9 Europe's green industrial policy

Simone Tagliapietra, Cecilia Trasi and Reinhilde Veugelers

1 Introduction

The transition of economies from brown to green represents the major socio-economic transformation of our time, often referred to as an industrial revolution against a deadline. Never in history has technological development been so crucial to tackle a global common good. The goal is clear: to facilitate a comprehensive decarbonisation process to avoid the most dramatic impacts of global warming, while simultaneously tackling the socio-economic issues that this transformation will unavoidably create.

With the European Green Deal, Europe has pledged to become the first climate-neutral continent by 2050. To get there, the European Union has committed to cut its greenhouse gas emissions by 55 percent by 2030 compared to 1990 and has also started to adopt the necessary legislation – the so-called 'Fit for 55' package – to turn this objective into reality (Tagliapietra and Veugelers, 2021).

But a strategy only based on climate targets and instruments would fall short if firms and citizens fail to adjust or reject the adjustment. The need to meet climate and environmental targets, while ensuring their economic and social sustainability, requires a transformation that generates enough benefits to compensate the losers. This puts industrial policy under the spotlight in the context of the European Green Deal's promise to be the EU's new growth engine.

Europe's focus on green industrial policy has gained momentum, notably since the adoption by the United States in August 2022 of the

Inflation Reduction Act (IRA). The IRA prompted fears of relocation of European clean-tech industries to the US, attracted by a combination of subsidies and protectionist local-content requirements. Regardless of how reasonable these fears are, this new geoeconomic context poses two challenges for Europe.

First, Europe is already lagging Asia and the US in the global race for digital technologies. It cannot afford to give up its position in the global race for clean technologies and miss out on the industrial growth opportunities from the green transition.

Second, for overall competitiveness and growth, the European economy is heavily reliant on carbon-intensive industries, such as the automotive industry. These sectors will undergo significant restructuring in the coming years, because of the transition to clean technologies – to electric vehicles, for example. A green industrial policy is therefore needed to ensure the success of the green transition and to help maintain and strengthen the EU's socio-economic model. This is why the EU has packaged the European Green Deal as its 'growth strategy' and why it has reacted nervously to the IRA by proposing its own Net Zero Industry Act (European Commission, 2023a).

In this chapter, we: i) outline a set of principles for an effective green industrial policy in Europe; ii) provide an overview of Europe's ongoing green industrial policy measures; iii) set out recommendations to deliver a more effective green industrial policy in Europe.

2 Principles for an effective green industrial policy in Europe

Green industrial policy is unique. Instead of solely focusing on the competitiveness of industries and companies, as is typical of traditional industrial policy, green industrial policy tackles the broader societal challenges arising from global warming. This sets it apart from climate-change policy, which usually has more narrow objectives aimed at reducing carbon emissions.

Similar to standard industrial policy, the selection of tools and projects for green industrial policy should be based on where the private

and public returns from clean markets diverge the most. A green industrial policy should be developed in coordination with the instruments used for climate policy, and with industrial policy instruments more generally. For example, carbon pricing is an important instrument in the green industrial policy toolbox, which also includes subsidies, taxes, targets, regulations, and standards.

Green technologies, often still emerging, are complex and uncertain. Future uncertainty about climate and technology scenarios underlines the importance of learning and information sharing, and thus experimentation, risk taking, self-discovery on the market and industry-research-policy collaborations to share risks, costs and information.

Clean technologies are also characterised by inflated costs or benefits for those other than the producers (Martin and Verhoeven, 2022), if only because of the variety of climate policies worldwide. This calls for a more directed approach to supporting investments in clean technologies. In addition, a clean-tech investment push is necessary to counter the locking-in of fossil fuel-based technologies and their path-dependencies.

The difficulty in profiting from green technologies, and in developing new low-carbon technologies, lies in the hidden support provided to fossil-fuel products in different forms, from the absence of a carbon price to explicit subsidies. These mechanisms can skew the market in terms of production, technology adoption and innovation (Aghion *et al*, 2016; Aghion *et al*, 2019). The case for subsidising green technologies, in this sense, is broader and stronger than the general case. Environment-directed innovation policy. Needs to select 'clean' to address the greater knowledge spillovers and lock-in problems. This still leaves the questions of whether and how to choose between 'clean' technologies, and which winners to pick (eg focusing on individual clean technologies such as batteries or hydrogen). When choosing between clean technologies, the principle of divergence between expected social and private returns, and the greatest scope for reducing clean market failures, should guide the decision-making process. Choosing between clean technologies should also take into account the impact of any choice on

other non-selected clean technologies. This calls for a good mix between vertical and horizontal instruments and putting time limits on support, and emphasises the importance of ensuring fair competition (Aghion *et al*, 2011).

