop must ensure that either itself, or any relevant authorities, issue a reasoned conclusion on the environmental impact of the project within 3 months of receiving it. About half of the Member States have already established specific timelines for the competent authorities to reach such a reasoned conclusion. In many cases these do not exceed one or two months (Bulgaria, France, Italy, Malta, Greece, Latvia, and Romania). Further, the timeframe for consulting the public on EIA report is set at 45 days. The 45 days proposed in NZIA is based on the minimum requirement of 30 days set out in the EIA Directive and follows the recommended 45 days for public consultation under the Aarhus convention. In cases of exceptional risks for the health and safety of workers or the general population, it may be extended to 90 days.

It is important to note that only certain net zero technology manufacturing projects will fall under Annex I of the EIA Directive which requires a mandatory EIA. Many of the projects that will fall under the scope of NZIA are likely to fall under Annex II of that Directive and therefore do not automatically undergo an EIA but are instead subject to a much lighter procedure – so called screening – under which competent authorities in the Member States determine if the project would have to be subject to an assessment (in case of potentially significant effects on the environment). It is to be noted that the EIA Directive already allows the project promoters to provide a description of any features of the project and/or measures envisaged to avoid or prevent what might otherwise have been significant adverse effects on the environment – this allows for the so called tailored-approach in the screening that can lead to no EIA being required. Therefore, it can be expected that only a limited number of projects falling under the scope of NZIA will be subject to a full EIA.

To speed up investments and construction of net zero technology manufacturing projects, and to facilitate more efficient EIAs, NZIA also requires Member States to consider net zero projects when preparing zoning, spatial and land use plans. Strategic Environmental Assessments carried out by Member States at planning level, as well as planning considerations and available and recent assessments of suitable sites, in particular in existing industrial clusters, on built surfaces, or brownfield sites, can further speed up the permitting procedures at project level. NZIA Article 8 provides that Member States consider such projects in spatial planning and zoning, *where appropriate* – leaving Member States discretion on the extent of such planning and types of value chains to be considered.

5.3.2.3. *Enabling conditions: Net-zero strategic projects and access to finance*

NZIA puts forward the possibility to establish Net-Zero Strategic Projects. They refer to manufacturing projects corresponding to a strategic net-zero technology that meets at least one of two criteria: 1) contributes to the technological and industrial resilience by increasing the manufacturing capacity of the EU of a component or part primarily used in the net-zero technology value chain for which the EU depends heavily on imports coming from a single third country; or 2) has a positive impact on EU's net-zero industry supply chain or downstream sectors, beyond the

⁽¹¹²⁾ Directive 2011/92/EU, Directive 92/43/EEC, Directive 2009/147/EC of the European Parliament and the Council, Directive 2000/60/EC, Directive 2001/42/EC of the European Parliament and the Council 68, Directive 2008/98/EC of the European Parliament and of the Council 69, Directive 2010/75/EU or Directive 2012/18/EU of the European Parliament and the Council

promoter and the Member States concerned, contributing to the competitiveness and quality job creation of the EU's net-zero industry supply chain. The latter are taken to refer to meeting at least three of the following criteria: 1) significant manufacturing capacity addition in the EU for net-zero technologies; 2) improved sustainability and performance of the manufactured technologies; 3) putting in place measures to attract, upskill or reskill a workforce required for net-zero technologies, including through apprenticeships, in close cooperation with social partners; and 4) adopting comprehensive low-carbon and circular manufacturing practices, including waste heat recovery .

Project promoters that wish to receive the status of a net-zero strategic project need to formally apply for such a status to the relevant Member State in accordance with the criteria described in NZIA Article 10 and subject the application and recognition criteria in Article 11. Project promoters located in 'less developed and transition regions' and Just Transition Fund Territories and eligible for funding under cohesion policy rules, may receive the status of strategic project automatically without a formal application process.

Strategic net-zero projects have additional benefits under NZIA. In relation to permitting, NZIA provides that strategic projects must be treated with priority and processed in the most rapid way possible via the provisions in Articles 12 and 13. Member States must also grant strategic projects the status of the highest national significance possible, where such a status exists in national law, and be treated accordingly in the permit-granting processes including those related to environmental assessments and spatial planning. Currently there are 16 Member States (Bulgaria, Germany, Greece, Finland, Croatia, Hungary, Ireland, Italy, Lithuania, Latvia, the Netherlands, Poland, Portugal, Romania, Slovenia, Slovakia) where this or a similar status exists at national level and where it facilitates, simplifies, or accelerates permit granting processes. Notably, during a recent evaluation of the TEN-E Regulation, it was found that 35% of project promoters confirmed a positive impact potentially reflecting the effectiveness of the status. In addition, all dispute resolution, litigation, appeals and judicial remedies must be treated as urgent, if national law provides for such urgency.

In addition, as per Article 12(3) Net-Zero Strategic Projects must be considered to contribute to the security of supply of strategic net-zero technologies and therefore be in the public interest and may be considered of overriding public interest. In practice it means that on a case-by-case basis, a competent permitting authority may conclude that the public interest served by the project overrides the public interests related to nature and environmental protection and that consequently the project may be authorised, provided that all relevant conditions set out in EU environmental legislation¹¹³ are met. In other words, if a national authority finds that a new production facility is likely to impact a Natura 2000 site it may still authorise the project if all conditions for an exception according to Article 6(4) of the Habitats Directive are fulfilled: no alternative solutions are available, and the operator proposes appropriate compensation measures. In this case, the national authority may decide that there is an overriding public interest at stake that makes it possible to authorise the construction. If significant negative impact affects priority habitats and species, prior to the authorisation, a Commission opinion may be necessary.

Article 13 provides that Net-Zero Strategic Projects benefit from shorter permitting time-limits: twelve months for facilities with a yearly production output of more than 1 GW, and 9 months for those with a yearly production output of less than 1 GW. The logic behind the differentiated time-limits is rooted in the need for prioritisation and is explained in detail in the previous section (pp. 50-51). Furthermore, NZIA includes a tacit agreement clause where national competent authorities must ensure in accordance with Article 13(4) that the lack of reply of the relevant administrative bodies within the applicable time-limits results in specific intermediary steps to be considered as approved. The provision clarifies that it must not apply to the final decision itself and may not be used to circumvent the environmental assessments or environmental permits.

Accelerating implementation and coordination of finance

⁽¹¹³⁾ Directive 2000/60/EC, Directive 92/43/EEC and Directive 2009/147/EC 63

NZIA aims at favouring the raising of private investments through the support of the Commission and Member States. In this context, the Net-Zero Europe Platform can discuss and advise on the completion of financing for net-zero strategic projects that have already fulfilled certain pre-conditions. Investments into net-zero technologies can further be attracted through the collaboration between the Net-Zero Europe Platform and the relevant industrial alliances, to bring together manufacturers and off-takers of net-zero technologies (as per NZIA's proposed article 29.11).

Regarding financing, no new money or funding instrument is provided in NZIA, but the latter provides for support for the coordination of financing. As the Commission's recent investment needs analysis showed,¹¹⁴ €92 billion cumulative over 2022-2030 are needed to ramp up EU's manufacturing capacity to meet the industry-led technology-specific objectives put forward in NZIA's recital 17. Out of these, around €16-18 billion could be required from the public purse, and in this respect several existing EU instruments, directly managed by the European Commission or with Member States (like InvestEU, Innovation Fund, RRF, Modernisation Fund, as well as cohesion policy instruments), can be better geared to contribute to the achievement of NZIA objectives and partly cover these public funding needs.¹¹⁵ This support can create an important pull factor for net zero innovation demonstration projects developed under the Horizon Europe programme below technological readiness level 8. In addition, the Commission will aim at ensuring that NZIA priorities and to support net-zero strategic projects is factored in relevant EU programs, as appropriate.

By establishing definitions of economic activities that can be considered environmentally sustainable, the EU Taxonomy will help direct investments to economic sectors where they are most needed to reach the objectives of the European Green Deal and enable the net-zero transition. The first Climate delegated act covering climate change mitigation and adaptation objectives (¹¹⁶) applies since January 2022; the delegated acts recently adopted by the Commission will foster sustainable investments in more economic activities (¹¹⁷).

In this context it is worth highlighting that the Commission has now, via its Temporary Crisis and Transition Framework of 9 March 2023, provided Member States with a possibility to implement State aid measures that facilitate new investments in production facilities within specific sectors that are strategic for the transition to a net-zero economy. These measures may be granted in various forms, including tax advantages. The permitted aid amount and intensity may be increased where the investment takes place in an assisted area (as per the applicable regional aid map), to contribute to the goal of convergence between Member States and regions. In exceptional cases, the TCTF allows Member States to provide higher support to individual companies, where there is a real risk of investments being diverted away from Europe. In such situations, Member States may provide either the amount of support the beneficiary could receive for an equivalent investment in that alternative location (the so-called 'matching aid'), or the amount needed to incentivise the company to locate the investment in the EEA (the so-called 'funding gap') whichever is the lowest. This option is subject to a number of safeguards. For the mid-term, the Commission intends to give a structural answer to the investment needs, by proposing a European Sovereignty Fund in the context of the review of the Multi-annual financial framework before summer 2023.

⁽¹¹⁴⁾ SWD (2023) 658 final

⁽¹¹⁵⁾ SWD (2023) 658 final estimates that around €8 billion could be available for supporting first-of-a-kind installations and net-zero technology production plants, leaving a public funding gap of around €8-10 billion.

⁽¹¹⁶⁾ Taxonomy Climate Delegated Act, [Commission Delegated Regulation \(EU\) 2021/2139 of 4 June 2021 supplementing Regulation \(EU\) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives](#)

5.3.2.4. *Setting a CO₂ injection capacity target*

Concerning CCS, by defining a 2030 EU target of operational CO₂ injection capacity and corresponding requirement for Member States in terms of transparency, forward planning and permitting, the EU will create new degree of regulatory certainty for storage operators and therefore also for transport operators and capture installations. Without an established EU target for operational injection capacity in 2030 as proposed in NZIA, all companies along the CO₂ value chain continue to de-risk their investment decisions in parallel, which favours integrated projects with smaller scale and therefore higher prices, all of which are subject to permitting procedures for this new market. Without an intervention, CO₂ storage services will develop too slowly, with too few projects looking for the highest bidder price and related high-cost upfront commitments from capturing plants, which in turn will reduce the real deployment of capture projects.

By requiring sectorial contributions from the oil and gas companies to the establishment of the front-runner storage projects, a reliable quantity of storage services supply will become available and recognised as Net Zero Strategic Projects. This in turn will increase certainty to underpin investment decisions for the development of CO₂ capture projects in hard-to-abate industries.

The first entrants on the CO₂ storage market are expected to be oil and gas companies as they are best placed to deal with the subsoil assets, considering their knowledge and experience. Often, they have already the rights to typical storage sites linked to oil and gas exploration, and by developing them as storage sites they can have market opportunities for their own long term business strategies (e.g. the production of blue hydrogen, natural gas processing). This indicates that the first service offers on the market will be strongly driven by oil and gas companies that have an inherent comparative advantage to develop such projects. This is further confirmed by the fact that they are already competing against each other to secure rights for exploration of other future storage sites. It is however important to remind that, according to the IPCC and the EU's long-term strategy, CCS has a role to play in hard-to-abate sectors. The priority is reducing emissions in all sectors: climate neutrality will not be reached if CCS capacities are used to remove emissions from sectors that can and must decarbonise.

As such by requiring sectorial contributions from the oil and gas companies to the establishment of the front-runner storage projects, a reliable quantity of storage services supply will become available and recognised as Net Zero Strategic Projects, provided by market participants that where anyway expected to be at the forefront of this development. This in turn will increase certainty to underpin investment decisions for the development of CO₂ capture projects in hard-to-abate industries.

The proposed EU target of annually 50 million tonnes of CO₂ injection capacity builds on the fact that several CO₂ storage projects are currently in different stages of the exploration and permitting process in the EEA, though no certainty exists on when they will become operational. These projects need to become operational by 2030 to allow industries to capture CO₂ instead of emitting it. The target is in line with the market expectations of the storage operators, as well as with the estimation of the CCUS Forum industry coalition of 80 Mtpa by 2030 in the EEA. The vast majority of the current storage projects are in the North Sea region.

Net Zero Strategic Projects will also be needed in southern and eastern EU Member States. The coordinated development of such storage projects across the EU, incentivising also companies with similar oil and gas activities in other regions, will create industrial scale capacity and learning effects that the storage sector can benefit from EU wide. The proportional contribution by oil and gas producers takes account of the medium and long-term revenue and growth potential for storage site operations. The 2030 target capacity will allow stable annual revenues during 15-20 years of operation. This will serve a growing demand for storage services, which the CCUS Forum stakeholder coalition has estimated to reach at least 300 million tonnes of CO₂ already in 2040.

5.3.2.5. *Improving access to markets*

The proposed measures related to access to market are meant to introduce a demand-side pulling factor that will incentivise investments to strengthen the sustainability and resilience of the EU

supply chain. As such, they will serve the purpose of delivering on wider societal values linked to environmental sustainability, innovation, energy system integration and resilience, based on a strong EU manufacturing sector. By awarding resilience aspects in public tender opportunities, it encourages the reduction of harmful dependencies on products or components originating from an excessively concentrated (more than 65%) single supply source and improve the prospects for diversification in net-zero industry supply chains, while respecting the EU's international obligations.

EU legislation on public procurement already allows contracting authorities and entities awarding public contracts to design award criteria as part of the most economically advantageous tender notion that may consider qualitative, environmental and/or social aspects. For auctions as well, qualitative criteria support the production and consumption of energy from renewable sources and other support schemes are to a certain extent already allowed in the EU and public authorities in Member States are already using them in some cases. This allows them to foster broader goals going beyond price only and with wider benefits for the society. These benefits include, for instance, rewarding those parts of the supply chain and industry players that invest in more sustainable, innovative, and functional products and services.

However, contracting authorities and entities awarding public contracts and, in the case of auctions, national public authorities, do not make wide use of the possibilities of including qualitative criteria. An approximation on the current use of non-price criteria in procedures falling under the procurement directives can be made by referring to the Common Procurement Vocabulary (CPV) codes used for reporting in the Tender's electronic database (TED), associated with the net zero strategic technologies listed in the Annex of the NZIA proposal (see Table 3).

This approximation shows that more than half of the public procurement contracts are awarded based on the lowest price criteria only. Introducing mandatory criteria for sustainability and resilience, for a limited set of strategic net-zero technologies, as stipulated in Article 19 of the NZIA proposal should support the use of non-price criteria in public procurement procedures. This also responds to the call for action that the EU's net-zero industry voiced with respect to increasing the use of non-price criteria to balance the need to deliver affordable products with the objective to ensure the sustainability, innovation, and resilience of the sector. The Commission has balanced these considerations against the objective of ensuring a rapid deployment of net zero technologies in line with the objectives of the Fit for 55 legislative package.

	Number of public procurement contracts award notices	
	2021	2022
Lowest price	439	836
Quality	293	393
Non-specified	245	341
Total	977	1570

Table 3: Public procurement contracts award notices in the EU based on price and non-price criteria: Source: European Commission sources drawing on the CPV codes (associated with net-zero strategic technologies as per the Annex of the NZIA proposal) used for reporting in TED

The proposal includes in the overall combination of mandatory award criteria sustainability and resilience criteria for the award of public procurement contracts and auctions. The use of award criteria ensures that no bottlenecks are created as contracts can be awarded even to tenderers that do not fulfil the criteria where their fulfilment does not allow to ensure sufficient supply for instance. The sustainability and resilience contribution is based on the following cumulative criteria: environmental sustainability, innovative characteristics of the proposed solution, the contribution to the energy system integration as well as to resilience (aiming at avoiding harmful dependence on one single source of supply). The proposal explicitly clarifies in Article 19 (4) that contracting authorities and entities remain free to use social aspects for the award of public procurement contracts in line with the possibilities offered under the procurement directives.

As an award criterion, sustainability (understood as environmental aspects linked to the subject-matter of the public contract in question, as per Article 67 of Directive 2014/24/EU on public procurement) must go beyond the minimum requirements in the applicable legislation. Similarly, contracting authorities and entities awarding public contracts should consider the innovative elements of a bid where they see a need to develop an innovative solution. However, innovation can be disruptive and entails risks related for instance to the buyer's organisation, IP rights, etc. Therefore, when assessing the innovative character of the solution, they must also consider the quality of its implementation plan, including risk management measures.

To ensure an efficient use of the energy that is produced and whenever applicable based on the need to support the integration of renewable electricity in the energy system, the proposal introduces an award criterion related to the energy system integration. This refers to solutions for maximising the integration of the electricity generated by renewable energy installations into the wider energy system. This means, for instance, adopting technical solutions that allow for the integration of surplus electricity generated by renewable electricity installations, including through storage, in its various forms and demand-side management.

The excessive reliance on the import of entire or parts of net-zero technologies from single sources of supply can create a risk of strategic dependence on sources of supply. To address this risk, the proposal introduces a resilience criterion for which contracting authorities and entities awarding public contracts must take into account the proportion of the products originating from a single source of supply from which more than 65% of the supply for that specific net-zero technology within the Union obtained in the last year for which data is available when the tender takes place. To help contracting authorities and entities awarding public contracts apply this provision, the Commission will publish and regularly update a list of each of the net-zero technology final products listed in the Annex, broken down by the share of Union supply originating in different third countries in the last year for which data is available (Article 22 (2) of the proposal).

The proposal requires sustainability and resilience criteria for the award of public procurement contracts and auctions to be subject to a mandatory weighting between 15% and 30% of the award criteria. This weighting range was chosen because it gives contracting authorities and entities awarding public contracts and public authorities running auctions flexibility to attribute significant importance to other criteria, whether other quality criteria or price or cost, while ensuring that the aims pursued with the sustainability and resilience considerations are sufficiently addressed (thanks to the minimum 15% threshold). At the same time, where legislation requires or allows national authorities to be more ambitious than the 30% on environmental sustainability requirements, the proposal does not prevent them from doing so. It therefore allows them to go beyond the 30% for environmental considerations. The same holds true for innovation.

However, the application of the criteria would lead to a significant increase in costs or technical incompatibilities, this would create pressure on the budgetary efforts required from contracting authorities and entities awarding public contracts, as well as public authorities running auctions, which in turn could lead to a slower deployment of net-zero technologies. To mitigate such risks, the proposal includes an exemption clause that allows contracting authorities and entities and public authorities running auctions for the support of renewable energy not to apply the above-mentioned criteria where their application would lead to disproportionate costs or technical incompatibilities. Costs may be presumed disproportionate in cases where the application of sustainability and resilience criteria would result in awarding contracts that result in 10% greater costs than the contracts that would be possible to award in case of price criteria solely. Contracting authorities and entities awarding public contracts and public authorities running auctions for the support of renewable energy are not obliged to use this safeguard clause and can decide to accept costs above 10% if they so choose. This threshold constitutes a safe harbour for national budgets and allows to avoid hampering deployment, while still allowing to pursue the sustainability and resilience goals.

The NZIA provisions on access to markets will ensure a sufficient supply of products responding to all the characteristics of the sustainability and resilience contribution, as well as lower costs resulting

from the production of sustainable and resilient products and services. The same sustainability and resilience considerations are provided for support schemes benefitting households and consumers for the purchase of net-zero technology final products.

5.3.2.6. *Enhancing skills*

Multiple Member States report relative severe shortages in professions that essentially constitute the skills-base upon which net-zero industries depend on for large part of their value chain, or the skills-pool of candidates that would need extra sectoral specialisation and training to fulfil roles on new green technologies.¹¹⁸

In the electrolyser/hydrogen sector, a European hydrogen production capacity of 10 million tons/year would imply the creation of roughly 440 000 jobs, of which the majority (roughly 70%) will be linked with renewable electricity generation.¹¹⁹ It seems reasonable to assume that if a European electrolysers production and deployment capacity of about 50 GW/y will be reached in 2030, 20 000 – 50 000 new jobs associated to electrolysers manufacturing will be created. The skill needs for the fuel cell hydrogen sub-sector in manufacturing alone are estimated at 180.000 trained workers, technicians, and engineers by the year 2030.¹²⁰ For solar energy, in manufacturing of photo-voltaic panels, 66.000 additional jobs are estimated in manufacturing and investment needs for retraining/reskilling/upskilling until 2030. To this can be added deployment jobs, given that according to various sources around 75% of solar PV employment is in panel installation.¹²¹ Demand for the above net-zero technologies is expected to continue growing, carried by the EU's ambitions regarding climate, as well as consumer demand for more autonomous energy production (in solar and batteries for example).

The figures presented above show a strong need for skills in net-zero industries in Europe. This is powered by both increased demand from industry and consumers, and by a policy and regulatory push from policy makers for a cleaner, more sustainable economy. The competition for a green skilled workforce is global, as production for solar panels, for example, is largely based in Asia. Similarly, in the past ten years, battery production capacities have been built up mainly in Asia (China, Korea, Japan) and in the US.¹²²

For Europe to respond to the rapidly growing need for net-zero technologies, it is key to ensure there is an available workforce with the appropriate skills. NZIA's proposed articles on enhancing skills for quality job creation, and notably on the European Net-Zero Industry Academies are designed with characteristics aimed to tackle the specific challenges of the net-zero industries skills gaps:

- They are focused on specific sectors (e.g. solar, hydrogen, raw materials) that allow them to cover in depth the learning content, from beginner to advanced levels.
- The learning material is co-designed with industry, which makes it both pertinent to filling in concrete industry needs, and for learners to find gainful employment.
- Their deployment model can reach local needs while being designed centrally, thus ensuring portability of skills acquired.
- Transparency will be ensured on the relation between the credentials and the qualifications required nationally for access to regulated professions by reporting obligations of Member States.

⁽¹¹⁸⁾ Commission Staff Working document "Investment needs assessment and funding availabilities to strengthen EU's Net-Zero" SWD(2023) 68

⁽¹¹⁹⁾ Clean Energy Technology Observatory 2022

⁽¹²⁰⁾ European Commission, Directorate-General for Research and Innovation, Joint Research Centre, The strategic energy technology (SET) plan, Publications Office, 2019, <https://data.europa.eu/doi/10.2777/04888>

⁽¹²¹⁾ Commission Staff Working document "Investment needs assessment and funding availabilities to strengthen EU's Net-Zero" SWD(2023) 68

⁽¹²²⁾ Future Expert Needs in the Battery Sector, Fraunhofer, March 2021

- Cross-border recognition of credentials will be governed by existing EU level rules – whenever the host Member State concludes that there is equivalence between the professional qualifications and the learning programmes developed by the European net-zero industry academies and the specific qualifications required for access to regulated professions, these credentials would be automatically recognised.