The climate crisis requires urgent mitigation efforts and green industrial policy is no exception. More than other areas of industrial policy, the lack of risk-taking in clean-tech sectors can be particularly problematic overall. A green innovation policy portfolio with risks entails acceptance that there will be failures. This makes experimentation a key principle of green industrial policy, alongside close monitoring of the effectiveness of experiments and adaptability.

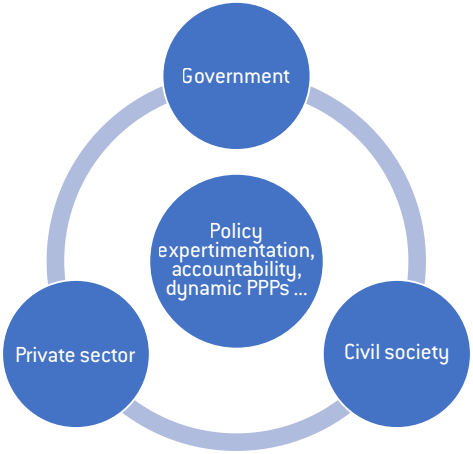
Finally, by addressing broader societal concerns, green industrial policy requires the involvement of a variety of stakeholders covering a larger set of private-sector areas. Public-private partnerships ought to be central in green innovation policy, much more than in climate policy and standard industrial policy. The extent of the transformation brought about by climate change means there is more need for the involvement of, and support from, civil society than in other areas of industrial policy.

3 Designing green industrial policy

Most of the challenges for green industrial policy deal with practical implementation rather than with theoretical justifications. This section lists a set of principles for green industrial policy design that draws especially on the insights of "*new industrial policy*" (Rodrik, 2014; see also Tagliapietra and Veugelers, 2021).

When introducing his new industrial policy perspective, Rodrik (2014) said industrial policy should be about institutionalised collaboration and dialogue between governments, the private sector and civil society, spanning multiple sectors, technologies and value chains (Figure 1), rather than about "*who gets how much*".

Figure 1: The new industrial policy approach as a process of institutionalised collaboration and dialogue



Source: Bruegel based on Rodrik (2014).

To implement a new green industrial policy approach, it is important for governments to work with the private sector and civil society to identify constraints and opportunities, leveraging their knowledge and capacities to generate solutions, while addressing issues such as rent-seeking and political capture. This in turn requires accountability and a balanced set of incentives and penalties, with coherent, measurable and well-communicated targets to enable effective monitoring and evaluation.

Co-financing should be used to support projects that accelerate and consolidate existing scientific and industrial capacity, and new projects at the frontier of technologies and markets along the entire value chain, from research, development and diffusion, to manufacturing, distribution and sales.

Information problems and the elevated level of uncertainty can be dealt with by viewing green industrial policy as a continuous learning process through policy experimentation. To encourage risk-taking,

policy should include milestones and should be adapted depending on lessons learned from regular monitoring and evaluation.

Finally, coordination between the many different stakeholders, policy governance areas, instruments and projects will require strong operational governance for successful green innovation policy.

4 An overview of Europe's current green industrial policy

The EU sets the framework for green industrial policies throughout the bloc through competition policy, trade policy, EU single market rules, climate policy, research and innovation policy, EU public investment and regional development policy. It has in place a wide range of policy tools, including public funding for green research, development and deployment of green technologies, green public procurement and clean energy standards (Table 1). This section summarises the financial tools available at EU level to support clean-tech innovation and deployment.

Table 1: Europe's main green industrial policy tools

	Innovation	Deployment	Framework conditions
EU level	• Horizon Europe European Research Council • European Innovation Council • European Institute of Innovation and Technology	• European Alliances • IPCEIs • EU Innovation Fund • European Investment Bank • EU Cohesion Funds • NextGenerationEU • Single market rules	• Trade and investment policy • Competition policy • Environmental standards • Climate policy • Energy policy • Development policy
National level	Regional level	• State aid • Investment programmes • Incentive programmes • Public procurement rules • Clean energy standards	• Energy policy • Environmental standards • Environmental taxation
Regional level	Regional level	• 'Smart' specialisation strategies • Regional investment budgets • Implementation of EU Cohesion policies	Regional regulations

Source: Bruegel.

4.1 Innovation

Horizon Europe is the EU's main funding programme for research and innovation[48]. Its budget is €95.5 billion for 2021 to 2027, of which €5.4 billion comes from NextGenerationEU[49]. Among other things, it seeks to tackle climate change and boost the competitiveness and growth of the EU. Horizon Europe also has a strong focus on green technologies. The programme defines a new partnership instrument, the Horizon Europe Missions, to catalyse cross-sectoral investments to find solutions to pressing challenges for society. In September 2020, Mission Boards proposed five Missions, of which four have a climate change/environment angle: A Climate Resilient Europe; Mission Starfish 2030: Restore our Ocean and Waters; 100 Climate-Neutral Cities by 2030 – by and for the citizens; Caring for Soil is Caring for Life.

The European Research Council (ERC)[50] was created in 2007 to fund frontier research through grants. Since its creation, it has funded more than 12,500 projects with an emphasis on early-stage researchers. The overall ERC budget from 2021 to 2027 is more than €16 billion. While ERC projects are selected for funding without thematic priorities, the research undertaken by many ERC grantees generates knowledge in support of the European Green Deal[51].

The European Innovation Council (EIC)[52] was created in 2017 to help companies grow and expand beyond European borders. It has a budget of €10.1 billion for 2021 to 2027. Money is provided to beneficiaries as grants and/or as equity investment. The EIC is split into two branches: the EIC Accelerator and the EIC Pathfinder. Although also a programme funding bottom-up proposals without thematic priorities, the EIC is

48 See: https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en.

49 See: https://commission.europa.eu/strategy-and-policy/recovery-plan-europe_en.

50 See: https://erc.europa.eu/about-erc/erc-glance.

51 See https://erc.europa.eu/projects-statistics/frontier-research-european-green-deal.

52 See: https://eic.ec.europa.eu/about-european-innovation-council_en.

strong in the areas of clean energy, clean mobility and smart buildings[53].

The European Institute of Innovation and Technology (EIT)[54] was created in 2008. Its 2021 to 2027 budget is €2.9 billion from Horizon Europe. The EIT supports the development of pan-European partnerships between companies, research labs and universities, known as EIT Innovation Communities (Knowledge and Innovation Communities – KICs), which aim to find answers to global challenges. The EIT provides grants with a varying funding rate according to the life cycle of the KICs. Five out of the eight Communities at time of writing are strongly relevant to green industrial policy: EIT Climate-KIC: Innovation for climate action, EIT InnoEnergy, EIT Manufacturing, EIT Raw Materials and EIT Urban Mobility.

4.2 Deployment

The EU Innovation Fund (IF) was established under the EU emissions trading system (ETS) for the period 2021-2030 with at least 450 million carbon allowances. Assuming a carbon price of €75 per tonne, the Fund will provide around €38 billion of support over the period. Projects supported by the fund are expected to be implemented in collaboration with industry partners, research institutions and other stakeholders. As of March 2023, 52 projects had been signed, for a total contribution by the Fund of €2.94 billion: 58 percent of projects target energy-intensive industries, 21 percent renewable energy, 17 percent energy storage and 4 percent carbon capture and storage.

Industrial Alliances are a tool to promote public-private partnerships with an increasingly leading role in regulating and directing funds towards the strategic priorities identified by the European Commission. The aim is to maximise the job, growth and investment potential of new green technologies, and to prevent a technological dependence on

53 See https://eic.ec.europa.eu/news/green-deal-challenge-eic-supports-solutions-2021-12-15_en.

54 See https://eit.europa.eu/.

EU competitors. In practice, these Alliances are a network of industrial and innovation players (including SMEs), regional authorities, national authorities, the European Commission and the European Investment Bank. Out of the nine Industrial Alliances, at least three cover clean technology industries (Box 1).