Furthermore, the NZIA’s proposed European Net-Zero Industry Academies build on the previous experiences of the European Battery Alliance Academy (EBAA)¹²³ recently rebranded as InnoEnergy Skills Institute and the EU Pact for Skills and Blueprint Erasmus+ projects and aim at developing and deploying education and training content for the upskilling and reskilling of workers required for key net-zero technology supply chains, such as those relating to solar, renewable hydrogen, and raw materials. This is to ensure that any bottlenecks in terms of upskilling and reskilling of the workforce necessary to manufacture the net-zero technologies in line with deployment needs are addressed to avoid shortages of needed occupational profiles. On certification of learning content, the InnoEnergy Skills Institute is in the progress of setting up a certification strategy with the aim of having at least 3 formally certified learning tracks within the EBA Academy portfolio. The Institute applied for EIT label for non-degree and professional education and training programmes that was obtained in January 2023. Moreover, the Institute collaborates with the European Certification and Qualification Association.

5.3.2.7. *Stimulating innovation*

The innovation dimension of NZIA is mainly supported via the integration of regulatory sandboxes, as the proposal introduces regulatory sandboxes to test innovative net-zero technologies in a controlled environment for a limited amount of time.

Regulatory sandboxes aim at allowing innovative technologies and solutions come to the market benefitting businesses and consumers. They help to prove and build up a business model for innovative solutions. They also have the objective of removing barriers, alleviating regulatory burden, reducing regulatory uncertainty, and supporting innovation in net-zero technologies. They will further enhance regulatory learning. In general, they ensure communication and collaboration between the different national authorities and market participants.¹²⁴

Regarding scope, net-zero regulatory sandboxes apply to innovative net-zero technologies, that are defined as “‘net-zero technologies’, except that they have not reached a technology readiness level of at least 8”, to ensure the genuine innovative character of the projects participating in regulatory sandbox schemes. The genuine innovation is one of the key elements to define adequacy of projects, in most existing schemes meaning that the technology is not currently available in the market or a new use of an existing technology. Supporting innovative net-zero technologies’ entrance into the market, will also support the potential market for their manufacturing base.

Several reasons justify the introduction of regulatory sandboxes in the proposal. Firstly, the net-zero technologies represent an ever-evolving sector: the energy system is in profound transformation due to the challenges of climate change, security of supply and competitiveness. The response requires more energy efficiency, higher share of renewables, more digitalisation of the system, decentralisation, and a more complex interrelation of roles of the actors and reducing external

⁽¹²³⁾ [The European Battery Academy](#) was launched in February 2022 to help provide the specific set of skills required for the manufacturing of batteries. The EBA Academy, now InnoEnergy Skills Institute works closely with the members of EBA250, the industrial aspect of EBA, to identify and frame the main skills demands across the European battery value chain. Additionally, it researches and identifies further gaps in key skills and competencies borne from Europe’s rapidly evolving battery and electrification landscape. On this basis, it develops and produces programmes and learning content to address those skills gaps, including online learning modules, in-person training, and training manuals.

⁽¹²⁴⁾ The recently published JRC report on regulatory experimentation in the energy sector in the EU Member States (JRC (2023): Gangale, F., Mengolini, A., Covrig, L., Chondrogiannis, S., Shortall, R.: Making energy regulation fit for purpose. State of play of regulatory experimentation in the EU - Insights from running regulatory sandboxes) states regulatory sandboxes and experimentation in general are reported to be a promising tool in the hands of regulators to promote the adoption of new technological and innovative solutions and to get information about necessary regulatory changes.

dependency. For providing this response, fostering innovation is key. While a stable regulatory environment is necessary, the regulatory framework must support this transformation and adapt, in case it is needed, to this rapidly changing environment. Regulatory experimentation tools, of which regulatory sandboxes are an example, can provide this flexibility needed, as they allow for trials with the aim to support regulatory learning in a controlled and transparent way.

Secondly, regulatory sandboxes¹²⁵ are instruments already used in some national regulatory frameworks¹²⁶ in relation to net-zero technologies, as several Member States (such as France, Denmark, Italy, or Portugal) have already considered or adopted different initiatives for regulatory experimentation in the energy sector. Moreover, the Commission has encouraged Member States to set up regulatory sandboxes in the energy sector in several proposals.¹²⁷

Regulatory sandboxes were introduced for the first time at European level in the Artificial Intelligence Act.¹²⁸ In the energy sector, the Commission Recommendation on speeding up permitting procedures has encouraged their use by Member States. Member States: There are some examples where regulatory sandboxes in Member States were used related net-zero technologies. Examples of recent regulatory sandbox and regulatory experimentation projects related to innovative net-zero technologies in some Member States:¹²⁹

Denmark:

- GreenLab Skive project. The project demonstrates the production of green hydrogen, including the development of a viable value chain, by enabling different companies to share each other's surplus resources, such as for instance CO₂ and energy.
- Siemens Gamesa's Brande Hydrogen project. The technology-focused project couples an existing onshore 3 MW wind turbine with a green hydrogen systems electrolyser stack, with the possibility to produce green hydrogen in 'island mode', i.e. without any connection to the grid. The green hydrogen fuel produced is then distributed by the Danish company Everfuel to the Copenhagen's fuel cell taxi fleet.

France

- Project led by SEM Energie Mayenne (Evron area), aiming to test the resort by the gas DSO to a compressed natural gas (CNG) station to provide the flexibility needed to allow the injection of biomethane without resorting to further investments in the network.
- Project led by Semardel, aiming at experimenting with the injection into natural gas networks of gas produced from biomass and solid recovered fuels.

Italy

- In its strategy for 2022-2025, ARERA, the Italian energy regulator envisaged the introduction of an experimental framework to promote system innovation for the development of renewable gases and hydrogen. Following wide stakeholder consultation, it adopted an incentive mechanism to support innovation in gas infrastructure, which also targets innovative uses of the existing infrastructure to accommodate an increasing input of

(¹²⁵) Better regulation' toolbox 2021 Tool #69 (Emerging methods and policy instruments) https://commission.europa.eu/system/files/2022-06/br_toolbox_-_nov_2021_-_chapter_8.pdf

(¹²⁶) JRC (2023): Gangale, F., Mengolini, A., Covrig, L., Chondrogiannis, S., Shortall, R.: Making energy regulation fit for purpose. State of play of regulatory experimentation in the EU - Insights from running regulatory sandboxes <https://publications.jrc.ec.europa.eu/repository/handle/JRC132259>. The study identifies the following Member states with regulatory sandboxes and/ or other types of regulatory experimentation in the energy sector: Austria, Belgium, Denmark, France, Hungary, Italy, Lithuania, the Netherlands Portugal, Spain and Sweden.

(¹²⁷) COM(2022) 3219 final COMMISSION RECOMMENDATION of 18.5.2022 on speeding up permit-granting procedures for renewable energy projects and facilitating Power Purchase Agreements; COM(2022) 222 final 2022/0160 (COD) Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources, Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency

(¹²⁸) Brussels, 21.4.2021 COM(2021) 206 final Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL LAYING DOWN HARMONISED RULES ON ARTIFICIAL INTELLIGENCE

(¹²⁹) JRC (2023): Gangale, F., Mengolini, A., Covrig, L., Chondrogiannis, S., Shortall, R.: Making energy regulation fit for purpose. State of play of regulatory experimentation in the EU - Insights from running regulatory sandboxes

renewable gases and hydrogen. Project applicants can ask for any derogation from the applicable regulations, provided that such derogations are necessary for the feasibility or significance of the experiment.

Portugal

- ERSE, the Portuguese energy regulator, in 2020 approved a regulatory experimentation for the injection of H₂ into a local gas distribution network ('Green Pipeline Project'), at a built-for-purpose mixing station. The project proposed to experiment with different equipment fit for H₂, with metering and billing adjustments to the new mixture of gases and with the control by the DSO of the mixing station. At the time of approval by ERSE, the possibility to inject H₂ in the gas network had to be granted by way of derogation, as it was still not foreseen in the legislation.

The Net Zero Industry Act will support a level playing field for innovation on net-zero technologies in the Union without undermining other regulatory and policy objectives. Moreover, by providing a legal basis for regulatory sandboxes at European level, the proposal ensures the possibility of their implementation in those Member States where there is currently no such scheme. Alternatively, their introduction at national level must start at the request of a company whose application could trigger the implementation of a regulatory sandbox if their application is accepted by the competent authorities.

The concrete modalities and conditions for the establishment and operation of net-zero regulatory sandboxes are to be defined through implementing acts to create uniform conditions for the implementation of this articles, while considering that these aspects have administrative and technical nature which might take various forms. National competent authorities that are to be assigned to supervise the net-zero regulatory sandbox will maintain their supervisory and corrective powers. They are entitled to have direct supervision of and requested to provide guidance on the net-zero regulatory sandbox scheme. Competent authorities are also requested to exercise their supervisory powers in a flexible manner promoting innovative net-zero technologies within the limits of the relevant legislation, as national experience of many regulatory bodies and other competent authorities in the use of regulatory sandboxes show that providing derogations and exemptions from the existing legislative framework is not always necessary. With appropriate guidance to applicants in many cases solutions can be found to test new technologies in the existing legislative framework.

Regulatory exemptions and derogations are important when the current legislative framework has not foreseen new technological solutions and might constitute an unintended barrier to innovative solutions to enter the market. For regulatory sandboxes there must be a regulatory learning element from the competent authorities' side.

The creation of regulatory sandboxes is subject to appropriate safeguards to ensure that any exemption from Union and national law (to the extent those exemptions or derogations are already allowed) is accompanied by appropriate mitigation measures to ensure that the regulatory objectives are fulfilled while supporting innovation. The proposal also provides a level of protection to the companies testing the innovative technologies, provided they respect the plan and terms agreed with the competent authorities, to which they must receive no fines or penalties when acting in good faith. Nonetheless third-party liability under other applicable legislation remains in place. The conditions for the sandboxes will be adopted via an implementing act at a later stage.

In line with the Council Conclusions on regulatory sandboxes⁽¹³⁰⁾ which call on the Commission to organise an exchange of information and good practices regarding regulatory sandboxes, the NZIA Regulation assigns the Net-Zero Europe Platform to be the framework also for coordination and cooperation activities between Member States and the Commission on net-zero regulatory sandboxes. This will ensure a future-proof legislation that considers the ever-evolving sector of net-zero technologies, national regulators and eventually the European Commission via the Platform,

⁽¹³⁰⁾ Council Conclusions on Regulatory Sandboxes and Experimentation Clauses as tools for an innovation-friendly, future-proof and resilient regulatory framework that masters disruptive challenges in the digital age (2020/C 447/01)

will be able to monitor the evolution of certain technologies that might eventually need to enter the scope of the NZIA (that would scale up their manufacturing capacities to meet a growing demand caused by the EU's climate ambitions), as well as inform regulatory decisions at national and European level on those technologies. The annual reporting and the continuous exchange of information and best practices ensure the monitoring and evaluation of the tool, encourages flexible use with the aim of continuous improvement.

Additional support to SMEs: A particular consideration is included for SMEs to ensure they will have priority access to the sandboxes, should they wish to enter them, as well as tailored SME support. In general, larger companies have an easier time participating in regulatory sandboxes, while SMEs often face more problems due to lack of information, confusion regarding the objectives of the sandboxes, lack of resources and others. To address this problem, the proposal asks Member States to consider these particularities when addressing SME requests. More concretely, national authorities are encouraged to raise awareness between the SME community, provide guidance and administrative support to SMEs the context of regulatory sandboxes, as well as granting them priority access.

6. EXPECTED IMPACTS

The type of impacts that are assessed in this Staff Working Document are displayed in Table 4. The assessment of the impacts or of the costs and benefits draws on a mix of qualitative and quantitative evidence, which in turn is based on various sources. However, the assessment does not make use of its own quantitative modelling or methodological approaches but takes the predominant form of a reasoned qualitative assessment, whilst presenting any quantitative evidence (where available) drawing from other analytical studies, responses to surveys, or other sources.

Impact type	Specific impact	Affected stakeholders					Assessment	
		Society, public, consumers	Workers including in supply chains	Businesses	Public administration in the EU*	Third countries	Qualitative	Quantitative
Economic impacts	Investments		✓	✓			✓	✓
	Price and non-price competitiveness	✓		✓		✓	✓	
	Industrial output, economic value, and GDP		✓	✓			✓	✓
	Security of supply (resilience)	✓		✓		✓	✓	
	International trade	✓		✓		✓	✓	
	Functioning of the single market	✓	✓	✓			✓	
	Consumer prices and choices	✓					✓	✓
	Impact on SMEs		✓	✓			✓	
	Business compliance cost reductions including			✓			✓	

	administrative costs/savings							
	Enforcement costs for public authorities				✓		✓	
Social impacts	Employment		✓	✓			✓	✓
	Skills		✓	✓			✓	✓
Environmental impacts	GHG emissions mitigation	✓				✓	✓	
	Environmental quality	✓				✓	✓	

*Table 4: Overview of impacts assessed; Notes *Although impacts on national public budgets other than those relating to enforcement costs are beyond the scope of this analysis, it is important to note that the access to market provisions of the NZIA proposal may also have relevant impacts on Member State budgets (although capped at the 10% difference pertaining to public procurement contracts including non-price criteria).*

6.1. Economic impacts, including on SME performance

Investments

The economic implications of achieving the technology-specific aspirational objectives set by the industry as per recital 17 of NZIA have been explored to a certain extent in the SWD assessing the investment needs and funding availabilities that would strengthen EU’s net-zero technology manufacturing capacity published on the 23rd of March 2023.¹³¹ It showed that, subject to several caveats,¹³² for the EU to scale up its manufacturing capacity for these five net-zero technologies, total cumulative investment needs would need to reach at least EUR 89 billion, which are around 84% higher than in the “status quo” option. When considering the EU target of 50 million tonnes of annual operational CO₂ injection capacity by 2030 (as per recital 15 of NZIA and article 16), the NZIA proposal could foster, if successfully implemented and if assumed to reach its objectives, at least EUR 92 billion of investments.

Investments in expanding the EU battery manufacturing capacity represent the lion’s share largely driven by the high expected demand for EVs, whereas investments in wind, solar PV, and heat pump industries represent each around 8% of the overall investment needs estimated, and investments in EU manufacturing of electrolysers constituting only around 1% of the investment needs required to achieve the NZIA’s aspirational objectives as stipulated in recital 17 (partly due to the lower CAPEX investment unitary costs for this technology relative to the others).

Competitiveness

The NZIA proposal will increase the competitiveness of EU’s net-zero industry, enabling it to compete both on price and on a non-price level. This may occur via three main channels: faster time to market: permitting; easier access to finance: coordination on strategic projects; and access to markets using qualitative criteria. Although the scaling up of EU industrial manufacturing, instead of relatively cheaper imports may lead to additional technology deployment costs in the short to medium term, it could be expected that such potential increased costs may be reduced over time, through increasing EU’s manufacturing capacity, economies of scale, and learning by doing effects. Nevertheless, there could be negative aspects on innovation in the medium to long run. Protecting

⁽¹³¹⁾ COM (2023) 68 final

⁽¹³²⁾ COM (2023) 68 final outlines several caveats associated with the manufacturing capacity investment estimates it provides, such as being subject to a number of uncertainties, in particular related to the deployment figures applicable to the respective five technologies (e.g. notably, the projected deployment of batteries, where the industry projects much higher figures than the models and literature on which the assessment was based), and the fact that the up- and downstream supply chains (e.g. raw and processed inputs) are beyond the scope of NZIA and were not covered in the investment needs in manufacturing capacity.

the EU industry can make the targeted industries less competitive and innovative over time as it could encourage investment decisions based on the level of government support. This can also undermine efficiency gains from global value chains. To this end, there are specific provisions for innovation in NZIA and it will be important to ensure that the implementation of NZIA to increase the share of domestic technology-supply does not hinder innovation and does not shield EU firms from global competition. Besides, the NZIA proposal is about diversifying net-zero industry manufacturing supply chains (based on both EU domestic production and extra-EU import sources), from which the EU would draw to meet its demand for these technologies.

Moreover, there are significant favourable non-price competitiveness effects that the NZIA is likely to induce. This may occur via multiple channels, such as increasing the resilience of the EU's energy system, boosting the quality and durability of net-zero technologies that are placed on the EU market (e.g. via the NZIA's provisions on access to markets complemented by EU market regulations on Ecodesign¹³³ and Energy labelling¹³⁴ that set innovation-inducing harmonised rules for energy-related products), and diminishing the risk of existing strategic import dependencies (e.g. the case of the solar PV supply chain) or of new ones forming. In other words, there are important longer-term sustainability and resilience gains that NZIA will foster, which in turn could mitigate the risk of future global supply chain disruptions and rises in import costs (as occurred in the case of the Russian invasion of Ukraine and the EU's urgent need to find alternatives to Russian gas imports)

⁽¹³³⁾ European Union (2009), Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products, OJ L 285, 31.10.2009, pp. 10–35.

⁽¹³⁴⁾ European Union (2017), Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU, OJ L198, 28.7.2017, pp. 1–23.

Industrial output and GDP

The increase in investments in EU's net-zero industry that the NZIA proposal aims to stimulate will have significant impacts on the industry's output. Should the EU attain the overall headline benchmark of (at least) 40% as put forward in NZIA article 1.2(a) and the indicative technology-specific objectives set out in recital 17 (and based primarily on pre-existing industry initiatives) would translate into substantial growth in EU's manufacturing capacity, with a large variation across technologies depending on their current situation, the envisaged 2030 manufacturing ambitions, and the projected EU demand for these technologies (based on REPowerEU for wind, solar PV, heat pumps and electrolysers and on the literature estimating 2030 demand for batteries) – see *Annex 8* for a visualisation of the respective impacts on industrial output should NZIA objectives be achieved.

It is important to note that, both the headline benchmark and the technology-specific objectives would translate in net-zero industry growth across the spectrum of technologies, even for those which already have a strong presence on the EU market (e.g. wind and heat pumps). This is mostly because of the high EU demand for these technologies that is envisaged in 2030 to achieve the Union's energy and climate targets, and the subsequent need for the respective EU industries to grow and expand their supply of technologies to keep up with the demand whilst maintaining their respective market shares.

Under NZIA's proposed headline benchmark, EU manufacturing capacity of solar PV would increase the most, by around seventeen-fold (from 1.4 GW in 2022 to 24 GW in 2030 for solar PV cells manufacturing capacity) for the tech-specific objective and 15-fold for the headline benchmark, followed by electrolysers (around four-fold in the case of the benchmark and ten-fold for the tech-specific objective) and batteries (around three-fold for the benchmark and seven-fold for the tech-specific objective). For wind and heat pumps, meeting the respective benchmark and tech-specific objective would translate into a lesser increase in manufacturing capacity compared with the other technologies, though still a considerable increase compared to today's situation (e.g. increase in wind industry output by 35% to meet the benchmark or three-fold to meet the tech-specific objective, whereas for heat pumps, manufacturing capacity would need to increase by 50% to reach the benchmark or around two-fold to reach the tech-specific objective).

Nonetheless, impacts on the EU's net-zero manufacturing capacity and output depend on the extent to which the NZIA's supportive regulatory framework succeeds in meeting its headline benchmark of EU domestic manufacturing meeting 40% of its domestic needs across the spectrum of strategic net-zero technologies. Some studies have highlighted that existing and announced projects show significant progress towards EU's industrial policy headline benchmark for some technologies, such as batteries, solar PV, electrolysers, and heat pumps (see Figure 11 for the case of solar PV and battery manufacturing).¹³⁵ Furthermore, the extent to which these EU net-zero industry growth ambitions would translate into practice will also largely depend on global circumstances and the economics and geopolitics of the EU being able to gain a competitive edge in the manufacturing of these technologies. For instance, some studies have argued that solar panels are relatively mature and commodified goods, and other regions, such as India and the U.S., are already ramping up their manufacturing capacities, which would help the EU reduce its reliance on Chinese suppliers and help diversify its supply chains.¹³⁶

⁽¹³⁵⁾ IEA (2023) "The state of clean technology manufacturing: An Energy Technology Perspectives Special Briefing", International Energy Agency, May 2023

⁽¹³⁶⁾ Jansen J, Jäger, P, Redeker, N. "For climate, profits, or resilience? Why, where and how the EU should respond to the Inflation Reduction Act", Hertie School / Jacques Delors Centre policy paper 5 May 2023

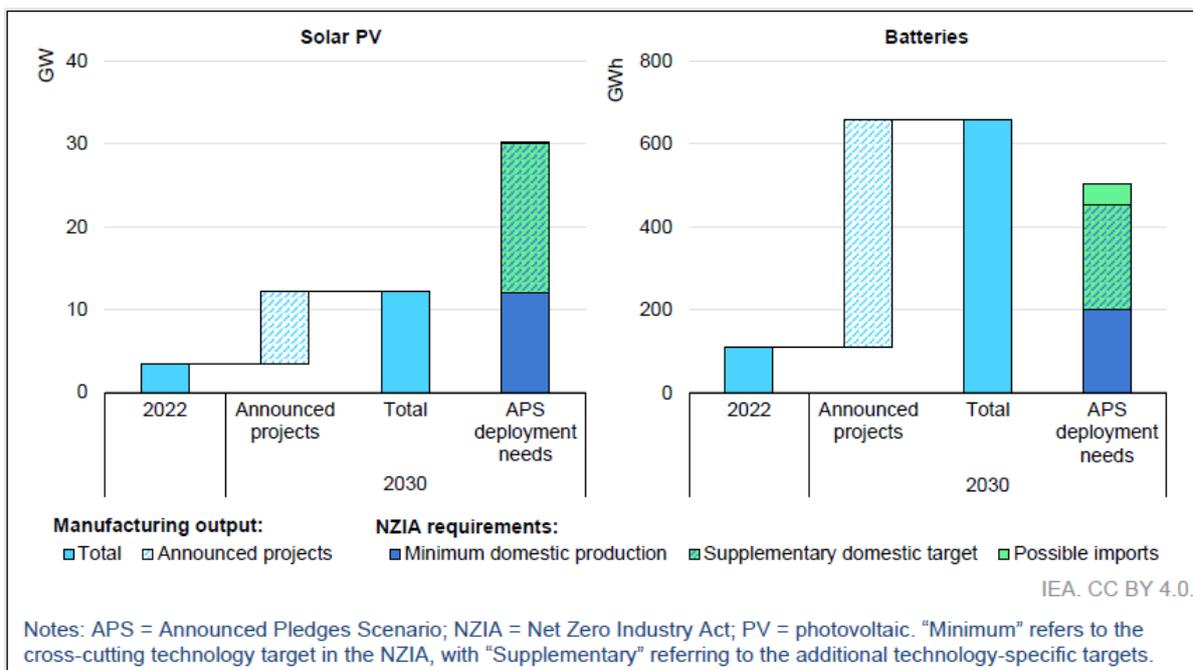


Figure 10: Announced manufacturing projects and domestic production objectives in NZIA for batteries and solar PV in the EU.¹³⁷ Notes: Source: IEA (2023) "The State of Clean Technology Manufacturing: An Energy Technology Perspectives Special Briefing"

NZIA supports crowding in of investments and willingness of entrepreneurs and banks to invest and lend, by making the EU's investment environment more predictable through regulatory measures. It will also facilitate access to public support provided by governments. The net economic effect will depend partly on the extent to which 'crowding-out' of investments occurs, i.e. the extent to which NZIA-induced investments in manufacturing would crowd out investments in other parts of the EU economy by competing for a fixed amount of savings and driving up the price of finance (real rate of interest). The aim of NZIA's proposed regulatory framework is that it results in an overall boost to GDP especially through investment, and offsets any potential adverse effects in terms of a decrease in consumption due to higher relative prices as EU manufacturing replaces to some extent cheaper imports. The NZIA's proposed regulatory framework aims to increase EU's investors' appetite to invest in net-zero technology manufacturing, and if commercial banks find such ventures credit-worthy, they may be willing to expand lending.¹³⁸ Thus, the NZIA proposal could have a net positive impact on EU's economy.