Box 1: EU Industrial Alliances in the clean-tech supply chain

Launched in 2017, the *European Battery Alliance (EBA)* initiative is intended to support frontier innovation along the batteries value chain, from mining and processing of raw materials, production of advanced chemical materials, design of battery cells and modules and their integration into smart systems, to the recycling and repurposing of used batteries. This includes providing adequate training at EU and country level, re-skilling and upskilling, making Europe attractive for world-class experts in the field, and supporting the sustainability of EU battery cell manufacturing industry with the lowest environmental footprint possible.

Launched in 2020, *European Clean Hydrogen Alliance* aims to foster the deployment of hydrogen technologies up to 2030, bringing together renewable and low-carbon hydrogen production, demand in industry, mobility and other sectors, and hydrogen transmission and distribution. The main target is to reach a level of six gigawatts (GW) of clean hydrogen by 2024, and then 40 GW (EU) and 40 GW (non-EU) clean hydrogen by 2030. The Alliance covers about 750 projects in six main thematic areas of intervention, from renewable and low-carbon hydrogen production to industrial applications and energy.

Also launched in 2020, the *European Raw Materials Alliance (ERMA)* focuses on securing access to resources deemed strategic for the development of a green industrial value chain and on mobilising investment and innovation in this area. Its creation is in line with the recommendations of the Action Plan on Critical Raw Materials on reducing Europe's dependency on third countries, diversifying supply from both primary and secondary sources and improving resource efficiency and circularity, while promoting responsible sourcing worldwide.

Important Projects of Common European Interest (IPCEI) were introduced in 2014 in the context of a wider modernisation of state aid rules to facilitate the disbursement of aid targeted at identified market failures and objectives of common EU interest and considered the least distortive (so-called 'good aid'). To qualify for support under the IPCEI framework, a project must: i) contribute to strategic EU objectives; ii) involve several EU countries; iii) involve private financing by the beneficiaries, iv) generate positive spill-over effects across the EU, and v) be highly ambitious in terms of research and innovation. IPCEIs thus seek to bring together knowledge, expertise, financial resources and partners throughout the EU by supporting cross-border projects. As of March 2023, the European Commission has approved state aid in the context of five IPCEIs to support the development of a European clean-tech industry (Table 2).

Table 2: IPCEIs in the EU

Industry	Launch	Description and objectives	Countries	Public invest.	Private invest.
Micro-electronics	12/2018	(i) Energy efficient chips; (ii) Power semiconductors; (iii) Smart sensors; (iv) Advanced optical equipment; (v) Compound materials.	DE (€820 million), IT (€524 million), FR (€355 million), UK (€48 million)	€1.75 billion	€6 billion
Batteries	12/2019	IPCEI Battery I - (i) Raw and advanced materials; (ii) Cells and modules; (iii) Battery systems; (iv) Repurposing, recycling, and refining.	DE (€1250 m), FR (€960 m), IT (€570 million), PL (€240 million), BE (€80 million), SE (€50 million), FI (€30 million)	€3.2 billion	€5 billion
	01/2021	IPCEI Battery II - The project complements the first IPCEI in the battery value chain.	AT, BE, DE, EL, ES, FI, FR, HR, IT, PL, SK, SE	€3.2 billion	€5 billion
Clean Hydrogen	07/2022	IPCEI Hy2Tech - (i) the generation of hydrogen; (ii) fuel cells; (iii) storage, transportation, and distribution of hydrogen; (iv) end-users' applications, especially mobility sector.	AT, BE, CZ, DE, DK, EE, ES, FI, FR, EL, IT, NL, PL, PT, SK	€5.4 billion	€8.8 billion
	09/2022	IPCEI Hy2Use - complements a "Hy2Tech". The target is to build new electrolysis capacity of approx. 3.5 GW equivalent to 340,000 tons of renewable and low-carbon hydrogen per year.	AT, BE, DK, FI, FR, EL, ES, IT, NL, PL, PT, SK, SE	€5.2 billion	€7 billion
	09/2022	IPCEI Hy2Use - complements a "Hy2Tech". The target is to build new electrolysis capacity of approx. 3.5 GW equivalent to 340,000 tons of renewable and low-carbon hydrogen per year.	AT, BE, DK, FI, FR, EL, ES, IT, NL, PL, PT, SK, SE	€5.2 billion	€7 billion

Source: Bruegel.