Regarding NZIA's proposed provisions aiming to establish in the EU an industrial scale capacity to store annually 50 million tonnes of CO₂ permanently, the output and economic value impacts will be based first and foremost on the long-term continuation of hard-to-abate industrial activities that rely on CO₂ capturing to reduce emission and their exposure to the carbon price. The economic impact for the oil and gas industry depends on whether companies invest in their own Net-Zero Strategic Projects for CO₂ storage or choose agreements with other oil and gas producers or third parties to fulfil their individual contribution obligation. The industry contributions are based on the pro-rata

⁽¹³⁷⁾ "Minimum domestic production target" refers to NZIA's headline benchmark, while the "supplementary domestic target" refers to the tech-specific objectives in recital 17 of the NZIA proposal. "APS" is the announced pledges scenario of the IEA that assumes that governments will meet, in full and on time, all the climate-related commitments, including longer-term net zero emissions targets and Nationally Determined Contributions (NDCs). According to the IEA "'Installed manufacturing capacity' refers to the maximum rated output of facilities for producing a given technology, as distinguished from the installed capacity of the technologies themselves once deployed. Capacity is stated on an annual basis for the final product (e.g. solar PV modules) and does not speak to the capacity for producing any intermediate products and components (e.g. polysilicon).

⁽¹³⁸⁾ On the potential for green growth and the likely net positive impacts of low-carbon investment on the macroeconomy are explained in detail from an economic theoretical and methodological perspective in S. Scricciu et al (2013) "On the economic foundations of green growth discourses: The case of climate change mitigation and macroeconomic dynamics in economic modelling", WIREs Energy Environ, 2: 251-268, and in J.F. Mercure et al (2019) "Modelling innovation and the macroeconomics of low-carbon transitions: theory, perspectives and practical use", Climate Policy 19 (8):1019-1037

share of the oil and gas production in the EU (2020-2023). These will be distributed among EU Member States where the companies that need to contribute to the CO₂ injection capacity are operating today in terms of oil and gas production (see *Figure 12*).

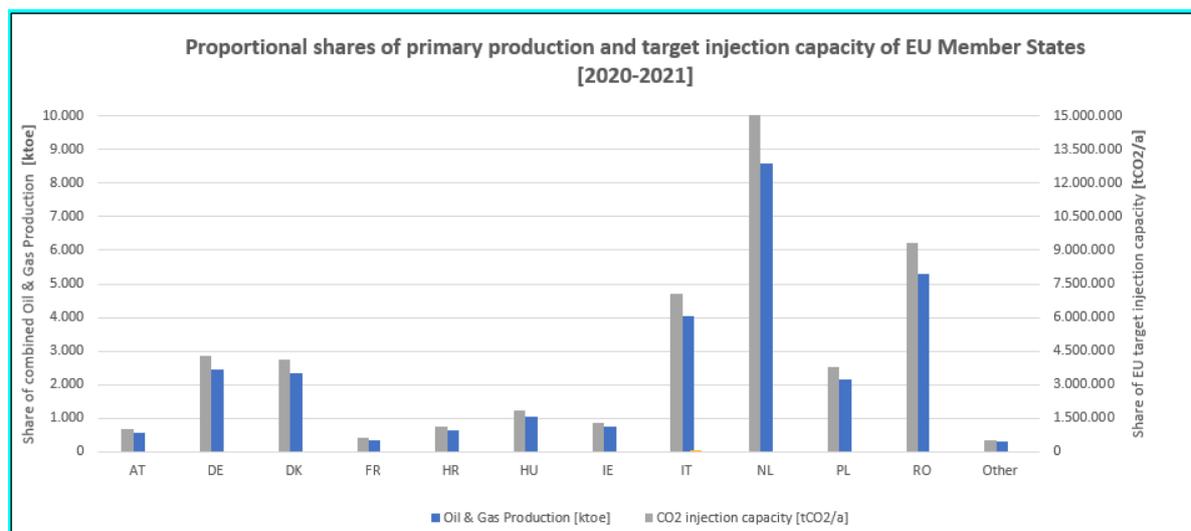


Figure 11: The distribution of the proportional shares of primary production of oil and gas production and target CO₂ injection capacity across Member States

The return on investment will depend largely on which storage sites will be chosen and how cost-effective and for how long they can be operated, for instance because of local demand for storage and/or because of the availability and suitability of storage sites. The location of the net-zero strategic projects will also determine to what extent projects will compete against each other from the start or can serve CO₂ capture clusters as part of regional CO₂ value chains. The 50 million tonnes annually stored from 2030 onwards aims to serve a larger market. Given that the demand for storage needs is projected to only increase, reaching amounts well above 50 million in the decade after 2030, the projects are expected to receive a steady stream of income, which will allow them to be profitable over the lifetime of the investment. Extrapolating from the capture potential of point source emissions in Denmark by 2030, a recent analysis¹³⁹ estimates the theoretical market potential of captured CO₂ in the EU between 360 and 790 million tonnes of CO₂ leading to a potential economic value of the future CO₂ value chain in the EU between EUR 45bn and EUR 100bn.

Security of supply and resilience

One of the objectives of the NZIA proposal is to improve the resilience of EU's net zero industry and to ensure a secure supply of net-zero technologies and the corresponding supply chains that fall under its scope. As such, through the favourable regulatory environment discussed in section 5, the NZIA proposal will increase EU's resilience due to stimulating not only EU supply of net-zero technologies, but also diversification of import sources for those net-zero technologies for which demand is set to increase in line with the EU's climate objectives and energy transition. Security of supply and resilience aspects will be ensured and enhanced, if the Regulation is implemented successfully, for the EU production of those net-zero technologies that are considered strategic, thus reducing strategic import dependencies, that is from single sources of supply.

International trade

Concerning international trade, the NZIA proposal is expected to have a mixed effect. It would positively impact EU exports of net-zero technologies, since the increased manufacturing of these in the EU would lead to improved extra-EU export prospects, especially for those technologies for which the EU already has a strong international market presence, notably thanks to economies of

⁽¹³⁹⁾ The potential of a European CCS market viewed from a Danish perspective, Kraka Advisory, March 2023, https://kraka-advisory.com/sites/default/files/2023-03/Notat_CCS_2023_final_EN.pdf.

scale (e.g. wind technologies). A model of international expansion building on significant domestic capacity build up has been successfully implemented notably by China. Although it may lead to reduced imports in some sectors, especially in those cases where strategic dependencies on imports from overly concentrated single suppliers need to be reduced, these are likely to be short-lived and temporary, particularly given that the manufacturing of net-zero technologies and their supply chains are fast-growing markets, with high potential for growth and high potential for many players to gain a share of this market. Moreover, the aim of the NZIA is to diversify the supply chains in relation to the manufacturing and trade of net-zero technologies, notably through net-zero industrial partnerships, which translates in both better prospects for production growth within the EU, but also an increase in the range of import sources from which the EU may acquire the net-zero technologies needed to satisfy its demand.

Functioning of the Single Market

The impacts on the functioning of the single market are expected to be positive. This is because the NZIA proposal takes the form of a Regulation with the aim of providing a sufficient harmonisation of the legal framework that would help Member States foster the Single Market for net-zero technologies. This would translate into reducing EU's market fragmentation, for example, with respect to the proposed articles on streamlining administrative and permit-granting processes for EU's manufacturers of net-zero technologies. The NZIA proposal will help develop and strengthen clean energy technology supply chains within the Single Market, with an important role for the Net-Zero Europe Platform to assist and facilitate exchange of information between public authorities and private stakeholders..

Consumer prices and choices

In the short run, the NZIA proposal, through fostering the scaling up of EU's net-zero manufacturing capacity, may replace, to some extent, relatively cheaper imports, which could result in additional technology deployment costs, with negative repercussions for consumer choices and prices. However, such effects are unlikely to be significant and are limited in time, for at least two main reasons, besides the safeguards mentioned in section 5.2.2.5. First, several net-zero technologies deployed but also manufactured in the EU have been benefiting over the past from falling costs and measures to incentivise demand, as they develop at scale, and this trend is expected to continue over the longer term.¹⁴⁰ There is strong market growth potential for the EU's net-zero industry, with good prospects, especially if encouraged under a supportive EU regulatory environment, to increase its scale, excellence, and price competitiveness, and overall solidify its business case. In addition, consumer choices are not only influenced by prices but also by non-price, qualitative criteria (such as environmental ones), although to a lesser extent. The EU buyer is environmentally conscious and also increasingly aware of the resilience and security of supply aspects, the importance of which has been brought in the spotlight by the COVID-19 crisis and more recently by the Russian invasion of Ukraine. For instance, studies have shown that EU customers display a willingness to pay a 10 to 20% price premium for European-made products with full value-chain traceability, good warranties and excellent product quality, a lower carbon footprint, and ability to deliver security.¹⁴¹ Nevertheless, this additional premium will be welfare reducing and has a distributional impact. In this context, policy measures and incentives should support the most vulnerable groups to guarantee access to such technologies.

Impact on SMEs

The proposed Regulation introduces targeted support for SMEs in the context of the net-zero regulatory sandboxes. Member States, when designing the modalities and the conditions for the establishment and operation of the net-zero regulatory sandboxes, must consider the special circumstances and capacities of participating SMEs, including start-ups. Member States must undertake the following actions: (a) provide small and medium enterprises with priority access to

⁽¹⁴⁰⁾ Wood Mackenzie "Renewable energy costs continue to fall across Europe", 08 March 2023

⁽¹⁴¹⁾ McKinsey & Company "Building a competitive solar-PV supply chain in Europe", December 2022

the Innovative net-zero regulatory sandboxes to the extent that they fulfil the relevant eligibility conditions; (b) organise awareness raising activities about participation to the regulatory sandboxes by small and medium enterprises; (c) establish a dedicated channel for communication with small and medium enterprises to provide guidance and respond to queries about the implementation of regulatory sandboxes.

As already mentioned, SMEs often face more problems to participate in regulatory sandboxes due to lack of information, confusion regarding the objectives of the sandboxes, lack of resources and others. The proposed Regulation can significantly benefit SMEs by reducing barriers to access the said regulatory sandboxes and enabling them to innovate in a more flexible environment. This can lead to increased competitiveness and market growth for SMEs.

The proposed Regulation can benefit SMEs in their access to finance. It can also benefit them in relation to the automaticity they gain with respect to getting shorter permitting deadlines for net zero projects, since no administrative steps need to be taken. SMEs can benefit from the support of the Net-Zero Europe Platform, thus be advised on the financing of their net-zero strategic projects. This support is particularly important for SMEs, in particular those involved in innovative activities, who are more likely to experience greater obstacles to access to finance.¹⁴² It is essential to note that the periodic evaluation of the Regulation's impact on SMEs will assess whether the Regulation's objectives have been achieved and its impact on business users, especially SMEs, and end-users. This will provide feedback on the effectiveness of the Regulation and enable policymakers to fine-tune it to address any unintended consequences.

The Skills Academies are projected to also engage strongly with SMEs. In solar for example, SMEs are a vital part of the PV value chain. A healthy and competitive solar PV value chain in Europe will require numerous SMEs to scale up their manufacturing capacities and to engage with large industry leaders. Skills, especially in sustainable and circular design and next generation solar PV technologies are a critical factor of success. Lack of qualified workforce has been identified as a major barrier to scale up of this sector in Europe, and boosting skills is one of the priority areas of the SME pillar. The role of SMEs increases when going down the value chain (manufacturing of basic precious and non-ferrous metals) where out of 3088 companies 2895 are SMEs. The role of SMEs in recycling is even more dominant (Materials recovery), where out of 20 345 companies only 59 are large.¹⁴³

SMEs will have an opportunity to directly train their staff on critical skills and competencies. This will include interdisciplinarity and skills needs for manufacturing competitive products in their respective supply chains. In addition, SMEs will be able to engage with larger industry leaders in Europe to better adapt their outputs to the overall value chain. This will result in more resilient, competitive, and agile SMEs.

For SMEs, applying for strategic project status can impose certain costs, in particular in terms of the administrative burden with respect to the preparation of the application in compliance with the NZIA requirements, follow its processing by the relevant Member State authorities, etc. To alleviate this burden, Member States may provide administrative support to net-zero strategic projects to facilitate their rapid and effective implementation. In addition, Member States authorities must ensure that net-zero strategic projects are treated in the most rapid way possible in accordance with Union and national law.

6.2. Social impacts

Employment

The NZIA proposal, if adopted and successfully implemented, will have important positive consequences for expanding the number of skilled people employed in quality jobs in EU's net-zero industry. For instance, it is estimated that reaching the five technology-specific objectives outlined

⁽¹⁴²⁾ <https://www.scirp.org/journal/paperinformation.aspx?paperid=122912>

⁽¹⁴³⁾ Based on the Eurostat NACE Rev. 2 Statistical classification of economic activities from 2021

in section 5.2.2.1 (and *Figures 10*) will create 350,000 additional jobs and would require around 3 billion euros of investment needs for retraining, reskilling, and upskilling until 2030.¹⁴⁴ The magnitude of such a growth in the net-zero skilled workforce will depend not only on a more favourable regulatory environment as aimed under the NZIA proposal, but also on several other factors, such as the labour intensity of the respective industries, the level and timing of investments, the pace of manufacturing scale-up, demand support etc. Specific attention will have to be paid when designing and implementing labour and skills related measures, in order to ensure the fairness to the society at large, and targeting workers and citizens particularly impacted by the expected decline in carbon-intensive industry sectors.

Most of the jobs are likely to be created in battery cell production as this is the technology with one of the largest capacity increases (in absolute terms) relative to the manufacturing of other key net-zero technologies (see *Figures and*). In general, positive employment effects are expected especially for those net-zero sectors that are relatively new, emerging industries, and which have a large potential for future growth, such as the manufacturing of electrolyzers and batteries, and the CO₂ capture, transport, and storage industry. The net employment impact on the EU economy overall is likely to be positive as the EU's economy is stimulated through the NZIA proposal that puts forward a favourable regulatory environment for a fast-moving industry with high growth potential.

The economy wide employment impact of establishing in the EU an industrial scale capacity to store CO₂ permanently will be dependent on the take-up of CO₂ capturing in industries and the extent to which other alternatives exist to reduce emissions. If both do not materialise, this would in the worst-case result in the eventual seizure of that economic activity in the EU with significant negative impacts on employment. Instead if CCS deployment is successful, assuming no other abatement options materialise, it will thus have a neutral employment effect in the industries capture emissions, as well as all their suppliers and customers. Given that with CO₂ capture, transport, and storage an entirely new industry will emerge, there is also a potential for new jobs to be created. The analysis referred to above¹⁴⁵ extrapolating the CO₂ capture potential in Denmark to EU estimates between 360 and 790 million tonnes of CO₂, estimates that this new CO₂ sector can contribute to creating up to 170.000 jobs in the EU. There is also significant re-skilling potentially in the oil and gas industry allowing staff to continue their specialist careers in a net-zero industry, since for example roughly 70% of jobs (in FTE) in the oil and gas sector display overlap with the offshore renewable segment.¹⁴⁶

Skills

NZIA's provision on skills are particularly important for fostering the education and training needed to address the skills shortages being reported in the EU with respect to meeting the challenges of the transition to a carbon neutral economy.¹⁴⁷ The establishment of the European Net Zero Industry Academies is supported in the NZIA proposal (under article 23.1), which takes inspiration from the existing model of the European Battery Alliance and the related Battery Academy¹⁴⁸, launched in February 2022), and which focuses on reskilling and upskilling workers to meet the skills needs in the European battery value chain. The aspects of the model that will be implemented in all the three proposed academies are the development of learning content together with Industry and E&T providers in Member States; the offer of this content to E&T providers in Member States on a voluntary basis and the development of learning credentials to ensure mobility of learners. The other aspects of the set-up will vary depending on the specific needs of each net-zero technology sector and will be on a case-by-case basis.

⁽¹⁴⁴⁾ As per *Commission SWD in investment needs assessment and funding availabilities to strengthen EU's net-zero technology manufacturing capacity*, COM (2023) 68 final

⁽¹⁴⁵⁾ The potential of a European CCS market viewed from a Danish perspective, Kraka Advisory, March 2023.

⁽¹⁴⁶⁾ Telsnig, T., Georgakaki, A., Letout, S., Kuokkanen, A., Mountraki, A., Ince, E., Shtjefni, D., Joanny Ordonez, G., Eulaerts, O. and Grabowska, M., *Clean Energy Technology Observatory: Wind Energy in the European Union – 2022 Status Report* Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-56584-0, doi:10.2760/855840, JRC130582.

⁽¹⁴⁷⁾ See for instance Czako, V., *Skills for the clean energy transition*, European Commission, Petten, 2022, JRC129676

⁽¹⁴⁸⁾ The EBA Academy was recently rebranded as "InnoEnergy Skills Institute"

With regards to permitting, sufficient staffing and skills are considered as a key requirement to make permitting work. Equally, the re- and upskilling of relevant national, regional and local authorities involved in the permit-granting procedures is an important element in ensuring effective implementation of NZIA. For this reason, NZIA includes a provision in Article 4(7) requiring Member States to “ensure that the national competent authority responsible for the entire permit-granting processes, including all procedural steps, has a sufficient number of qualified staff and sufficient financial, technical and technological resources necessary, including for up- and re-skilling, for the effective performance of its tasks under this Regulation.” To this effect, the Commission will assist Member States via the Technical Support Instrument (TSI) by providing support to implement NZIA provisions, such as those related to permitting and net-zero strategic projects.

Regional dimension

The provisions of the Net Zero Industry Act provide an efficient framework to Member States to use the EU’s cohesion policy programmes to encourage the take up of net-zero strategic projects in less developed and transition regions. The resources mobilised via the EU’s cohesion policy programmes would support the deployment of investment projects contributing to the transition towards a net-zero economy, while avoiding a possible asymmetric impact on regions and Member States with the risk of widening territorial disparities otherwise likely to occur.

Furthermore, the Net Zero Industry Act (via Article 10(3)) introduces the possibility for projects located in less developed and transition regions as well as in areas covered by the Just Transition Fund to be automatically considered by Member States as strategic upon the request of the project promoters (without these having to submit formal applications), opening the possibility for faster administrative procedures in licensing and permitting.

Projects in the scope of NZIA which were already selected under past calls under the Innovation Fund also demonstrate the potential positive regional impacts of such projects. For example, through the TANGO project, an industrial scale PV factory in Italy is expected to have a positive impact on the local economy, especially during the factory construction phase. It will contribute to the creation of both direct jobs (estimated to grow to around 1 000 jobs, including current ones, in 2024), and indirect jobs. The ReLieVe project, a project of close-loop recycling for Li-Ion batteries is part of a wider development plan to create a European “battery hub” around the French port of Dunkirk.

Skills Academies also allow lower income regions to access quality educational content. Due to their design and distribution model, the Academies can provide their content to the same standards throughout Europe, reaching areas seeking to reskill/upskill their workforce. For instance, the InnoEnergy Skills Institute (former European Battery Alliance Academy) is partnering up with the University of Petroșani (Romania), an area where the traditional industry was coal mining.

6.3. Environmental impacts

GHG emissions

Although the onshoring of net-zero industries and the partial substitution of extra-EU imports of net-zero technologies with those manufactured in the EU may lead to a temporal increase in GHG emissions in the EU, this is likely to be negligible for at least three different reasons. First, the EU has well defined and ambitious decarbonisation objectives and targets covering all sectors of the economy, including industry and manufacturing (meaning that the GHG reductions are “fixed” within the EU, independently of the place where technologies are produced). Second, the NZIA proposal will stimulate the manufacturing of carbon capture, utilisation, and storage (CCUS) technologies. In particular the CO₂ injection capacity of at least 50 million tonnes that is to be achieved by 2030 in storage sites located in the EU¹⁴⁹ will to some extent offset any additional GHG emissions attributed to the growth in the EU’s net-zero industry stimulated by the NZIA proposal. The CO₂ emissions removal impact of establishing in the EU an industrial scale capacity to store CO₂ permanently will

⁽¹⁴⁹⁾ Including its exclusive economic zones or on its continental shelf within the meaning of the United Nations Convention on the Law of the Sea (UNCLOS) and which are not combined with Enhanced Hydrocarbon Recovery (EHR) (as per article 16 of the NIZA proposal).

be based on the faster reductions of emissions from industries that can capture CO₂ and can continue to operate in Europe (relative to the case of not capturing these and emitting GHGs until ETS allowances run out). Third, the contribution of the net-zero manufacturing industry in total EU GHG emissions is marginal, given that the overall share of GHG emissions attributed to the overall manufacturing industries (including construction) sector is around 16%.¹⁵⁰

Importantly, the NZIA proposal is likely to have an indirect positive impact or knock-on effects on GHG emission mitigation in the rest of the world, particular in those parts of the world that have in general weaker environmental standards and a higher carbon footprint associated with the manufacturing of these technologies. Furthermore, importing these technologies from outside the EU involves trade or transport-related GHG emissions which adds to the carbon footprint of net-zero technologies produced outside the EU but destined for use in the EU. This potential positive impact can be illustrated by already selected projects under past calls for the Innovation Fund. For example, the NorthStor + project, a lithium battery manufacturing project between Sweden and Poland is estimated to allow for carbon emission reduction of 34.6 Mt of CO₂ equivalent during the first ten years of operation, comparable to the annual emissions related to the energy needs of nearly 2 million European households (according to the GHG calculation made under the Innovation Fund).

The sustainability considerations introduced under the “Access to markets” chapter of the NZIA proposal will also have significant positive effects on emissions. In particular, the requirement to base the award of public procurement procedures, auctions for renewable energy and other support schemes also on environmental sustainability will improve the environmental performance of the products concerned. An example could be, for instance, rewarding products with lower carbon footprint in competitive procedures falling under the scope of this chapter or rewarding products and projects that mitigate or restore the impact on biodiversity, such in the case of the recent auctions for offshore wind in the Netherlands in which the bidders had to demonstrate that they could mitigate or restore the impact of an offshore wind farm on the maritime biodiversity.¹⁵¹ The “Access to markets” chapter of NZIA, in particular Article 20 on auctions for the support of renewable energy, is not expected to lead to a decrease or a slow-down of renewable energy deployment. The provision contains a safeguard clause to address the potential risk that the sustainability and resilience criteria introduced in auctions lead to excessive additional costs for public authorities, thus causing a decrease in deployment. In addition, by supporting a strong and reliable EU manufacturing base, NZIA prevents the potential risks to deployment stemming from overdependence on foreign suppliers and possible disruption to international supply chains that could have a detrimental effect on deployment.

Regarding permitting, the NZIA provisions focus on improving procedures, and are without prejudice to the substantial conditions set out in relevant national and EU legislation. In addition, some measures are expected to have a positive impact on the environment:

- The mandatory scoping procedure will help clarify the environmental issues to be covered in the assessment report, e.g. the most important impacts, preferred methodologies, and relevant information sources, thereby likely increasing the quality of the resulting report and help provide robust evidence for the final decision in Member States where it is not yet mandatory.
- The creation of a one-stop shop and streamlining of different assessments is likely to have a positive impact on the environment, as it enables a more comprehensive information base for decision-making.

Environmental quality

⁽¹⁵⁰⁾ Based on European Union (2022) “EU Energy in Figures”, Statistical Pocketbook 2022 (million tonnes of CO₂ equivalent)

⁽¹⁵¹⁾ <https://windeurope.org/newsroom/news/the-netherlands-run-another-successful-auction-based-on-non-price-criteria/>

Despite their crucial contribution to achieving EU's climate and energy targets and commitments, low-carbon energy technologies are not environmental or climate impact-free, although the use of net-zero technologies relative to their high-carbon counterparts will have overall a clear positive impact on environmental quality.¹⁵² According to the literature assessing the environmental impacts of energy technologies from a life-cycle analysis (LCA) perspective, the manufacturing of net-zero technologies may affect the natural environment via air pollution, terrestrial and water pollution, resource consumption, and land use. However, there are large variations in the LCA estimates put forward in the literature, due to various factors, such as: methodological assumptions, technological specifications, and local conditions (e.g. climatic conditions, local resource attributes or infrastructural characteristics).¹⁵³ Nonetheless, any potential adverse environmental impacts due to the NZIA-induced growth in the net-zero industry could be more easily mitigated in the EU owing to its stricter environmental regulations,¹⁵⁴ with possible indirect net positive environmental impacts globally. As such, replacing extra-EU imports with domestically produced technologies might indirectly result in net positive environmental impacts from a global perspective.

Concerning faster and streamlined permitting procedures, these are without prejudice to environmental assessments and authorisations as laid down in EU law. In order to improve the quality of an environmental impact assessment, to simplify the procedures and to streamline the decision-making process, it is proposed that the opinion on the scope and level of detail of the environmental information to be submitted in the form of an environmental impact assessment report is mandatory. The existing EU framework provides for a voluntary scoping on request of the project promoter, but experience shows that its systematic application improves the quality of and speeds up the overall permit granting process. Further on, the proposed bundling of the environmental assessments, based on already existing requirements under the EIA Directive (Art. 2(3)), is expected to improve the effectiveness of the assessments, reduce administrative complexity and increase economic efficiency. The proposed time frames for reaching reasoned conclusion on the environmental effects of the projects as well as for consulting the public concerned based on already introduced time frames in the Member States are expected to have positive impact also in view of contributing to further streamlining of the decision-making process.

Well-designed plans, including spatial plans and zoning, that take into account the potential for implementing net-zero technologies manufacturing projects and whose potential environmental impacts are assessed, have the potential to help balance public goods and interests, decreasing the potential for conflict and accelerating the sustainable deployment of net-zero technologies manufacturing projects in the Union. Responsible national, regional and local authorities should therefore consider the inclusion of provisions for net-zero technologies manufacturing projects when developing relevant plans which shall also undergo assessments as required under the existing EU legal framework, thus contributing to the promotion of sustainable development by identifying environmental consequences early in the decision-making process.

Overall, to have positive environmental impacts, it is crucial that EU's net-zero manufacturing industry is based on the circular economy. Circularity, reusability, repairability, recyclability and use of recovered and recycled materials need to have key role in the design and manufacturing of the EU's net-zero industry in line with the European Green Deal, the Circular Economy Action Plan, and

⁽¹⁵²⁾ However, for some of these technologies (e.g. electrolysers, batteries giga-factories), environmental impacts are not fully known yet and further environmental norms / regulations may need to be developed. For example, electrolyser manufacturing could have important impacts on water consumption and could potentially emit persistent organic pollutants and hazardous substances such as PFAS. Furthermore, if part of the upstream life cycle stages of these technologies is coming from third countries, there is no possibility to ensure that the overall environmental footprint will be lower. To however will be partly addressed through the Directive on Corporate Sustainability Due Diligence.

⁽¹⁵³⁾ See for instance JRC(2021) *Technical assessment of nuclear energy with respect to the 'do no significant harm' criteria of Regulation (EU) 2020/852 ('Taxonomy Regulation')*.

⁽¹⁵⁴⁾ NZIA may also help avoid encouraging unsustainable social practices by reducing harmful dependencies and imports from countries with questionable social standards. For example, a study of the University of Sheffield denounced serious human rights violations against the Uyghur population for the production of polysilicon, needed for solar panels, in province of Xianjiang (which produces about 45% of the world's supply of this raw material) - Murphy, L. and Elimä, N. (2021). "In Broad Daylight: Uyghur Forced Labour and Global Solar Supply Chains." Sheffield, UK: Sheffield Hallam University Helena Kennedy Centre for International Justice.

the Long-term Competitiveness Strategy of the EU. For example, the huge material input of wind turbines and critical materials of solar panels should be easily recoverable and recyclable at the end of their life cycle. This requires circular economy approach and thinking already in the design and manufacturing phase.

In relation to NZIA’s provisions on CO₂ injection capacity, environmental protection is guaranteed as only sites with valid storage permit for the safe and permanent geological storage of CO₂ in accordance with Directive 2009/31/EC can be used. The required CO₂ transport infrastructures will have a long-term role not only for reducing emissions, but also for carbon removals and achieving negative emissions. The latter could thus also compensate for the construction- and operation-related emissions of CO₂ transport infrastructures.

The impacts of the NZIA proposal discussed above are summarised below in *Table 5*.

Impact type	Specific impact	Type of impact
Economic impacts	Price and non-price competitiveness	++ (EU’s net-zero industry)
	Functioning of the single market	+ (EU economy)
	Investments	++ (EU’s net-zero industry)
		+ / - (Other parts of the EU economy)
	Industrial output, economic value, and GDP	++ (EU’s net-zero industry)
		+ (Other parts of the EU economy)
	Consumer prices and choices	- (short-run) + (longer-run)
	Security of supply (resilience)	++ (EU’s net-zero industry)
	International trade	+ / - (World economy)
Impact on SMEs	+ (EU’s net-zero industry)	
Social impacts	Employment	++ (EU’s net-zero industry & its workforce)
		+ (EU’s economy and labour)
	Skills	++ (EU’s net-zero industry & its workforce)
Environmental impacts	GHG emissions mitigation	0 / + (EU / rest of the world)
	Environmental quality	- / + (EU / rest of the world)

Table 5 Summary of impacts discussed in terms of their likely nature, strongly positive (++) , moderately positive (+) or moderately negative (-), and zero (net) effect (0)

7. BENEFITS AND COSTS

This section provides a summary of the impacts by main dimension of the NZIA proposal presented in section 5. The focus is placed on the likely impacts on the administrative burden in terms of benefits (cost savings) and cost increases, covering businesses and public authorities.

7.1. Benefits

An overview of the direct and indirect benefits associated with each main dimension of the NZIA proposal are described in more detail and mostly in qualitative terms in *Table 6*.

Table 6: Overview of Benefits per type of NZIA provisions		
NIZA dimension	Description	Comments
Direct benefits		
1) Headline benchmark	Incentive significant investments	Provides a strong long-term positive signal that EU industrial policy supports investments in EU net-zero technology manufacturing. Businesses in the EU are the main stakeholder group benefiting.
2) Permitting	Provisions on permit granting make processes more efficient and therefore contribute to faster time to market and lower administrative and transaction costs associated with net zero technology industrial project development, positively impacting project promoters at large and especially SMEs active in the industry. Member States and regions also benefit from being able to more easily attract projects which due to previously complex and uncertain permitting procedures may have been deterred otherwise.	Shorter and more efficient permit-granting processes for net-zero technology manufacturing projects will have a direct impact in increasing the competitiveness of the EU in the green transition and play an important role in increasing the production capacity – and deployment – of net zero technologies, hence contributing directly to the goals set in the European Green Deal and the REPowerEU plan.
3) Net-zero strategic projects & access to finance	Fostering the deployment of net-zero strategic projects that are instrumental to strengthen the competitiveness and resilience of the supply chains.	This can also create positive spill over effects for the businesses linked to the respective strategic projects as well on the overall economy.
4) CO₂ injection capacity target	Providing transparency about the accessibility prospective CO ₂ storage site, via public recognition as strategic net-zero project, allows ETS installations to invest in capturing emissions and to reduce exposure to the ETS price.	It also allows for targeted investments into CO ₂ transport infrastructure. The emission reduction equals the used injection capacity.

<p>5) Access to markets</p>	<p>Not quantifiable but the relevant provisions should help the EU reach its climate goals by increasing the share of sustainable and innovative products. They should also contribute to open strategic autonomy by reducing harmful dependencies from overly concentrated single sources of supply into the EU and promoting diversification. This would not only bring wide societal benefits but would also support companies which may be able to provide more innovative and environmentally sustainable products but would not be able to compete based solely on price.</p>	<p>Public procurement procedures and auctions for renewable energy based only on price, while conducive to price reductions, do not consider the wider impact of the deployment of net-zero technologies and other societal benefits that can be achieved by adding non-price considerations. It is in the EU interest to push for the inclusion of such qualitative elements, both to ensure a more sustainable and resilient supply chain.</p>
<p>6) Skills</p>	<p>The proposed academies would aim to enable the training and education of 100.000 learners each, within three years of their establishment, to contribute to the availability of skills required for the net-zero technologies</p>	<p>The number of learners is based on the experience of the battery academy and its targets and on the actual skills needs in the sector (180.000 for hydrogen, 66.000 for solar only in manufacturing). The EBA foresees to train 50.000 learners by M24 and 100.000 by M36.</p>
<p>7) Innovation</p>	<p>Direct benefit is the possibility to test new products and solutions in the market and improve regulatory learning on those technologies, that would face otherwise regulatory difficulties. The longer-term benefit of raising awareness about the identified barriers and the evidence provided by the testing in the net-zero regulatory sandbox scheme is enhancing regulatory learning and adapting the regulatory framework accordingly. Consequently, large-scale deployment of that net-zero innovative technology solution will be possible.</p>	<p>This can be a benefit to any company, but is particularly relevant for new entrants, SMEs, start-ups. To set up a successful net-zero regulatory sandbox scheme, it is important to have consultations with stakeholders to identify the main regulatory barriers they are facing. For example, the problem definition about which sectoral legislation should be in the scope (e.g. energy, spatial planning, building codes, environmental, etc.) will have consequences in the definition of competent authorities. The assignment of competent authorities on the other hand will have consequences on what administrative flexibility or derogations from existing rules are possible under current law.</p>
<p><i>Indirect benefits</i></p>		
<p>1) Headline benchmark</p>	<p>Increase in the employment and competitiveness of EU's net-zero industry, with possible spill-over effects on the rest of EU's economy, as well as on the potential for extra-EU import diversification and the stimulation of the net-zero growth industry in third countries.</p>	<p>The net-zero industry displays strong growth and innovation potential and increased investment in the EU has the capacity to stimulate the workforce and stimulate productivity and growth throughout the Single market. EU's net-zero industry is well embedded in global supply chains and growth in EU's industry may have</p>

		positive implications for some third countries, including via technological transfer and learning by imitation effects. Businesses and public authorities in the EU, but also some businesses and public authorities outside the EU would benefit, inter alia from the diversification measures.
2) Permitting	An indirect benefit from the NZIA permitting provisions is that it will lead to a clearer understanding of what net zero tech permit-granting processes entail. Currently Member States do not have a full overview of which authorities or permits are involved. Some Member States are currently carrying out assessments in this regard, which together with NZIA will lead to a better organisation (and re-organisation) of the understanding and of the allocation of resources necessary to effectively carry out permitting procedures (and to be in line with the provisions put forward in the future Regulation).	As mentioned in this document, the increase in ambitions for speeding up and making permitting more efficient may mean that Member States will be required to allocate sufficient, and possibly additional, resources, as well as adequately qualified staff. This poses a challenge to many Member States and hence the EU will support in these efforts via the Technical Support Instrument, and in particular with the two flagships on the Green Deal Industrial Plan and Skills for 2024.
3) Net-zero strategic projects & access to finance	Not quantifiable, but benefits generated by improved access to finance for net-zero manufacturing project promoters	The overall benefits will however be directly dependent on the size of the funds that can be made available.
4) CO₂ injection capacity target	Ensuring the availability of sufficient CO ₂ storage capacity will unlock CO ₂ capture projects across the EU as a cost-effective abatement option for hard-to-abate sectors and will reduce compliance costs for those companies in the ETS. Capturing and storing CO ₂ allows hard-to-abate industries also to market carbon free products.	The benefit of a functioning CO ₂ value chain depends on the share of the relevant industrial activities in the Member State economy.
5) Access to markets	Discussion and advise on investment would enable the uptakes by further private investment sources as well.	
6) Skills	Both skill and labour needs can act as a bottleneck, particularly in sectors characterised by high specialisation. The proposed provisions aim at contributing to the availability of skills required for the net-zero technologies. Development of learning credentials by the academies (and the facilitation of their recognition for what concerns access to regulated professions) would have a positive impact on the mobility of workers in the addressed technology sectors.	
7) Innovation	The setup of an experimentation scheme usually contributes to a much closer cooperation of market actors with regulators and agencies which provides better understanding of the regulatory framework by the market actors on one hand, and better	As with the direct benefits, the indirect ones might impact any company, but of course the gains can be much higher to new entrants, SMEs, and start-ups in particular.

	understanding of competent authorities about the regulatory barriers perceived by companies and possible regulatory adaptation needed.	It can be good practice also to include in the scheme consultation channels, advisory services. Many innovative solutions that perceive a regulatory barrier might prove to be compatible with existing regulation, as regulatory experimentation shows in the energy sector. ¹⁵⁵ Moreover, the involvement of the consumer is key to success for any program where the use of the new technology or solution and the regulation impacts the consumer. ¹⁵⁶
Compliance cost savings for business		
	Adjustment cost savings	Administrative cost savings
1) Headline benchmark	Not identified	Not identified
2) Permitting	Shortening and making permit-granting procedures more efficient would reduce adjustment costs due to lower overheads and other types of costs caused by needing to comply with permitting procedures, which is particularly costly when the procedures become unpredictable in duration and in additional steps that may need to be taken due to the absence of a harmonised regulatory framework on permitting. A gigafactory project developer from the solar PV industry, reported that the costs of 1'000'000 EUR spent on the permitting procedure could be reduced considerably.	<p>Streamlining permitting for NZIA Projects will substantially reduce the administrative burden on companies benefiting from those measures.</p> <p>The NZIA permitting provisions around the one-stop shop, digital by default, the fixed durations, streamlined environmental assessments and planning provisions have a direct impact on administrative cost reduction.</p> <ul style="list-style-type: none"> - One-stop shops allow project developers to have a single point of contact which coordinates the entire permit-granting procedures and avoids lengthy and costly exchanges with many other authorities involved in the process. The one-stop shop in NZIA also provides a detailed schedule to the project, creating clarity from the start and reducing costs that would otherwise be spent by the project in planning the entire permitting procedure. - Permitting in NZIA is made digital by default. This means that national authorities have to accept documents digitally, and need to provide NZIA projects with business support services and other relevant information on-lien and in a centralised

⁽¹⁵⁵⁾ JRC (2023): Gangale, F., Mengolini, A., Covrig, L., Chondrogiannis, S., Shortall, R.: Making energy regulation fit for purpose. State of play of regulatory experimentation in the EU - Insights from running regulatory sandboxes

⁽¹⁵⁶⁾ ETIP SNET Regulatory Sandboxes Questionnaire - Answers Compilation WGS Regulatory Sandboxes Task Force, 5 May 2023

		<p>manner. Direct and fast digital interaction as well as access to information can play an important factor in cost reduction for project promoters.</p> <ul style="list-style-type: none"> - NZIA includes fixed permitting durations, both for the overall permit-granting process, but also for certain individual steps such as requiring that the one-stop shop validates the project application within one month of receiving it. Fixed permitting time-limits increase planning certainty and create clear timelines for project's to navigate more efficiently through the process. This reduces possible costs endured due to prolonged processes, which can have a major impact on projects. - The NZIA provisions to streamline environmental assessments can lead to major cost savings on behalf of the project promoter, in particular via the requirement on national competent authorities to provide a scoping study that clarifies ex-ante all that is required for an EIA report (and thus avoids lengthy back and forth, or misunderstandings), as well as the provisions that make mandatory the bundling of environmental assessments and thus create a more predictable and efficient, less costly process. - The provisions on planning and structural integration of NZIA projects into spatial plans combined with the application of the SEA Directive to those plans is expected to decrease the costs of individual permitting procedures for companies. The SEA Directive provides for an overall and cumulative assessment of the environmental impacts of planned activities. As such, it would provide a framework for the easier identification of areas suitable for NZIA projects at an early planning stage. It would also provide an information basis for
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		<p>subsequent more specific environmental assessment performed by project developers.</p> <p>The extent of the cost decrease (including administrative costs) of the measures described above is difficult to quantify, as it is highly case-specific and differ from Member State to Member State.</p> <p>Overall, the direct impact on cost savings can be significant. As an example, the case study on p.38 (Oxford PV) shows that projects can endure many additional costs due to currently unpredictable permitting processes, which in this particular case required the project (as well as the local authorities) to hire costly third-party consultants to guide through the process.</p>
3) Net-zero strategic projects & access to finance	<p>Net zero strategic projects receive priority status and benefit from a further shortening of the duration of the permit granting process. This results in other adjustment cost savings in addition to those already mentioned above under “permitting”, further reducing business compliance costs. Furthermore, being a strategic project provides a positive signal in terms of access to finance, possibly resulting in banks or financial institutions being more willing to lend on more attractive terms, reducing financing costs.</p>	<p>Related information and reporting obligations for businesses may be reduced via the administrative support that could be provided by Member States to net-zero strategic projects to facilitate their rapid and effective implementation, including by providing:</p> <p>(a) assistance to ensure compliance with applicable administrative and reporting obligations.</p> <p>(b) assistance to project promoters to further increase the public acceptance of the project.</p>
4) CO₂ injection capacity target	<p>Ensuring sufficient CO₂ storage capacity will accelerate the emergence of a liquid European CO₂ market, enhance the cost-efficiency of climate policy overall, and in the longer term will facilitate carbon removals that are necessary to balance out residual GHG emissions in an economy that aims to achieve climate neutrality by 2050.</p> <p>For oil and gas operators potential decommissioning cost for depleted EHR fields can be replaced by future CO₂ storage fees revenues.</p>	Not identified
5) Access to markets	Not identified.	Not identified
6) Skills	Not identified	Not identified
7) Innovation	<p>Participation in the regulatory sandbox might reduce costs by eliminating certain regulatory barriers. Moreover, the participation in a regulatory sandbox scheme might allow for</p>	<p>Participants of a sandbox plan (if respecting the terms and conditions of their participation, issued by the competent authority for that plan) will</p>

	recovering costs incurred in the development of a new technology, or solution which would not be possible otherwise due to a regulatory barrier.	have no administrative fines or other penalties for infringement of Union or MS legislation relating to the net-zero technology supervised in the regulatory sandbox.
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7.2. Business compliance costs

Business compliance costs are discussed with reference to two main categories: adjustment costs and administrative costs. The former relates to direct labour costs, overheads, equipment costs, material costs, cost of external services, etc. that are incremental costs for businesses of complying with any new administrative requirement put forward under the proposal. Administrative costs are defined mostly in terms of reducing related information and reporting obligations for businesses.