The European Investment Bank (EIB) has positioned itself as the EU's "*climate bank*" since 2019. It adopted a new energy lending policy and sustainability strategy based on three pillars: i) end of lending for fossil-fuel projects from the end of 2021; ii) focus future financing on clean energy innovation, energy efficiency and renewables; iii) unlock €1 trillion of climate and environmentally sustainable investment in the decade to 2030. In 2022, the EIB allocated around €17.5 billion to the transport and industrial sectors. We estimate that €3.3 billion of this package was targeted at clean technology projects. In addition, the EIB provided €10.4 billion to projects in the energy sector, out of which €4.4 billion went to renewable energy-related projects. The EIB is also responsible for the implementation of around 75 percent of the EU guarantees allocated to the InvestEU programme. This is a tool with an EU budget guarantee of €26.1 billion to promote private investments in priority areas, distributed between four policy windows, including sustainable infrastructure (€9.9 billion) and research, innovation and digitisation (€6.6 billion).

Finally, it is worth mentioning that most state aid in the EU is paid out by EU countries. This state aid requires approval by the European Commission. In 2020, state aid approved for objectives related to environmental protection, renewable energy and energy savings amounted to €61.41 billion, with indications of levelling off compared to previous years (European Commission, 2022a).The Commission issued guidelines on state aid for climate, environmental protection and energy (CEEAG) in January 2022, to implement the European Green Deal objective of revising state aid rules to support a cost-effective and just transition to climate neutrality (European Commission, 2022b).

EU countries also have access under the NextGenerationEU Recovery and Resilience Facility (RRF) to loans and grants to support green investments, including for decarbonisation of industry and the strengthening of clean-tech supply chains.

Nevertheless, despite all these elements of green innovation policy at EU level, there remains a long way to go to achieve a green industrial policy, as outlined in section 2. Notably, strong governance that can

ensure the consistency of green industrial policy is missing. Instead, the EU green industrial policy strategy seems more like a scattered collection of energy, climate, innovation and social policy initiatives, rather than a coherent industrial policy framework.

5 Recommendations for a more effective green industrial policy in Europe

The need to tackle climate change calls for a green industrial revolution. A new policy-driven approach should be based on strong governance, on formalised collaboration with the private sector and civil society, and on development of solutions that combine public and private knowledge and capacities. To design green industrial policy, a new industrial policy perspective is helpful. This should have much broader multi-dimensional objectives and should view policymaking as a process of partnership between the public sector, the private sector and society, rather than a top-down approach of allocating funds to a few winners.

The traditional EU strategy is not sufficient to turn the green transition into an industrial opportunity. The EU faces challenges in coordinating and achieving the necessary economies of scale because of the fragmentation of tools and funding sources, and because of nationalistic industrial policies. While some elements already reflect the new industrial policy approach, such as provision of support for industrial ecosystems encompassing all players operating in a value chain, much stronger measures are required to develop an effective EU green industrial policy.

5.1 Governing public-private collaboration and dialogue

Given the inherent complexities of both green industrial policy and the EU as policymaking machinery, strong governance is a prerequisite for effective EU green industrial policy. Only a leadership that is competent, independent and accountable to clear goals and milestones, and that encourages risk-taking, can coordinate the progress of different government groups, which are each responsible for distinct parts of green industrial policy.

5.2 Revamping EU-level subsidies for green innovation

While the EU should not copy the US IRA production subsidies, there may be a case for more EU subsidies for green R&D, innovation and early-stage deployment of next-generation green technologies, in which EU companies could build globally competitive positions. There may also be a case for building or maintaining within the EU minimum levels of capacity in certain areas critical for the green transition, to make the EU more resilient to natural or political shocks.

The EU should design such subsidies without harming the single market's level playing field. This justifies an EU-level approach, particularly for early-stage, high-risk projects, which are more vulnerable to market and eco-system failures. There should be more reliance on synergies, integration of knowledge spillovers, and cost and risk sharing, rather than on national subsidies. Current schemes are bureaucratically heavy and end up mostly supporting a few large incumbent firms that can propose and manage such projects, which typically take place in the EU countries that have sufficiently deep pockets to support them. While large firms can play anchor roles in such projects, it is important to ensure that smaller players and radically new clean eco-systems can find their place (Poitiers and Weil, 2022). Otherwise, the IPCEI format may fail to pick 'winning' clean eco-systems or particularly disruptive new green technology solutions, proposed by new young firms.