The NZIA proposal is not foreseen to generate any significant business compliance costs or administrative burden for EU's net-zero industry. On the contrary, as outlined in Table 6 above, there are several business compliance cost savings that may arise from the NZIA proposal. For instance, in terms of adjustment costs, the NZIA proposal reduces these costs by encouraging the streamlining of administrative requirements in relation to permit-granting processes (as well as the shortening of their duration) for producers of net-zero technologies, by setting up regulatory sandboxes, and by ensuring access to information.

Some marginal administrative costs may be generated by NZIA provisions on access to markets, in terms of companies manufacturing net-zero technologies presenting the sustainability and resilience of their products when participating in public procurement tenders or in auctions to support the production or consumption of energy from renewable sources. Other marginal administrative costs may be incurred by businesses when applying to be recognised as net-zero strategic project by Member States, and consequently be granted priority status. However, the NZIA proposal ensures that such applications are straightforward by providing guidance as to the application and recognition process (as per article 11). Companies participating in procurement, auctions, and public schemes applicable to net-zero technologies would be encouraged to provide information and identify where their products and components thereof have been sourced. However, altogether these marginal administrative costs are more than offset by the benefits in terms of administrative cost reductions that result from the other NZIA provisions. In addition, it is very likely that businesses already have this information at hand, and that they are already collecting the data on a systematic basis for other various business projects, although reporting requirements may need streamlining.

In other words, the NZIA proposal will increase legal certainty, support the set-up of new manufacturing facilities through rendering permitting procedures easier and quicker, as well as facilitate access to finance and provide for a trained adequately skilled labour force in the EU. All these outcomes, if materialised, will help businesses (companies manufacturing net-zero technologies in Europe) further cut their production costs, whilst helping providers of net-zero technology solutions in the EU to secure a stable source of demand of highly sustainable clean energy equipment, products, and components. A more detailed overview of these costs associated with each main dimension of the NZIA proposal are put forward in *Table 7*.

7.3. Enforcement costs for public authorities

The NZIA proposal will have increase enforcement costs for public authorities, particularly in relation to implementing, administering, and enforcing the respective regulatory requirements. Member States would need to put in place (where lacking) monitoring and information systems that would enable them to smoothly implement the Regulation, such as setting up one-stop shops for streamlined and faster permitting of net-zero manufacturing facilities, or of public procurement procedures and auctions to support the production or consumption of energy from renewable sources that would better account for non-price criteria, such as resilience and sustainability as put forward in the NZIA proposal. All these aspects will create enforcement costs for Member State authorities, however, exact costs are difficult to calculate as the approach will vary from Member State to Member State also with regards to how, for instance, the one-stop shop concept will be

implemented. This can vary, from on one hand a re-organisation of pre-existing and readily available resources (which in itself incurs costs) to on the other hand the acquisition of additional resources. Different examples of existing one-stop shops are listed on p.18, with the system of the Netherlands being built around a fully digital one-stop shop, an approach which would incur additional development and maintenance costs for the software and website. Related to net-zero regulatory sandboxes, Member States will have to set up net-zero regulatory sandbox schemes. Competent authorities will have additional costs related to the selection procedure, monitoring, and evaluating of the sandbox plans. In addition, they will have costs related to the awareness raising activities for the participation of SMEs in regulatory sandboxes and due to the establishment of a dedicated communication channel with SMEs on the same subject. However, NZIA provisions (such as those on permitting) seek to provide simplification and greater flexibility in the ways in which business can comply with the regulatory requirements which may minimise the administrative burden or costs to firms. A more detailed overview of these costs associated with each main dimension of the NZIA proposal are put forward in *Table 7*.

Nonetheless, the Commission has at its disposal several tools that can help Member States in alleviating any enforcement costs arising from NZIA implementation. For example, the Technical Support Instrument (TSI) can help Member States and regions in preparing net-zero growth strategies, improve the business environment, reducing red tape and accelerating permitting. Building on the TSI 2023 flagship supporting Member States on faster permitting for renewable energy deployment projects, the TSI 2024 flagship on *Support to the Green Deal Industrial Plan* provides assistance to NZIA implementation, with a focus on assessing and improving the national regulatory environment to reduce administrative burden (e.g. through one-stop shops) and accelerate and simplify permitting procedures for investments in net-zero technologies and for “Net-Zero Strategic Projects”.¹⁵⁷ In addition, Member States are being encouraged in the context of the Reform and Resilience Facility (RRF) REPowerEU chapters to include reforms aimed at setting up one stop shops.

In addition, the Commission promotes the establishment of community of practices among public buyers and offers the space for stimulating the collaboration among them. As an example, a community of practice on Sustainable Solar PV¹⁵⁸ has been recently established to exchange insights and information on sustainability, quality and financial aspects, market surveys, as well as templates for tenders and contracts. Nonetheless, it is expected that the NZIA proposal will have a positive impact on the growth of the EU’s net-zero industries and its overall economy, thus increasing the tax base with subsequent positive repercussions on state budgets. EU’s cohesion policy programmes could also encourage the take up of net-zero strategic projects in less developed and transition regions, also benefiting from the increased aid ceilings offered by the Temporary Crisis and Transition Framework, as well from the provisions of the Net Zero Industry Act.

In addition, the NZIA proposal ensures full consistency with existing sectoral EU legislation applicable to net-zero technologies (e.g. on energy savings, energy labelling, eco-design, and deployment), as well as with the proposed legislation on critical raw materials. Moreover, since the legal form of the NZIA proposal is a Regulation, this means that it does not require transposition through national measures and is directly applicable, responding to the urgency for ensuring competitiveness and resilience of net zero technology supply chains. For these reasons, the NZIA proposal is assessed to bring further clarity and help to simplify and facilitate the enforcement of new rules across the EU.¹⁵⁹

Table 7: Overview of Costs per type of NZIA provisions					
	<table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 50%;">Compliance costs for businesses</th> <th style="width: 50%;">Enforcement costs for public authorities</th> </tr> </thead> <tbody> <tr> <td style="height: 30px;"></td> <td style="height: 30px;"></td> </tr> </tbody> </table>	Compliance costs for businesses	Enforcement costs for public authorities		
Compliance costs for businesses	Enforcement costs for public authorities				

⁽¹⁵⁷⁾ https://reform-support.ec.europa.eu/tsi-2024-flagship-support-green-deal-industrial-plan_en

⁽¹⁵⁸⁾ <https://public-buyers-community.ec.europa.eu/communities/community-public-buyers-sustainable-solar-pv>

⁽¹⁵⁹⁾ As per the Political Guidelines of President von der Leyen, ‘better regulation’ Communication COM(2021) 219)

	Adjustment costs	Administrative costs	
1) Headline benchmark	Not identified	Not identified	Not identified
2) Permitting	<p>One stop shop (Art 4-5) and time-limits (Art 6)</p> <p>There may be some minor adjustment costs for businesses in the sense that the NZIA provisions need to be understood. Ultimately the cost reduction from the provisions far outweighs any adjustment costs. No additional FTEs.</p>	Same as in the case of adjustment costs.	<p>There may potentially be considerable costs for public authorities in adapting to the NZIA permitting provisions. It is necessary for national authorities to map other authorities involved in permit-granting of NZIA projects, this is necessary on one hand for the one-stop shop to fulfil its coordinating function, to carry out its tasks under the prescribed time-limits, and on the other hand also to comply with specific provision such as in Article 6(7) on the requirement to provide project promoters with a detailed schedule which would contain information on other authorities, timeline, types of permits, etc.</p> <p>1-2 FTEs. Depending on the amount of projects this can be higher. Member States with federal organisation may require additional resources due to potentially having to cater to other/different authorities in different regions, where and if relevant for NZIA projects.</p>

	<p>Environmental assessments (Art 7) and planning (Art 8)</p> <p>There may be some minor adjustments costs for businesses in the sense that the NZIA provisions need to be understood. Ultimately the cost reduction from the provisions far outweighs any adjustment costs.</p> <p>No additional FTEs.</p>	<p>Same as in the case of adjustment costs.</p>	<p>The environmental assessment provision for bundled assessments decreases enforcement costs as this increases efficiency. The obligation to provide a scoping opinion on the EIA report requires resources, however, any additional resources invested will bear benefits by reducing complexity and costs otherwise spent if the process without clear scoping results in an overly lengthy and unclear process.</p> <p>In terms of the planning provisions, national authorities shall consider NZIA projects in spatial planning, where appropriate. Normally such efforts are already underway in Member States.</p> <p>Overall, it is estimated that these tasks can be carried out with current resources and thus no additional FTEs are required.</p>
<p>3) Net-zero strategic projects & access to finance</p>		<p>Administrative costs may be incurred by businesses when applying to be recognised as net-zero strategic project by Member States, and consequently be granted priority status</p>	<p>Provision by MS of administrative support to net-zero strategic projects to facilitate their rapid and effective implementation.</p> <p>Ensure that net-zero strategic projects are treated in the most rapid way possible in accordance with Union and national law.</p> <p>We can estimate that these activities would require max 1 FTE in total for each MS.</p>
<p>4) CO₂ injection capacity target</p>	<p>Investments in CO₂ storage infrastructure vary significantly, depending on the locations and characteristics of the storage site, but also on economies of scale (see Investment needs assessment SWD for details).</p> <p>These costs need to be considered in comparison with the storage fees that can be generated for decades, depending on</p>	<p>Not identified</p>	<p>Where not yet established, competent authorities would face administrative cost for CO₂ storage permit procedures and for reporting, which correlate based on the given geology with the size of relevant industrial activities.</p>

	the injection and total storage capacity of a given site.		
5) Access to markets	No direct impact foreseen for business except where they need to adapt their production lines to respond to sustainability and resilience criteria.	Business may incur some increase in administrative costs where they need to prove compliance with sustainability and resilience criteria of their products when participating in public procurement tenders or in auctions to support the production or consumption of energy from renewable sources.	Public entities may require more specialised staff for an in-depth assessment of the criteria set out by NZIA.
6) Skills	Not identified	Not identified	<p>Competent authorities would face administrative cost resulting in the participation to the proposed sub-group n skills within the Net-Zero Industry Platform.</p> <p>Administrative costs related to the obligation to identify every two years whether the learning programmes developed by the European net-zero industry academies are equivalent to the specific qualifications required by the host Member State to access regulated activities within the scope of a profession with particular interest for the Net-Zero Industry, and to make the results of this assessment publicly available online.</p> <p>Administrative costs related to the participation of MS representatives within the skills sub-group of the Net-Zero Europe Platform</p>
7) Innovation	Not identified.	Costs related to the preparation and presentation of a proposal for the participation in the net-zero regulatory sandbox. If selected, and	The setting up of the net-zero regulatory sandbox scheme creates administrative costs. Competent authorities will have enforcement cost related to the operation of the scheme (evaluating applications, monitoring projects, making final evaluations). With the focus on SMEs they are required to organise

		participating, cost related to reporting on the implementation of the sandbox plan.	awareness raising activities and establish a dedicated communication channel to provide guidance and respond queries.
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7.4. Regulatory simplification – application of the One-in-One-out principle

The proposal has implications on the administrative burdens that companies are facing. Some of the provisions create additional information obligations, others simplify and speed up administrative processes, leading to a reduction in administrative costs for businesses. In sum, they are not expected to lead to a significant net increase for the following reasons:

1) Net-zero strategic projects

Some administrative costs for companies are introduced by the proposal related to obtaining the status of “net-zero strategic project” (Article 11). Applicants need to provide evidence regarding the fulfilment of the relevant criteria in Article 10 and a business plan. It is not possible to anticipate how many companies would apply for this status, yet the number is likely to be limited. The benefits consist of streamlined national permitting processes (shorter duration, one-stop-shop), which are case-dependent and cannot be quantified. Nevertheless, it is highly unlikely that successful applicants would encounter a net administrative cost. As application is voluntary, companies will apply only if the benefits outweigh the costs of doing so. Therefore, the overall effect is likely to be a net reduction in administrative burdens. In addition, it should be kept in mind that a larger group of companies (the ones pursuing non-strategic net-zero projects) are likely to benefit from simplified and streamlined processes without incurring any increase in administrative burdens. For this group a reduction in administrative burdens is expected.

2) CO2 injection capacity target

Article 17 (1)(b) of the proposal creates the obligation for companies to make certain information publicly available (geological data relating to certain production sites). As this provision concerns authorised oil and gas producers, the number of affected companies is expected to be rather limited. Since the data should be available for those companies, the related administrative costs are not considered to be significant. Companies affected also need to submit a plan to the Commission on how they intend to meet their contribution to the CO2 injection capacity (Article 18(4)) and report on progress (Article 18(6)). Altogether, the overall impact on administrative burdens is considered not to be significant.

3) Access to markets

Companies intending to participate in public procurement procedures (Article 19) or auctions to deploy renewable energy sources (Article 20), in which a sustainability and resilience contribution is required under the award criteria, need to provide evidence regarding the fulfilment of these criteria. As it is not possible to anticipate the number of companies likely to be affected by these provisions, nor the number of procedures or the cost to provide the necessary documentation, the related administrative costs cannot be estimated. However, it should be borne in mind that companies, while likely to incur higher costs for the more complex procedures, would benefit from a higher reward of the fact that the quality of their products will be better reflected by the award criteria.

4) Innovation

Companies that intend to benefit from national regulatory sandboxes face some administrative costs related to the preparation and presentation of a proposal for the participation in the net-zero regulatory sandbox and – if successful – related reporting costs regarding implementation under

Article 26. As participation in a regulatory sandbox is purely voluntary, companies will only decide to participate if the benefits (in terms of simplification of the regulatory environment) outweigh the costs (of application and reporting). Therefore, the overall impact on administrative burdens should be positive.

- 5) The proposal is not creating administrative costs for citizens.

Reporting obligations are as follows:

- The reporting obligations/administrative costs for companies are described in the previous paragraphs. The proposals generate a number of necessary reporting obligation for public authorities but they are limited to the strict minimum to ensure the proper implementation of the measures.

7.5. Budgetary Implications

The NZIA proposal will require staff expenditure to coordinate the work of the Net-Zero Europe Platform which will function as the governing body to the proposed Regulation. Further expenditures are necessary to conduct research and data analysis for monitoring the initiative and market developments as well as to obtain up-to-date data on net-zero technology supply chains. A budget for seed funding to support the creation and functioning of Net-Zero Industry Academies and other administrative arrangements has also been included in the proposal. Lastly, a budget has been foreseen to cover expenditures of committees. These financial expenditures will be covered by the resources of the current Multi-annual Financial Framework, as they will be taken from the Clean Hydrogen Joint Undertaking, Single Market Programme SME Pillar as well as Operation and development of the single market of goods and services.

In the financial statement detailed in the NZIA proposal, it was estimated that the operational costs for the European Commission including for research and setting up of the European Net-Zero Industry Academies amount to EUR 6.220 million, while the administrative expenditure consisting of a budget for staff and committee would amount to a maximum of EUR 5.225 million for the first 4 years after entry into force. However, this is a preliminary estimate based on the information collected and the extrapolation of costs for other decentralised systems currently under development.

8. GOVERNANCE AND MONITORING

The governance and monitoring of the NZIA proposal will be mainly carried out via a dedicated structure, labelled the Net-Zero Europe Platform (see in *Figure 13*). This allows the Commission to coordinate the actions as set out in the proposal jointly with Member States. The Platform, which serves as a reference body, enables the Commission and Member States to discuss, exchange information and share best practices on issues related to the NZIA proposal. The following diagram illustrates the structure of the Net-Zero Europe Platform, which consists of the Commission and Members States and is chaired by the Commission. Each Member State will appoint a high-level representative to the Platform. The Platform may establish standing or temporary sub-groups dealing with specific questions and tasks. The Platform will invite representatives of the European Parliament to attend, as observers, the platform and subgroup meetings. The Platform or the Commission may invite experts and other third parties to Platform and sub-group meetings or ask them to provide written input, such as representatives from the European Financial Institutions, representatives from the net-zero industry and the Strategic Energy Technology Plan community (SET Plan), organisations representing the interests of the net-zero industry, representatives of industrial alliances, partnerships for net-zero industries at Union level, research institutes, social partners, consumer associations, NGOs and other stakeholders with an interest in the net-zero industry sector. The Platform will cooperate with existing industrial alliances.

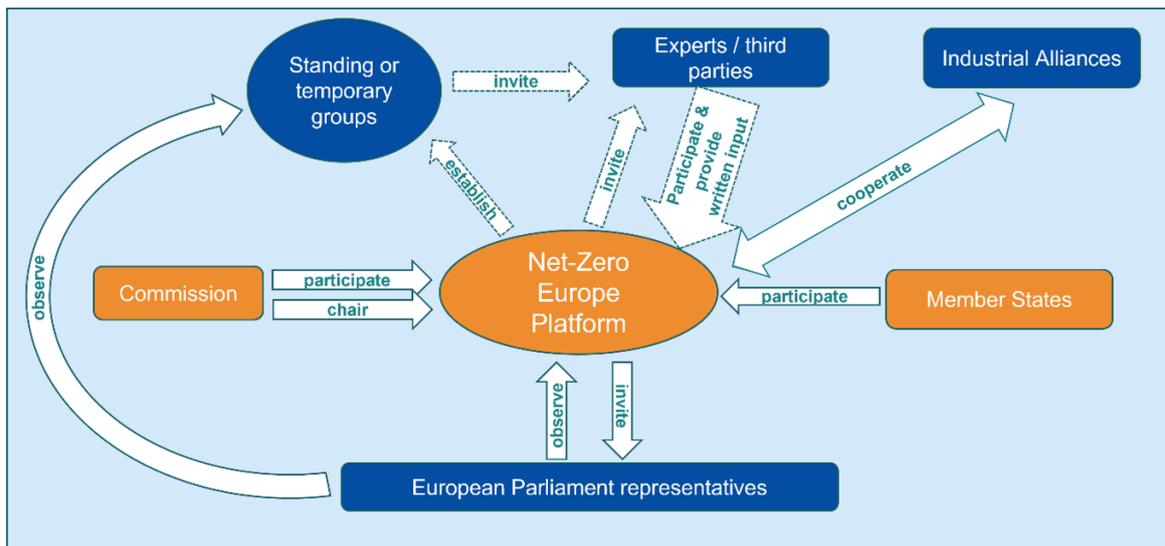


Figure 12: The proposed structure of the Net-Zero Europe Platform

The activities of the platform relate to the various actions outlined in the different Articles of the proposed Regulation, such as Article 4 on the streamlining administrative procedures and permit granting processes, article 11 on net-zero strategic projects, article 15 on the coordination of financing, articles 19, 20 and 21 on access to markets, article 25 on skills, and article 26 on innovative net-zero regulatory sandboxes.

For permitting, the proposal foresees that the Net-Zero Europe Platform is used as a platform by Commission and Member States to exchange best practices on national permit-granting processes and the implementation of the NZIA permitting provisions, including the setting up of one stop shops, but also procedural aspects such as the streamlining of environmental impact assessments.

The platform plays a significant role in supporting the setting up of Net-Zero Academies and the monitoring and forecasting of the demand and supply of a workforce for the net-zero industries. The platform will assist the mobilisation of stakeholders including industry, social partners and education and training providers for the roll-out of learning programs. The platform will also support the setting up of net-zero strategic projects, provide advice and facilitate in the coordination of financing and access to markets. The implementation of regulatory sandboxes, including lessons learnt and recommendations, may be discussed as part of the platform. Furthermore, the Commission and Member States may get active under the Platform to foster cross-country contacts between undertakings active in net-zero sectors within the European Union, in particular by making use of the work of industrial alliances.

The proposal includes provisions to monitor supply chains (Article 31) to track the progress with respect to the headline benchmark, progress towards reaching the CO₂ storage target, as well as the trends in a range of indicators relevant for assessing the economic performance of EU's net-zero industry, its resilience and sustainability. The Commission's ambition in monitoring of the EU's progress in moving towards the common target of increasing manufacturing of net-zero technologies ties in closely with the work of the Net-Zero Industry Alliance. To successfully monitor the progress, Member States and their relevant national authorities must collect and provide data and other evidence required and report each year to the Commission. To maximise synergies among reporting and monitoring obligations in the field, Member States and national authorities are asked to factor in the information requested in the Commission Notice on the Guidance to Member States for the update of the 2021-2030 National Energy and Climate Plans.¹⁶⁰ The Guidance includes request to Member States to integrate in national objectives and policies measures related to: skills development for the clean energy transition; clean energy and low carbon technology value chains,

⁽¹⁶⁰⁾ Commission Notice on the Guidance to Member States for the update of the 2021-2030 national energy and climate plans (2022/C 495/02)

e.g. by strengthening manufacturing capacities for renewable energy technologies; manufacturing scale-up and diversified production capacity of clean energy and low carbon technology value chains; the notions of recyclability and circularity and the need to reduce dependency and diversifying the sourcing of imports required to manufacture clean energy technologies. Building on the submitted data and evidence provided by Member States, and with the contribution of the platform, the Commission will monitor progress and publish recommendations on an annual basis as part of the Annual Reports on Competitiveness of Clean Energy Technologies,¹⁶¹ under the State of the Energy Union Reports.¹⁶²

As the platform will contribute to the preparation of the Annual Reports on Competitiveness of Clean Energy Technologies, under the State of the Energy Union Report, the submitted monitoring data by Member States will facilitate this undertaking. The CO₂ storage target will be governed and monitored based on the existing requirements of Directive 2009/31/EC and Directive 2003/87/EC respectively. Oil and gas producers and operators of Net-Zero Strategic Projects for CO₂ storage will have to report to the relevant Member States authorities and the European Commission.

In addition to being based on industry input, the assessment, monitoring and forecasting of skills needs for NZIA will also build upon the work of the European Centre for the Development of Vocational Training (Cedefop), which supports the development and implementation of European vocational and educational policies and has a line of work specifically on skills for the green transition under its 'Green Observatory'. It will also build on the European Labour Authority (ELA), which assists the Commission and Member States in ensuring that EU rules on labour mobility and social security coordination are effectively enforced. This is done through initiatives such as EURES. The work of the European Network of Employment Services (EURES) in facilitating job placements has on average more than 3 million job vacancies available on its portal. Given the variety of job vacancies and employers and its tool for automated skills-based matching, the placements facilitated by the EURES network and EURES portal provide jobs relevant for the net-zero Industry. Finally, of important relevance for the NZIA proposal has been the establishment of a European Battery Alliance Academy that serves as a model for the main functions around which the NZIA Academies should be build.

9. WHAT SUCCESS LOOKS LIKE

In 2030, the EU will have significantly scaled up the manufacturing capacity of its net-zero industry, accelerated its net zero technological innovation process, boosted quality jobs in its net-zero manufacturing sectors, provided adequate skills for a better match with the green jobs of the future, and will have secured resilient, diverse, and sustainable supply chains for the net-zero technologies demanded to achieve its energy and climate goals. The future with a successful NZIA is that of an EU with a strong and diverse net-zero industry across not only strategic technologies, but covering a wide range of competitive, quality net-zero technologies capable of delivering the necessary GHG emission reductions effectively, efficiently, and equitably. This strong and diversified net-zero industry will contribute to REPowerEU objectives by making our future energy system more resilient.

The Net-Zero Industry Act will have been considered successful, if it would have contributed effectively to the positive trends and dynamics outlined above, and more specifically if:

- NZIA's headline benchmark is achieved across the supply chains covered by the NZIA proposal. This would have meant that, especially for strategic net-zero technologies, EU's net-zero industry manufactures by 2030 at least 40% of its technology deployment needs (measured for instance based on physical capacity expansion).
- By establishing an industrial scale capacity to operationally store CO₂ permanently, the EU will have allowed hard-to-abate industries to decarbonise their existing operations while at the same time creating a new market for CO₂ storage services. This could be measured by the amount of CO₂ stored permanently and safely in accordance with Directive 2009/31/EC.

⁽¹⁶¹⁾ [Clean energy competitiveness \(europa.eu\)](https://europa.eu)

⁽¹⁶²⁾ in accordance with Article 35(1)(m) of the Regulation on the Governance of the Energy Union and Climate Action.

- Permitting processes for expanding the net-zero manufacturing capacity are simplified, streamlined, and shortened as proposed under NZIA, with the setup of efficient and informative one-stop shops across Member States. This could be measured for instance via the average duration of permitting procedures, the types and number of permits granted at national level within the past 12 months.
- A multitude¹⁶³ of successful net-zero strategic projects are set up and operational across the EU so that it benefits the entire territory of the Union, contributing to the resilience of EU's net-zero industry and of our economy.
- Contracting authorities and entities awarding public contracts and, in the case of auctions, national public authorities, make widespread use of the obligation to include qualitative criteria relating to sustainability and resilience. This helps reinforce the resilience and sustainability of EU's net-zero industry supply chains across Member States.
- Skills shortages are lowered, and new talent and a quality workforce is attracted and shaped.
- The EU strengthens and diversifies its capacity to innovate in manufacturing the net-zero technologies of the future (which could be measured via the number of sandboxes plans set up within the past 12 months).

An in-depth understanding of the intricacies and complexity of net-zero manufacturing supply chains is gained, helping the EU to identify future emergent issues, risks, and take appropriate preventive measures, where deemed necessary.

⁽¹⁶³⁾ Considering the project pipelines of the Industrial alliances that were launched by the Commission, such as the European solar PV Industry Alliance or the European Batteries Alliance, it could be estimated that for these two value chains alone, around a dozen projects each could materialise in the coming 2-3 years. Therefore a rough estimate would be that up to hundreds of projects will be in the scope of NZIA, all net-zero strategic technologies considered.

ANNEX 1: INTERNATIONAL COMPETITIVENESS OF NET-ZERO INDUSTRIES

The latest data on the global key players, market shares, and supply risks along the supply chains for solar PV, wind, and heat pumps are provided in the graphs below under Figure A1.1

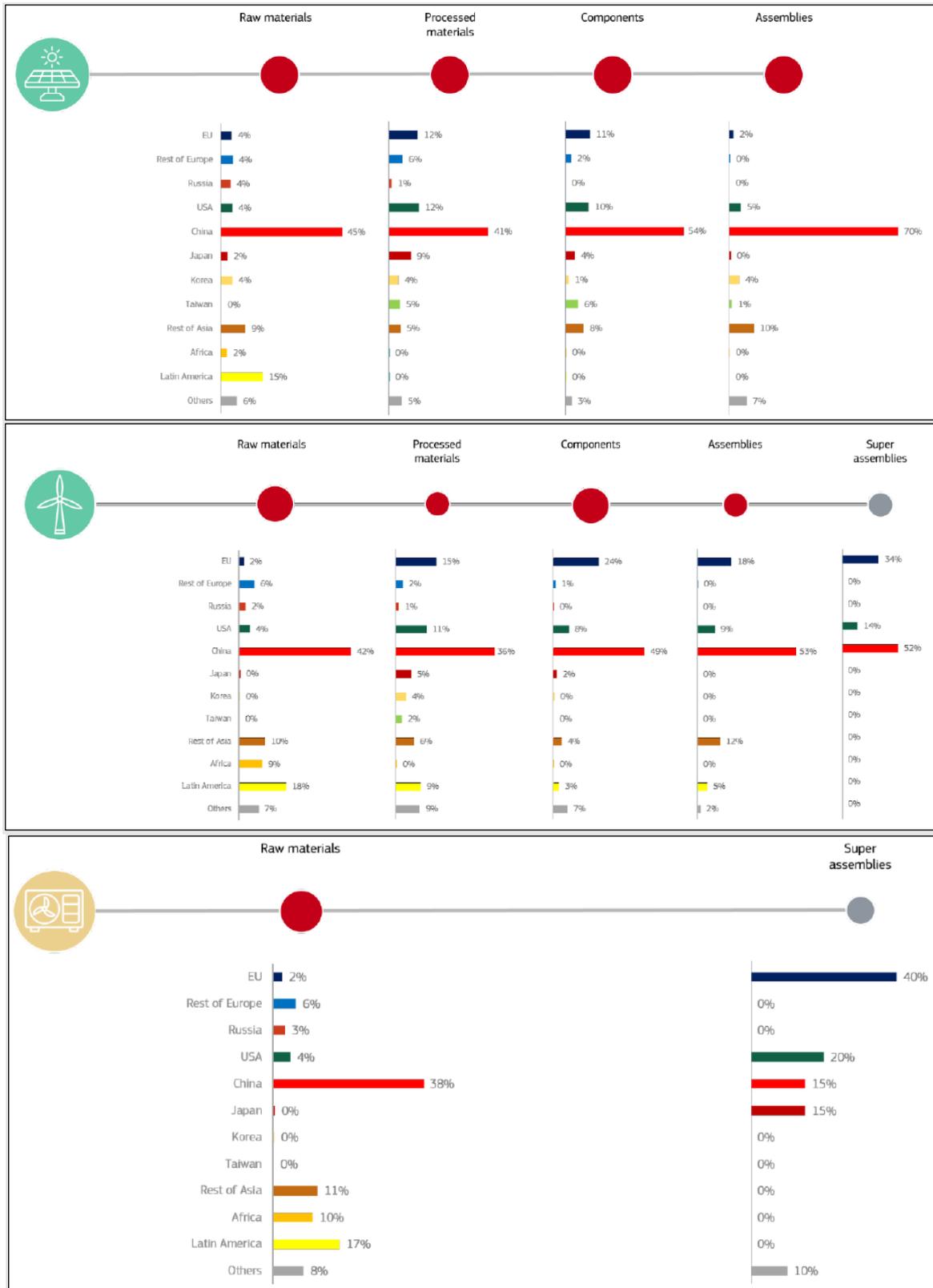


Figure A1.1: Global key players, EU market shares, and supply risks along the supply chains for solar PV, wind, and heat pumps; Notes: The red bars represent China and the dark blue bars represent the EU; the red dots signal where there is a security of supply risk across the supply chain for the respective net-zero technology as per the methodology described in European Commission "Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study", JRC Science for Policy Report, S. Carrara et al, 2023

However, global market shares do not provide a clear picture of the factors driving the business case or the competitiveness of net-zero industries, as they may hide generous subsidies affecting the final selling price. Having said this, it is generally argued that economies of scale, supply chain integration, relatively low energy costs and labour productivity make China the most competitive manufacturer worldwide.¹⁶⁴ For example in the case of solar PV technologies, the total manufacturing costs for mono PERC c-Si solar, excluding subsidies, are the lowest in China, around 40% lower than in Europe, reflecting the country’s favourable cost competitiveness stance in this industry area, especially due to lower energy, investment, and labour costs (see Figure A1.2). Higher investment costs in India are the main reason for the cost differential with China; higher overhead, and labour costs in the US make PV manufacturing not as competitive, while higher energy prices (particularly last year) in Europe widened the cost gap with China.

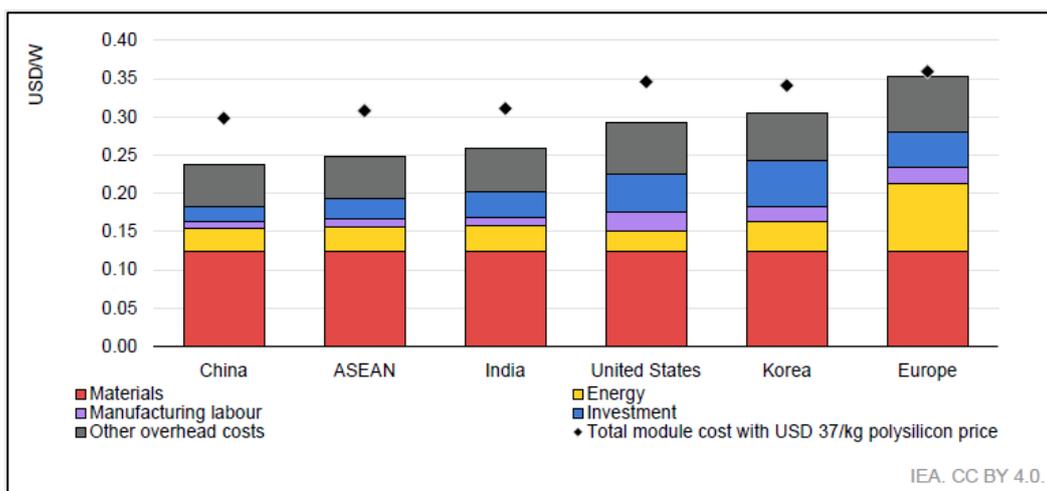


Figure A1.2: Total manufacturing costs for mono PERC (Passivated Emitter and Rear Contact) c-Si (crystalline Silicon) solar components by input across major economies, 2022. Source: IEA (2023) Renewables 2022: Analysis and forecast to 2027. Notes: ASEAN – Association of Southeast Asian Nations. Values exclude subsidies as well as additional costs such as transportation, company profits, taxes, and tariffs. Thus, total cost inputs may not match final market sale prices.

Furthermore, it should also be noted that besides the cost-competitiveness angle, China also appears to be highly innovative in these areas, as measured by its share of global patents (see Figure A1.3)

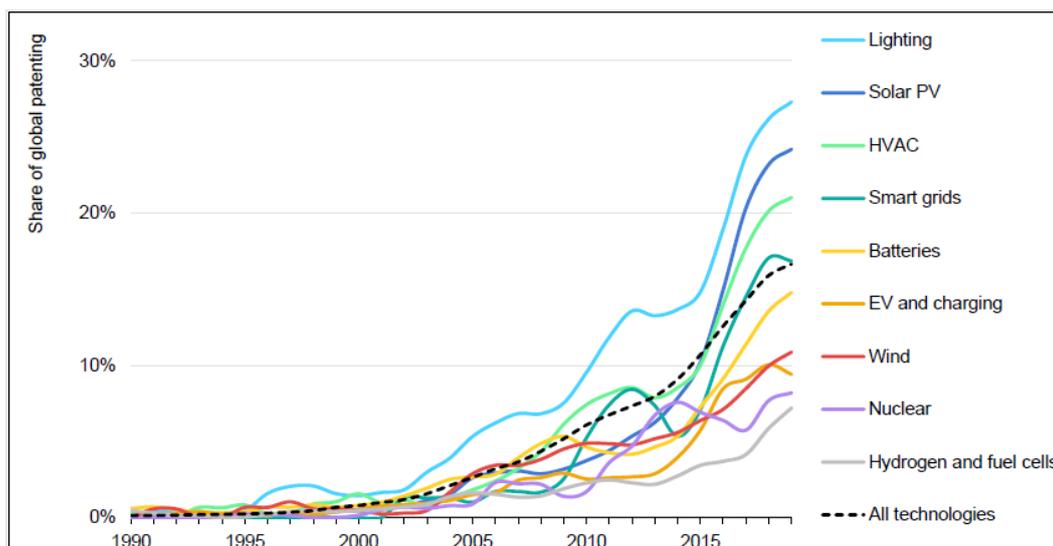


Figure A1.3: China’s share of global patenting; Source: IEA: Tracking Clean Energy Innovation; Focus on China

Overall, there are several factors underpinning China’s competitiveness. First, there is the issue of facilitated access to critical raw materials, with China producing a large share of its own raw materials

⁽¹⁶⁴⁾ IEA Renewables 2022. Analysis and forecast to 2027, International Energy Agency, January 2023.

needed to produce net-zero technologies and components. Second, on the investment front, “China had surpassed the U.S. by the late 2000s and Europe by 2012 to be the world leader in low carbon technology investment, pumping in annually at least US\$100 billion into innovation by 2014.”¹⁶⁵ These two reasons, raw materials and investments, are also confirmed by a recent JRC analysis: “Thanks to its natural abundance of raw materials and its strong industrial push, China has secured its position as a key supplier of materials for energy technologies and is using its prominent role to attract more advanced stages of production, with higher added-value.”¹⁶⁶ Third, China also has cheaper labour and other costs than Europe or the US. Fourth, the government takes an active role through subsidies and even nationalisations: “Thanks to its proximity to the producers of raw materials and to the availability of cheap labour, China’s manufacturing capacities for alloys and permanent magnets have expanded significantly, reaching 90% of global production of permanent magnets and specific alloys (Adamas Intelligence, 2019). China has also taken steps towards nationalising much of the value chain for these strategic industries, beginning with the consolidation of its rare earths mining and separation sector in six state-owned companies.”¹⁶⁷ Fifth, China is also at the forefront of R&D spending: “China has become the world’s second largest public spender in energy R&D (about USD 8.4 billion in 2020) after the United States, surpassing other established technology hubs such as Japan and Europe.”¹⁶⁸ Finally, sixth, as with all economic activities, it can be presumed that Chinese companies benefit from economies of scale as well as learning effects.

The stark increase of green patents in China is somehow mitigated when considering that many of them are held at the local patent office. The 2022 EU Industrial R&D Investment Scoreboard¹⁶⁹ provides a firm-based analysis of the 2500 top-R&D investing companies worldwide. It shows that green inventions accounted for 9% of all patent filings in 2018, driven by very high numbers of Chinese inventions only protected domestically. Green high-value¹⁷⁰ inventions had a share of 10% of all high-value patent filings in 2018. As shown in Figure A1.4, the EU and Japan lead in green high-value patents, with the US in third place. At 58%, the US and the EU have the highest shares of high value patents (patents filed at several patent offices, indicating international protection) among their green patents.¹⁷¹ The EU and the US also have a more diverse contribution to green innovation from applicants beyond the Scoreboard. In contrast, in Japan and South Korea, most of the high-value green filings come from major Scoreboard investors. Energy and transport remain as the most prominent areas in the EU portfolio of green inventions (33% and 28%, respectively), and the EU had highest specialisation index on green patents. The EU also leads in inventions relevant to circularity both in absolute terms and as a share in overall green inventions.

⁽¹⁶⁵⁾ Chia, 2022: How China is Winning the Race for Clean Energy Technology;

<https://fairbank.fas.harvard.edu/research/blog/how-china-is-winning-the-race-for-clean-energy-technology%EF%BF%BC/>

⁽¹⁶⁶⁾ *China 2.0, Status and Foresight of EU-China Trade, Investment, and Technological Race*, Publications Office of the European Union, Luxembourg, 2022, doi:10.2760/45420, JRC131882

⁽¹⁶⁷⁾ *China 2.0, Status and Foresight of EU-China Trade, Investment, and Technological Race*, Publications Office of the European Union, Luxembourg, 2022, doi:10.2760/45420, JRC131882

⁽¹⁶⁸⁾ IEA: Tracking Clean Energy Innovation; Focus on China

⁽¹⁶⁹⁾ <https://iri.jrc.ec.europa.eu/scoreboard/2022-eu-industrial-rd-investment-scoreboard>

⁽¹⁷⁰⁾ An invention is considered high-value invention, when it contains patent applications protected in more than one patent office around the world.

⁽¹⁷¹⁾ EU vs China share of high-value patents in selected NZIA technologies for 2016-2019: Batteries: EU 16% vs China 14%; Fuel cells: EU 22% vs China 5%; Wind: EU 58% vs China 5%; Solar PV: EU 14% vs China 22%; Electrolysers/hydrogen: EU 31% vs China 5%; Heat pumps: EU 45% vs China 6%; Biomethane/biogas: EU 63% vs China 7%; Smart Grids: EU 27% vs China 7% ; CCUS: EU 26% vs China 3% - based on JRC, commissioned by DG GROW -European climate-neutral industry competitiveness scoreboard (CIndECS) (Draft, 2022)

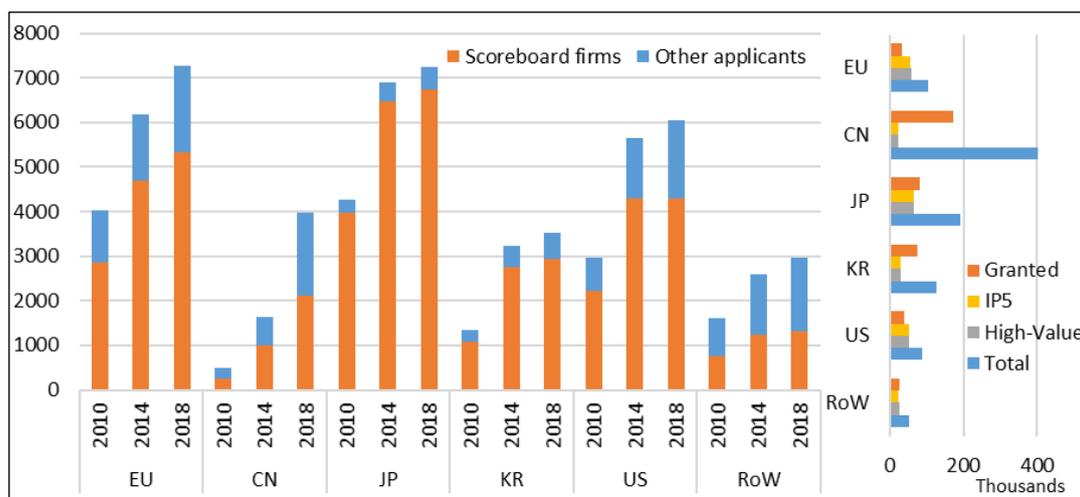


Figure A1.4: Trends in high-value green inventions: Scoreboard firms and other applicants, 2010-2018

Note: On the left: trend of annual filings of high-value green inventions for major economies for the years 2010, 2014 and 2018. On the right: Green inventions in the period 2010-2018: total number of inventions, high-value inventions, IP5 inventions and granted inventions for major economies. Source: The 2022 EU Industrial R&D Investment Scoreboard, European Commission, JRC/DG R&I.

The world's top R&D investors are key contributors to global climate-related innovation.¹⁷² They own 70% of global climate change mitigation or adaptation patents and over 10% of global climate-related trademarks, which is larger than their contribution to overall patents and trademarks across all fields. However, while top R&D investors produce large amounts of climate-related innovation, other inventors – such as young firms – develop more radical innovations and are therefore more likely to generate the breakthrough discoveries needed to achieve net-zero emissions. Some disparities across sectors emerge: while the electricity production, transportation and construction sectors heavily invest in climate-related innovation, other sectors such as information and communication technology (ICT) invest little in low-carbon innovation but contribute by developing enabling technologies such as artificial intelligence (AI). Focusing on a few technologies that are key to reaching the climate neutrality objective (renewable energy, electric cars, and hydrogen), companies headquartered in Asian countries exhibit clear specialisation patterns: Japanese firms lead in hydrogen technologies, Korean firms in electric cars and batteries and Chinese firms in renewable energy technologies. On the contrary, the EU27-headquartered companies do not exhibit such a pronounced specialisation pattern but have a broad technological base contributing to all climate-related technologies in equal measure. Relative to firms in other regions, US-based firms are not specialised in these key climate-related technologies. Looking at the twin transition, the potential contribution of the digital revolution to climate-related innovation at the invention stage, 20% of climate-related patents have a digital component (compared to 33% for patents across all technological fields). This suggests further potential regarding the digital transformation enabling the green transition across many carbon-intensive sectors of the economy. However, 60% of climate-related trademarks are also ICT-related, which is much larger than for the average trademark filed (around 30%). Hence, the use of digital solutions to address climate-related issues seems especially widespread at the commercialisation stage.

⁽¹⁷²⁾ Amoroso S., Aristodemou L., Criscuolo C., Dechezleprêtre A., Dernis H., Grassano N., Moussiégt L., Napolitano L., Nawa D. Squicciarini M., Tübke A. (2021). World Corporate Top R&D investors: Paving the way for climate neutrality. A joint JRC and OECD report. EUR 30884 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-43373-6, doi:10.2760/49552, JRC126788.

ANNEX 2: RELEVANT LEGISLATION IN NON-EU COUNTRIES AND AT EU LEVEL

A.2.1 Relevant legislation in non-EU countries

Many major economies pursue the same objectives to reduce domestic emissions whilst also reinforcing the competitiveness of their net-zero technology manufacturing industries that would contribute to domestic economic growth, boost green jobs, and take advantage of export opportunities presented by low-carbon technologies and services into new global emerging markets. Canada is amongst the most recent major economies to release a “A Made-in-Canada” plan that awards investment tax credits targeting both clean energy and technology manufacturing. This echoes similar initiatives like the Korean New Deal, Digital India and Australia’s Supply Chains Resilience Initiative. (see table A2.1) The fact that major economies around the globe build their net-zero industries of tomorrow results not only in cooperation to develop and deploy innovative and affordable solutions, and positive international spillover effects, but also in increased level of global competition, a race to the top in terms of delivering the technologies helping mitigate climate change. Within this context, NZIA aims to strike the right balance between EU domestic interests and possible international partnerships with other regions of the world.

Among the initiatives of our global partners, the EU has been particularly concerned by the United States’ Inflation Reduction Act (IRA). Mainly delivered through grants and tax incentives, the IRA earmarks USD 369 billion to support climate and energy programmes, including the manufacturing of some key net-zero technologies. The IRA is probably the most impactful piece of climate legislation passed by the U.S. since the landmark Clean Air Act over 50 years ago. To a large degree, it aligns policy direction of travel for the US economy with the European Green Deal. For instance, in relation to batteries, the law calls for tax credits of up to 50% for autonomous energy storage and USD 7,500 for emission-free vehicles, with tax credits for the domestic production and sale of qualified components such as batteries being also provided.¹⁷³

According to a Deloitte study,¹⁷⁴ the US, for political reasons, is fully focusing on an “all carrots, no sticks” subsidies-based approach, which creates a structural challenge for the EU, while the EU pursues a policy mix based on carbon pricing, sector-specific and target-based regulation, and incentivising the deployment of technologies and innovation. Whereas the EU essentially focuses on deployment subsidies while making fossil-based production more expensive, the USA is making manufacturing costs of carbon-neutral production temporarily cheaper. Especially investment in emerging new value chains such as green hydrogen and battery production may be drawn towards the USA, potentially translating first-mover advantages into the creation of future industrial ecosystems.

The NZIA takes a different approach when compared to the IRA. First, the NZIA does not aim to replicate IRA, but rather aims at addressing the challenges generated by the recent energy crisis to pursue the EU’s competitiveness agenda with short- and long-term regulatory measures. Second, unlike the IRA, the NZIA does not take an approach based mostly on local content and production requirements and instead focuses on security of supply, avoiding strategic dependencies, and increasing diversity in supply chains and imports into the EU. For example, in its proposed provisions on access to markets, NZIA also allows certain third country tenderers to qualify and to achieve the highest available score should their technologies perform well not only on the price front but also for sustainability and resilience.

⁽¹⁷³⁾ VDI/VDE Innovation + Technik GmbH “Resilient supply chains in the battery industry”, March 2023

⁽¹⁷⁴⁾ Deloitte. Sustainability & Climate IRA and the net-zero race – How EU industrial policy should respond. March 2023

United States	<p>Enacted in August 2022, the Inflation Reduction Act (IRA) signifies substantial federal commitments aimed at diminishing the United States' greenhouse gas emissions and tackling climate change. The estimated budget allocation is \$369 billion as assessed by the US Congress, but it could rise due to an uncapped US budget. The Act is a catalyst for the enhancement of domestic clean energy, promoting its creation, implementation, and expansion. In addition, the Act seeks to bolster US energy security, with an investment of over \$60 billion.</p> <p>The funding for these new expenses, as well as \$300 billion dedicated to reducing the deficit, is sourced from a new minimum tax imposed on larger corporations' income, an excise tax on public corporation stock buybacks, and significantly increased funding for IRS enforcement, operations, and modernization.</p> <p>The Act's implications span both immediate and long-term effects on the clean energy supply chain, particularly on renewable energy industries such as clean hydrogen production and decarbonization activities. It also significantly impacts energy-intensive users and automobile manufacturers both domestically and abroad, including suppliers in third countries like the European Union. Certain parts of the Act have been criticized for being discriminatory.</p> <p>Included within the Act is the Advanced Manufacturing Production Credit, with a total estimated value of \$31 billion. This provision provides \$35 per kilowatt-hour of capacity for battery cells manufactured for domestic production and sales of eligible solar and wind components. In conjunction with the Clean Vehicle Tax Credit, this Advanced Manufacturing Credit can benefit suppliers of clean products within the United States.</p>
Canada	<p>Canada's 2023 federal budget titled, "A Made-In-Canada Plan" proposes a refundable tax credit equal to 30 percent of the cost of investments in machinery and equipment used to manufacture or process key clean technologies, and extract, process, or recycle certain critical minerals essential to clean technology supply chains (Government of Canada "A Made-in-Canada Plan: Affordable Energy, Good Jobs, and a Growing Clean Economy", press release March 28, 2023). This tax credit is available for the manufacturing of renewable energy and energy storage equipment, and the recycling of critical minerals used in EV and energy storage batteries ("Canada formalises six-year 30% federal ITC credit, among other incentives, March 30, 2023, pv magazine).</p>
Korea	<p>The Korean New Deal, announced in Korean on July 14, 2020, plans to invest total 160 trillion won (114.1 trillion won worth of fiscal investment) to create 1,901,000 jobs by 2025. The Korean New Deal aims to transform the economy to make it greener, with more digital services and stronger safety nets, implemented through fiscal support for pump priming and improved regulations to promote the private sector. (Source: IEA, Korean New Deal - Digital New Deal, Green New Deal and Stronger Safety Net – Policies - IEA)</p>
Australia	<p>Australia's Supply Chain Resilience Initiative, launched together with Japan and India in 2021, provides businesses up to \$2 million to establish or scale a manufacturing capability or a related activity to address supply chain vulnerabilities for a critical product or input identified in the Sovereign Manufacturing Capability Plan. The main new policy tool established in September 2021 is the SCRI grant (AUD 50 million) to improve access to critical products in times of crisis.</p>
India	<p>The Production Linked Incentive (PLI) Scheme managed by the Ministry of Heavy Industries provides subsidies and incentives under several national programmes to local industries to help develop local supply chains. Local governments participate by providing land and facilitating permitting for the benefiting companies. Benefitting industries have included the battery ecosystem (under the 'National Programme on Advanced Chemistry Cell Battery Storage') with US\$ 2.49 billion over 5 years in subsidies to develop 50 GWh of battery capacity in India. Beneficiaries must ensure 60 percent domestic value addition within 5 years.</p> <p>An additional PLI scheme was launched to boost solar panel production in India as well, with a budget of US\$ 600 million. The goal is to attract US\$ 2.30 billion in private financing and to reach an additional 10,000 MW solar electricity production capacity in India. This project is managed by the Ministry of Renewable Energy. Additional PLI are being launched in the pharma sector, the steel sector the electronics sector and in the mobility sector.</p>

Table A2.1: Promoting net-zero technology manufacturing in other parts of the world

A.2.2 Relevant legislation and policy initiatives at EU level

Other EU-level legislation of relevance to the NZIA proposal comprises the new **European Battery Regulation (EBR)**¹⁷⁵ that covers the entire battery life cycle, from design to end-of-life and apply to all types of batteries sold in the EU, in particular for electric vehicles. The EBR's guarantee of compliance with strict sustainability requirements for batteries and/or battery cells produced and traded in Europe will help European battery manufacturers improve their sustainability credentials and help them benefit from NZIA's provision on public procurement and access to markets. NZIA will also be complementary with the new **Ecodesign for Sustainable Products Regulation (ESPR)**,¹⁷⁶ which will become the cornerstone of the Commission's approach to more environmentally sustainable and circular products. Until the ESPR's entry into force (which will repeal the Ecodesign Directive), it will be also supported by new proposals under the current **Ecodesign**¹⁷⁷ framework which also seek to secure more environmentally sustainable products, such as the one for solar PV products.

This should be in line with the regulatory framework related to **environmental challenges**, such as air and water quality, waste management and biodiversity protection, and several legislative instruments such as the environmental impact assessment¹⁷⁸ and the **Industrial Emissions Directive**¹⁷⁹, which covers some activities also covered by NZIA. The revised IED will support the activities under its scope in operating such industrial installations in the most sustainable and greenest possible manner, promote innovation and facilitate a level playing field through the provision of EU environmental requirements. It will therefore be an important instrument in supporting the transformation of the EU industry towards net zero.

In addition, it is crucial to improve the circularity and efficient material recycling within the net-zero industry to tackle in parallel with climate change also the loss of biodiversity and pollution. The main aim of the **Circular Economy Action Plan**¹⁸⁰ is to reduce consumption footprint, to increase resource efficiency, and to double the EU's circular material use rate in the coming decade. Furthermore, circularity as one of the nine mutually reinforcing drivers of the **Long-Term Competitiveness Strategy of the EU** and a necessity to strengthen resilience and strategic autonomy at the same time.

The proposed provisions in NZIA on streamlining permitting procedures are consistent with Union legislation that contains similar provisions on permitting such as the **Renewable Energy Directive (EU) 2018/2001**,¹⁸¹ the **TEN-E Regulation**,¹⁸² the **Gas Directive**,¹⁸³ and the **Council Regulation on**

⁽¹⁷⁵⁾ [Batteries: deal on new EU rules for design, production and waste treatment | News | European Parliament \(europa.eu\)](#) Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020 COM/2020/798 final

⁽¹⁷⁶⁾ [Ecodesign for sustainable products \(europa.eu\)](#) Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a framework for setting ecodesign requirements for sustainable products and repealing Directive 2009/125/EC (Text with EEA relevance) {SEC(2022) 165 final} - {SWD(2022) 81 final} - {SWD(2022) 82 final} - {SWD(2022) 83 final} COM(2022) 142 final

⁽¹⁷⁷⁾ [Ecodesign Directive 2009/125/EC](#)

⁽¹⁷⁸⁾ DIRECTIVE 2014/52/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment

⁽¹⁷⁹⁾ Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) and Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste COM/2022/156 final/3

⁽¹⁸⁰⁾ COM(2020) 98 final Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee of the Regions A new Circular Economy Action Plan For a cleaner and more competitive Europe, 11 March 2020.

⁽¹⁸¹⁾ Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast) (Text with EEA relevance), (OJ L 328, 21.12.2018, p. 82).

⁽¹⁸²⁾ Regulation (EU) 2022/869 of the European Parliament and of the Council of 30 May 2022 on guidelines for trans-European energy infrastructure, amending Regulations (EC) No 715/2009, (EU) 2019/942 and (EU) 2019/943 and Directives 2009/73/EC and (EU) 2019/944, and repealing Regulation (EU) No 347/2013, (OJ L 152, 3.6.2022, p. 45).

⁽¹⁸³⁾ Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC (Text with EEA relevance) Text with EEA relevance, (OJ L 211, 14.8.2009, p. 94) - text currently under revision notably regarding hydrogen

permitting for renewable energy deployment.¹⁸⁴ They are also consistent with the proposal on a recast of the **Renewable Energy Directive** and its REPowerEU amendment,¹⁸⁵ the **Chips Act Regulation proposal**,¹⁸⁶ the **Gigabit Infrastructure Act proposal**,¹⁸⁷ and the **Critical Raw Materials Act Regulation proposal**. Such EU legislation includes provisions on one-stop shops, time-limits for the entire permit-granting process, provisions on streamlining internal processes and environmental impact assessments, as well as provisions and principles on prioritization of strategic projects.

With regards to financing, the effective roll-out of net-zero industry projects may require public support, including in the form of State aid. As far as national resources are concerned, the State aid framework already provides for possibilities to support private investments and to effectively roll-out of net-zero industry projects. In this respect, the Commission adopted a new **Temporary Crisis and Transition Framework (TCTF)**¹⁸⁸ and endorsed a targeted amendment to the **General Block Exemption Regulation ('GBER')**¹⁸⁹ to foster support measures in sectors which are key for the transition to a net-zero economy.¹⁹⁰ TCTF allows further flexibility for the Member States to grant aid (including in the area of net-zero technology manufacturing) with easier calculations, simpler procedures, and accelerated approval, while limiting distortions to competition in the internal market and preserving cohesion objectives.

Several Union funding programmes, such as the **Recovery and Resilience Facility**,¹⁹¹ **InvestEU**,¹⁹² cohesion policy programmes or the **Innovation Fund**¹⁹³ are also available to fund investments in (large scale) net-zero technology manufacturing projects. The Innovation Fund also provides a very promising and cost-efficient avenue to support the scaling up of manufacturing and deployment of renewable hydrogen and other strategic net-zero technologies in Europe, and thus reinforcing Europe's sovereignty in the key technologies for climate action and energy security.

Regarding CCS, the CO₂ storage target in the Net-Zero Industry Act complements the revised **EU emission trading system (ETS) Directive**¹⁹⁴ which enshrines a faster reduction of the ETS cap and a faster reduction of free allocations. Especially for energy-intensive 'hard-to-abate' sectors, plans to

⁽¹⁸⁴⁾ Council Regulation (EU) 2022/2577 of 22 December 2022 laying down a framework to accelerate the deployment of renewable energy, (OJ L 335, 29.12.2022, p. 36.

⁽¹⁸⁵⁾ Proposal for a Directive of the European Parliament and of the Council amending Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources, COM/2022/222 final, 18.05.2022.

⁽¹⁸⁶⁾ Proposal for a Regulation of the European Parliament and of the Council establishing a framework of measures for strengthening Europe's semiconductor ecosystem (Chips Act), COM/2022/46 final, 08.02.2022.

⁽¹⁸⁷⁾ Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on measures to reduce the cost of deploying gigabit electronic communications networks and repealing Directive 2014/61/EU (Gigabit Infrastructure Act), COM(2023) 94 final

⁽¹⁸⁸⁾ Communication from the Commission on the Temporary Crisis and Transition Framework for State aid measures to support the economy following the aggression against Ukraine by Russia (OJ C 101, 17.3.2023, p. 3)..

⁽¹⁸⁹⁾ COMMUNICATION TO THE COMMISSION Approval of the content of a draft for a Commission Regulation amending Regulation (EU) No 651/2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty and Regulation (EU) 2022/2473 declaring certain categories of aid to undertakings active in the production, processing and marketing of fishery and aquaculture products compatible with the internal market in application of Articles 107 and 108 of the Treaty C(2023) 1712 final

⁽¹⁹⁰⁾ https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1563

⁽¹⁹¹⁾ REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Regulation (EU) 2021/241 as regards REPowerEU chapters in recovery and resilience plans and amending Regulation (EU) 2021/1060, Regulation (EU) 2021/2115, Directive 2003/87/EC and Decision (EU) 2015/1814 COM(2022) 231 final

⁽¹⁹²⁾ Regulation (EU) 2021/523 of the European Parliament and of the Council of 24 March 2021 establishing the InvestEU Programme and amending Regulation (EU) 2015/1017PE/74/2020/REV/1

⁽¹⁹³⁾ 10/08/2021 – EU (2019/856) Consolidated text: [Commission Delegated Regulation \(EU\) 2019/856 of 26 February 2019 supplementing Directive 2003/87/EC of the European Parliament and of the Council with regard to the operation of the Innovation Fund \(Text with EEA relevance\)](#)

⁽¹⁹⁴⁾ DIRECTIVE (EU) 2018/410 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814 (Text with EEA relevance) and Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union, Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and Regulation (EU) 2015/757 (Text with EEA relevance) {SEC(2021) 551 final} - {SWD(2021) 557 final} - {SWD(2021) 601 final} - {SWD(2021) 602 final} COM(2021) 551 final

capture CO₂ instead of emitting and then surrendering allowances under the revised ETS are increasingly expected to give positive economic returns before 2030, based on projected carbon prices. Investments in such capture, for subsequent storage, depend on the reasonable expectation that storage sites will be operationally available on the EU market. Whereas the EU's oil and gas producers have unrivalled skills and assets to provide the EU with operational storage capacity to launch a market of industrial CO₂ storage services in 2030 or to support other investors in doing so, no EU policy exists that requires them to directly engage in these activities.

Concerning skills for the green transition, the EU is also acting on several fronts, which NZIA aims to both complement and support. **The Pact for Skills** is the first flagship action of the **European Skills Agenda**, a five-year plan to help individuals and businesses develop more and better skills and to put them to use, among others, by strengthening the European Green Deal. Through the Pact, the Commission invites public and private organisations to join forces and take concrete action to upskill and reskill people in Europe. So far, 18 partnerships have already been launched with pledges to up and reskill and upskill at least 10 million people.¹⁹⁵ The Skills Agenda also put forward tools and initiatives to support people in their lifelong learning pathways (such as the Council Recommendations on individual learning accounts and micro-credentials and the new Europass platform) and actions to ensure that people have the right skills for jobs, including an action on skills to support the twin transitions. In parallel, the Commission's May 2021 **Industrial Strategy Update** calls for the co-creation of **transition pathways** for the EU's 14 industrial ecosystems. A transition pathway is an actionable plan for all stakeholders of a given industrial ecosystem to follow to successfully achieve the green and digital transition. The transition pathways identify which unmet skill-related needs exist in the workforce at all levels of the ecosystem to realize the twin transition, while proposing action to meet these needs.

The latest developments linked to Russia's invasion of Ukraine, the energy crisis, and the labour shortages the EU is currently facing, are pushing skills, and more specifically skills for the green transition, to the top of the EU's political agenda. This priority was confirmed by the announcement of the **European Year of Skills** taking place in 2023 by President von der Leyen at the State of the Union speech on 14 September 2022, where skills needed for the green transition will also play a key role, and where a mindset of reskilling and upskilling is being promoted to support European companies grappling with staff shortage. NZIA's proposed articles on enhancing skills for quality job creation would further support Commission's efforts in fostering a mindset of reskilling and upskilling.

The Commission's Communication on "**A secure and sustainable supply of critical raw materials in support of the twin transition**" announces that the Commission will: establish a large-scale skills partnership on CRMs with stakeholders and public authorities under the EU Pact for Skills with the objective of rolling out successful education and training activities across the entire value chain to strengthen security-of-supply linked to the net zero tech value chains. It will propose to establish a Raw Materials Academy as part of the Net Zero Academies, to develop and offer training and education programmes to reskill and upskill a workforce for the upscaling of the critical raw material value chain in Europe.

Furthermore, there are relevant synergies between the NZIA proposal and the **Strategic Energy Technology (SET) Plan**,¹⁹⁶ which is a key stepping-stone to boost the transition towards a climate neutral energy system through the development of low-carbon technologies in a fast and cost-competitive way. . It steps up cooperation between governments, industry, and research institutes, between public and private investors in net-zero technologies. While the SET Plan focuses on

⁽¹⁹⁵⁾ As regards Pact for Skills figures, the following numbers have been published: 2 million people benefited from up-and re-skilling activities; 21 500 stakeholders joined forces in skills partnerships or networks; 15 500 training programmes were updated or developed; €160,000,000 was invested into upskilling and reskilling by Pact members.

⁽¹⁹⁶⁾ The SET Plan was established in 2007 to support the EU's energy and climate goals and make Europe a global leader in low-carbon energy and energy efficiency technologies. It is linked to the 5th dimension of the Energy Union – research, innovation and competitiveness – which are translated into SET Plan's 10 key actions. The SET Plan is the technology pillar of the EU's energy and climate policy. The latest SET Plan progress report has been published in November 2022: [SET Plan progress report 2022 \(europa.eu\)](#)

research and innovation through the whole innovation chain, from research to market uptake, the NZIA proposal focuses mostly on those technologies that are commercial and tradeable. Both the SET Plan and the NZIA proposal aim to maintain EU industrial leadership on low-carbon technologies, although the former is a non-legislative (or non-binding at EU level) instrument, whereas the latter is a Regulation.

Finally, in accordance with the 2021 Trade Strategy as well as the Green Deal Industrial Plan, the trade policy will help make the EU stronger and more competitive. It will build partnerships in flexible ways including by developing our formidable network of Free Trade Agreements (FTAs) and other forms of engagement. It will promote stability by safeguarding and reforming the WTO, which provides the guardrails against protectionism. Trade policy will also make the world more sustainable by combatting climate change, strengthening environmental protection and defending labour rights. Moreover, it will shield the EU from unfair trade practices and threats to its economic security.

ANNEX 3: SUPPORTED PROJECTS UNDER THE CENTRES OF VOCATIONAL EXCELLENCE

<p>Skills Agenda Centres of Vocational Excellence</p>	<p>Out of the Centres of Vocational Excellence (CoVEs) selected for funding so far, a significant number has focused on topics related to green skills, notably:</p> <p>GREENOVET – European VET Excellence Platform for Green Innovation will foster the development of Vocational Excellence in Green Innovation across Europe enabling an innovative, inclusive and sustainable economy. It will provide a platform to interconnect the European VET schools at regional, national, and transnational level together with key partners in the local innovation and skills ecosystems. http://www.greenovet.eu/</p> <p>EPLUG – European Platform for Urban Greening aims to increase the knowledge and skills required to address biodiversity, climate adaptation and well-being in the urban green living environment, and to broaden the expertise among professionals in Europe. The project specifically addresses the development of innovative curricula and teaching methodologies in the field of urban green landscaping, in order to raise the quality and adaptability of the skills ecosystem. https://www.platformurbangreening.eu/</p> <p>The European Hydrogen Academy is a topic under the Clean Hydrogen Joint Undertaking call for proposals 2023. It follows up on the ERASMUS+ project GreenSkills4H₂, aiming to select 19 core jobs for hydrogen, and launched in July 2022 for a four-year duration. The Academy addresses the lack of specialisation in several fields directly or indirectly related to job positions across the whole hydrogen value-chain, from production to storage to distribution to end-usage. After its initial deployment and setup, it will be followed-up under the Net Zero Industry Act as one of the Net Zero Industry Academies. To be funded with EUR 3 million, coming from the EU, and to be matched by the same amount by the private partners. The grant agreement is expected to be signed by the end of 2023, lasting between 36 to 54 months (depending on the awarded proposal) and the kick-off meeting will happen in early 2024.</p> <p>3LOE – Three-Level Centres of Professional Excellence: Qualification, Entrepreneurship and Innovation in the Green Economy aims for comprehensive provision of green skills. Addressing the challenges of energy, climate and environmental protection, 3LoE establishes Centres of Vocational Excellence on green economy and implements a wide range of vocational education, training, and higher education measures concerning green economy, digitalisation, and entrepreneurship. https://3-loe.eu/</p> <p>T-SHORE – Technical Skills for Offshore Renewable Energy develops innovative approaches for skills provision in the offshore renewable energy sector. Linking offshore-energy-hotspots spread across Europe and stimulate innovation and collaboration between VET providers, industry and research institutes. The project aims to develop and establish of a European network of VET-schools and VET training Centers in Offshore wind energy, establish strong links between businesses, research and VET providers and combining these stakeholders to meet the industry’s skills needs, understand and define new competency profiles and developing advanced digital and evidence based educational training methods and materials in a work-based learning environment. https://t-shore.eu/</p> <p>SECOVE – Sustainable Energy Centres of Vocational Excellence establishes a network of cooperation among CoVEs in 5 European countries, in the sector of clean and sustainable energy. The CoVEs will cooperate transnationally with each other through common structured forms of dialogue and communication. The network will target a wide range of groups in the area of sustainable energy: VET students and institutions, companies (both staff and managers), women across educational levels and sectors, policymakers, and organize impactful events: 28 local and transnational workshops, networking events, capacity building, transnational Conferences, provide training of adults in partner organizations, foster mobility of VET learners, and provide summer VET academies for girls in secondary education. https://secove-project.eu/</p> <p>SEED – Sustainable Energy Education aims to provide innovative vocational education and training skills provision, providing solutions for preventing global climate change and for Europe to become a fossil free energy continent. VET is seen as a driver for innovation and growth and agile in adapting to the labour market needs. The project aims to prepare learners and professionals with skills and competences for the future, and promote work-based, innovative approaches for transnational learning responsive to labour market needs, creating COVEs dedicated to sustainable energy in five regions, empowering regional innovation based on regional needs learning, developing a learning platform for the VET sector and regional stakeholders, establish an international learning community, and developing and exchanging good practices and tools. https://www.seedeuproject.eu/</p> <p>PoVE – Platform of Vocational Excellence Water Scale-up will educate and train VET learners to become agile, digitally skilled, and sustainable oriented water sector professionals. The project will have a holistic approach to VET in the EU Water sector with a central role in regional Innovation Ecosystems, and partnerships between VET, research, and the water industry. It will also set-up interlinking CoVE Water networks that operate on interregional level, drive innovation by developing Digital, VR learning materials and blended training, increase student’s, teacher’s and professional’s competence through international mobility, establish PoVE Water as a worldwide point of reference for VET in the water sector, and raise the attractiveness of the Water sector. https://povewater.eu/</p>
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ANNEX 4: SUMMARIES OF STAKEHOLDER SURVEYS IN RELATION TO THE NZIA PROPOSAL

Main bottlenecks identified based on the industry stakeholder target survey

The most systematic responses from stakeholders were received with respect to bottlenecks, classified into the overarching categories of permitting, supply chain, competition, infrastructure, access to markets, skills, costs, funding, and standards (see *Table A4.1*). Under these categories, the stakeholders specifically and repeatedly mentioned the following challenges (in descending order of importance or frequency):

1. Long lead times and lengthy permitting for projects and ramping up production capacity
2. A lacking level playing field with international competitors
3. Disruption and shortages in materials
4. Patchwork, unclear or constraining legislative frameworks at Union and/or national level
5. Difficulties in finding suitable production and deployment sites
6. Barriers related to public tenders
7. Shortage of a skilled workforce
8. Insufficient own production and dependency on manufacturing capacities of key components
9. High production costs.

In relation to permitting, stakeholders called for the need for national permitting authorities to proactively simplify coordination and streamline the procedures; the need for appointing single points of contact for projects; the need for full digitalisation of the procedures; the possibility for projects to carry out various procedures in parallel rather than sequentially; the need for authorities to adopt binding timeframes for different process-steps (and automatic approval when no reply); for national authorities to consider net zero technology manufacturing projects as projects of strategic priority and where feasible to grant preferred planning and permitting statuses (e.g. free economic zones, tax exemptions, etc.).

Additionally, but less frequent were bottlenecks related to lack of installation equipment, tariffs/import duties, subsidies for fossil technologies, lack of funding for R&I and first industrial deployment, as well as certification and standards and unclear EU funding mechanisms. The survey aimed to gather additional information on bottlenecks for scaling up manufacturing capacity to key net-zero technology sectors.

Barrier	Category	Solar	Wind	Batteries	Heat pumps	Electrolysers / hydrogen	Score
Long lead times and permitting for projects and for ramping up production capacity	Permitting	x	x	x		x	4
Disruptions and shortages in materials	Supply chain bottleneck	x	x	x		x	4
Patchwork/Unclear or constraining legislative framework	Regulatory framework	x		x	x		4
Level playing field with international competitors	Competition	x	x		x	x	4
Difficulties to find suitable production and deployment sites	Infrastructure	x	x	x			3
Barriers related to public tenders	Access to markets	x	x			x	3

Shortage of highly skilled workforce	Skills		x		x	x	3
Insufficient/dependency in manufacturing capacities of key components & equipment	Supply chain bottleneck	x	x				2
High production costs	Costs	x	x				2
Lack of installation equipment	Deployment		x				1
Tariffs / import duties	Costs	x					1
Subsidies for other (fossil) tech	Competition				x		1
Public funding for RDI and first industrial deployment	Funding					x	1
Certification and standards	Standards					x	1
Unclear EU funding mechanisms	Funding			x			1

Table A4.1: Main barriers mentioned by industry associations by sector. The score indicates how many times a certain barrier was mentioned; Source: Based on a survey sent by the European Commission DG GROW to industry stakeholders, February 2023.

Summary of the feedback from stakeholders responding via “Have your say” portal associated with the NZIA proposal.¹⁹⁷

- A prioritisation in permitting for NZIA may lead to **delays of non-strategic sectors**.
- The request for an Impact Assessment to **specifically address the reasons why some technologies were chosen** and why others not.
- **Span the scope of NZIA** and the technologies in the Annex to include semiconductors, innovative biofuels, decarbonization of heavy industry, circular economy projects, zero emission vehicles among others. Moreover, inclusion of nuclear energy in the light of application of the Euratom Treaty. Utilisation and transport of CO2 should be part of strategic net-zero technologies.
- **Inconsistencies with nuclear and inclusion in the ANNEX.**
- **Inclusion of the upstream value chain** as key components requires a better definition.
- The **benchmark seems problematic** for some stakeholders.
- NZIA does not address the **problem with electricity prices** and set to increase with the increase in demand by NZSP. Price ceilings and budgets of renewable energy auctions for considering additional cost due to qualitative criteria should be increased.
- **Support net zero project outside of the EU** for some technologies.
- A more cohesive and **simplified funding of CAPEX and upscaling OPEX** through the sovereignty fund.
- Lamenting the **lack of budget** and simple incentives us in the IRA in NZIA.
- **Clarity of interactions with the Hydrogen Bank** and other EU funding instruments (Hydrogen Valleys, Hydrogen Bank, Innovation Fund, EPCEIs).
- Ensure **regulatory coherence and legal certainty regarding environmental sustainability** requirements.

⁽¹⁹⁷⁾ [Net Zero Industry Act \(europa.eu\)](https://european-council.europa.eu/media/en/press-operations/infographic-117336.pdf)

ANNEX 5: EXAMPLES OF KEY STUDIES INFORMING THE SWD

Some of the key studies used to inform this Staff Working Document are enumerated below:

- JRC (2023) “Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study”, Joint Research Centre of the European Commission
- IEA- Energy Technology Perspectives. 2023
- IEA The State of Clean Technology Manufacturing: *An Energy Technology Perspectives Special Briefing, 2023*
- *IEA (2023) Renewables 2022: Analysis and forecast to 2027.*
- Commission’s Staff Working Document on Investment needs assessment and funding availabilities to strengthen EU's Net-Zero technology manufacturing capacity (SWD(2023) 68 final).
- European Commission (2022), “Progress on competitiveness of clean energy technologies”. COM/2022/643 final
- European Commission (2022). “European Climate Neutral Industry Competitiveness Scoreboard (CIndECS) – Annual Report 2021”.
- Clean Energy Technology Observatory (CETO). Reports 2022.¹⁹⁸
- Deloitte “Sustainability & Climate: IRA and the net-zero race – How EU industrial policy should respond, Issue 03/2023.
- Jansen J, Jäger, P, Redeker, N. “For climate, profits, or resilience? Why, where and how the EU should respond to the Inflation Reduction Act”, Hertie School / Jacques Delors Centre policy paper 5 May 2023
- McKinsey & Company “Building a competitive solar-PV supply chain in Europe”, December 2022
- *European Union (2022) “China 2.0, Status and Foresight of EU-China Trade, Investment, and Technological Race”, Publications Office of the European Union, Luxembourg, 2022, doi:10.2760/45420, JRC131882*

⁽¹⁹⁸⁾ Links to CETO reports 2022 are available at: [CETO reports 2022 \(europa.eu\)](https://europa.eu/ceto/reports-2022)

ANNEX 6: NET ZERO TECHNOLOGIES NOT INCLUDED IN THE NZIA ANNEX

As explained in section 5.2.1.1 above, the net zero technologies listed in the annex of NZIA are the ones which were found to be critical technologies for our path towards our 2030 climate and energy objectives. The choice of these technologies was based on the three criteria 1) technology readiness level; 2) contribution to decarbonisation and competitiveness; and 3) security of supply risks. The list is broad and inclusive.

The table below contains a non-exhaustive list of net-zero technologies which, among the very broad selection of net zero technologies, were not found to be responsive to the three criteria listed above, in the afore-mentioned temporality (by 2030).

	TRL ¹⁹⁹ ≥ 8	Additional contribution to decarbonisation and competitiveness by 2030	Security of supply risks
Ambient energy			The relevant energy to exploit ambient energy is heat pumps, which is considered a strategic net zero technology.
CCU			CCU was excluded from the list of strategic net zero technologies as it cannot be considered as a manufacturing technologies. Moreover, similar important identified gaps as for the case of CCS does not exist for CCU technologies.
Hydropower	Yes	Important system services (baseload capacity) and refurbishment of existing capacity required.	Limited: the EU holds 50% of the global exports of such technologies (with large EU construction firms providing their expertise in such projects for the construction of large dams throughout the world) and it is a manufacturer, industrial and scientific leader in the field. Nevertheless, there is a high risk of EU losing this leading position, e.g. in Africa and other emerging markets to Chinese technology providers in the near future
Biomass other than biogas, biomethane	Yes	Direct use of biomass is not expected to have a significant additional contribution to competitiveness by 2030. Indirect use of biomass, under the form of biogas/biomethane is listed among strategic net zero technologies.	EU has a strong power equipment industry and no significant dependency on imports was identified for biomass stoves or boilers and CHP units. There is no significant dependency for vessels, reactors and apparatus in the biofuels production.
Landfill gas/Sewage treatment gas	Yes	The collection and use of landfill gas and sewage treatment gas, though important measures to minimise damage to or deterioration of the environment and risk to human health, are not expected to have a significant contribution to either decarbonation objectives or competitiveness by 2030	No significant dependency on imports was identified for landfill gas/sewage treatment gas collection systems.

(199) IEA scale

		(essentially owing to the fact that these are established practised, and due to the limited growth of the resource).	
Sustainable alternative fuels and renewable fuels of non-biological origin, technologies which are not covered by upstream technologies referred to in NZIA Annex I	Yes	The trajectory outlined in the ReFuelEU Aviation initiative foresees that the share of sustainable aviation fuels will be 6% in 2030 (with a share of 2% of synthetic aviation fuels). It is around 2045 that sustainable aviation fuels will represent >50% of all aviation fuel volumes consumed in the EU. It can also be noted that a key input for plants producing synthetic fuels will be hydrogen, whose production is covered among strategic net zero technologies (through the inclusion of electrolyzers).	Moderate to strong risk for synthetic aviation fuels for which both renewable hydrogen and CO2 capture is necessary. High offshoring risks, as synthetic fuels are much easier to transport than hydrogen itself. In result, synthetic fuel production, if not properly supported, may shift to location in close proximity where hydrogen is produced.
Advanced technologies to produce energy from nuclear processes with minimal waste from the fuel cycle, and related best-in class fuels	Yes	Because of very long lead times in the nuclear industry, investments in energy generation from nuclear sources incentivised by NZIA provisions would be unlikely to provide significant results before 2030 (let alone investments in manufacturing assets which, once setup, will produce components which will in turn be used for the deployment of additional nuclear generation capacities).	Only moderate: Europe has a widely recognised expertise in nuclear energy generation, along with a strong industrial base: newly commissioned installations over recent years have only called for the import of a limited proportion of machinery and components.
Small modular reactors, and related best-in-class fuels	Yes	Because of very long lead times in the nuclear industry, investments in energy generation from nuclear sources incentivised by NZIA provisions would be unlikely to provide significant results before 2030 (let alone investments in manufacturing assets which, once setup, will produce components which will in turn be used for the deployment of additional nuclear generation capacities).	Europe already has a high degree of expertise and experience in nuclear technologies applicable for the development and deployment of SMRs, with a supply chain that could generate most of the value added within Europe. The relevant expertise and experience which can be utilised for the development and deployment of SMRs has been accumulated in EU member states regarding the whole lifecycle of large power reactors, as well as the whole value chain for fuel fabrication and related services.
Energy-system related energy-efficiency technologies	Yes	In the context of NZIA, the targeted energy efficiency technologies are the ones which are considered “energy-system related” and which main function is to improve energy efficiency. Examples of such technologies are energy management/control systems including building automation and control systems, heat pumps, industrial automation and control systems, and Variable Speed	

	<p>Drives (VSD). Therefore, unlike the majority of strategic net zero technologies, energy efficiency technologies constitute a composite set of technologies. Taken collectively, and overall, there are no major identified dependencies on a single supplier (precisely due to their composite nature), so criterion #3 would not apply. While taken one by one, some dependencies may exist for specific sub-technologies within energy efficiency technologies, at individual technology level, criterion #2 would not apply any more (because each sub-technology only has a minor contribution to decarbonization and competitiveness compared to the overall contribution of this greater set of technologies), to the exception of heat pumps and energy management/control systems, already included in the Annex. So either way (i.e. whether they are taken individually or as a whole), energy efficiency technologies do not fulfil either criterion #2 (contribution to decarbonization and competitiveness) or criterion #3 (security of supply risks).</p>
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Table A5.1: Reasoning of why some net-zero technologies covered by the NZIA proposal are not part of its Annex

**ANNEX 7: ILLUSTRATIVE EXAMPLES OF COMPONENTS COVERED BY THE NZIA PROPOSAL
FOR A SELECTED SET OF STRATEGIC NET ZERO TECHNOLOGIES**

Components	Assemblies / end products
Permanent magnets	Wind turbines
Blades	
Nacelle casing	
Gearbox	
Shafts	
Power generator	
Bearings	
Tower	
Others	
Silicon Ingots	Solar PV panels
Silicon Wafers	
Solar Cells	
Modules	
Inverter	
Junction box	
Frames	
Connectors	
Others	
Compressor	Heat pumps
Electronic control	
Heat exchanger	
Tanks & hot water cylinders	
Valves	
Pumps	
Fans	
Pipework	
Others	
Anodes	Li-ion battery technologies
Cathodes	
Electrolytes	
Separators	
Others	
Anodes	Electrolysers
Cathodes	
Catalysts	
Membranes	
Electrolytes	
Bipolar plates	
Others	

Anodes	Fuel cells
Cathodes	
Electrolytes	
Catalysts	
Bipolar plates	
Cell sealants	
Others	
Conductors, towers, insulators	Grid technologies
Transformers	
Switchgears	
Circuit breakers	
Capacity banks, bus bars	
Others	
Membranes	Biomethane technologies
Electronic components	
Others	
Solar thermal panels, pipes, tanks	Solar thermal
Concentrated solar plant: mirrors, lenses, tower (for molten salt), heat exchanger, heat engine (steam turbine); power generator	
Others	

Table A6.1: An indicative non-exhaustive listing of types of components that are covered by the NZIA proposal for a selected set of strategic net-zero technologies; A relevant source in this respect is the European Commission’s “Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study”, JRC Science for Policy Report, S. Carrara et al, 2023

ANNEX 8: IMPACTS ON NET-ZERO INDUSTRIAL OUTPUT SHOULD NZIA OBJECTIVES BE ACHIEVED

The impacts on the net-zero industrial output that could be achieved should NZIA’s objectives come to fruition are presented in the Figures A7.1 and A7.2.

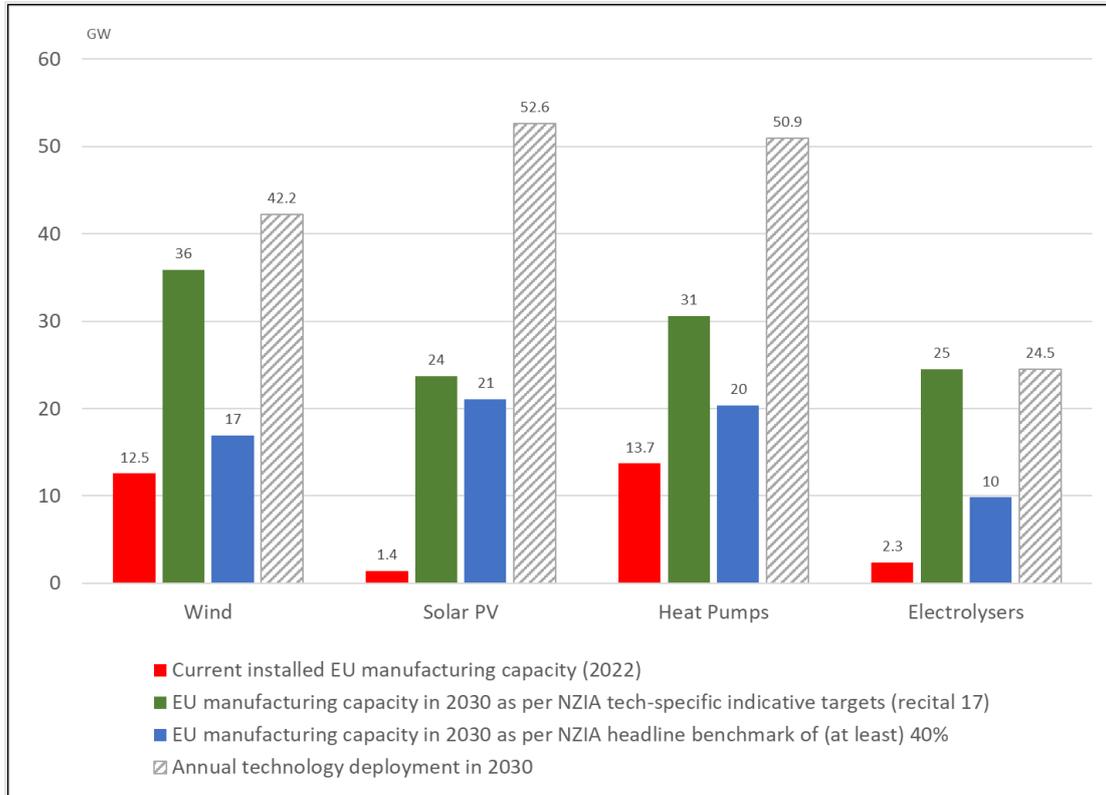


Figure A7.1: Implications of achieving NZIA’s headline benchmark (art. 1.2(a)) and indicative tech-specific objectives (recital 17) for the net-zero industry manufacturing capacity for wind, solar PV, heat pumps, and electrolysers (GW). Source: Drawing on the figures presented in SWD(2023) 68 final. Notes: Capacity is expressed in GW of electricity for electrolysers and GW AC for solar PV. For solar PV, capacity represented above relates to solar cells (which currently stands at around 1.4 GW according to Bloomberg NEF estimates).

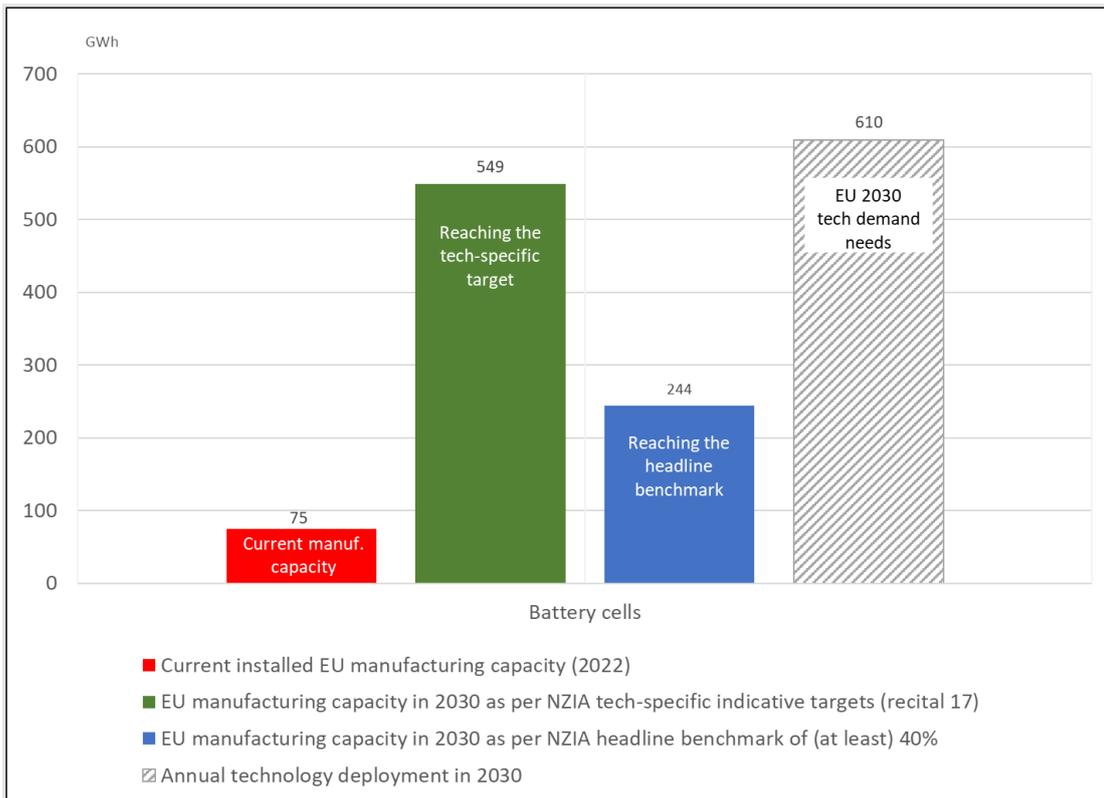


Figure A7.2: Implications of achieving NZIA’s headline benchmark (art. 1.2(a)) and indicative tech-specific objective (recital 17) for the net-zero industry manufacturing capacity for battery cells (GWh). Source: Drawing on the figures presented in SWD(2023) 68 final.