EU funding should also be deployed to improve EU strategic resilience. This involves support for new technological solutions for critical components that, without support, might make EU clean-tech production vulnerable to supply chain disruption. The EU should, for example, fund mission-oriented programmes to develop substitutes for certain critical raw materials. For these new early-stage projects, the EU approach should rely on an instrument other than IPCEIs. Novel support models that provide grants in a relatively non-bureaucratic

way are crucial to unleash high risk/high return ideas[55]. Funding such grants could be the main purpose of the EU Sovereignty Fund proposed by the European Commission[56].

New joint borrowing may not be needed to fund such EU initiatives. As suggested by the European Commission (2023b), one option could be to re-shuffle EU budget money. Another option could be to make use of the additional grants that will be devoted to the new REPowerEU facility under the RRF, and to blend some of this money with EIB loans and guarantees[57].

Public funding can be more efficient when leveraging private investments in clean-tech public-private partnerships, with the size of the multiplier depending on the framework conditions that shape the private incentives for clean-tech investment. A green EU subsidy policy should thus be accompanied by monitoring of the barriers private firms face when investing in clean tech. These barriers can include lack of access to finance, excessive regulatory burdens, lack of access to public (procurement) and private markets, and lack of access to critical skills and components. Unless these barriers are addressed, additional public funding may not be as efficient. A further complementary policy instrument is carbon pricing. The EU ETS remains the critical cornerstone of any net-zero industry strategy.

5.3 Leveraging the single market as the most valuable tool

The single market is the EU's most valuable tool for EU green industrial policy. Single market rules can accelerate the roll-out of clean

55 See Tagliapietra and Veugelers (2021) on how to design such green subsidy programmes at EU level.

56 See European Commission press release of 15 September, 2022: https://ec.europa.eu/commission/presscorner/detail/en/statement_22_5543.

57 This will be financed through the frontloaded sale of emissions trading system allowances (40 percent) and the resources of the Innovation Fund (60 percent). The distribution of these extra resources will take into account cohesion policy, EU countries' dependence on fossil fuels and the increase in investment prices. See Regulation (EU) 2023/435.

technologies by avoiding regulatory costs associated with fragmentation, uncertainty, and bureaucracy. These include regulations that place time limits for decisions at each stage of permitting procedures, a measure that can accelerate developments in areas vital to decarbonisation, thus enlarging clean-tech markets more quickly. For example, in December 2022, EU countries agreed a temporary emergency regulation to fast-track permits for renewable energy infrastructure and grids (Council Regulation (EU) 2022/2577).

Similarly, tighter European standards can foster global competitiveness by demonstrating marketability and attracting investment into firms that comply with standards. One example, agreed by the EU in December 2022, is the introduction of stronger environmental sustainability requirements for all batteries sold in the EU[58]. Another option could be to develop regulatory sandboxes – frameworks for experimentation – to push for quicker development of clean technologies and fast-tracking of the necessary certifications required for placing them on the market[59]. Coordinated use of procurement can provide a larger, more integrated lead market for clean technologies. An efficient EU electricity market design could help to lower energy costs structurally, also for clean-tech manufacturers, with the related competitiveness benefits. Greater use of green public procurement would be particularly important in sectors in which public purchasers make up a large share of the market, including transport and construction (Rodríguez Quintero *et al*, 2019). By introducing sustainability requirements for clean technologies (for instance, by rewarding in tenders the use of electric cars that are produced to certain sustainability criteria, or based on certain innovation or environmental

58 See European Parliament press release of 9 December 2022: https://www.europarl.europa.eu/news/en/press-room/20221205IPR60614/batteries-deal-on-new-eu-rules-for-design-production-and-waste-treatment.

59 Such schemes already exist in EU countries, notably in Germany (see https://www.bmwk.de/Redaktion/EN/Dossier/regulatory-sandboxes.html). EU countries endorsed regulatory sandboxes in November 2020; see Council conclusions of 16 November 2020: https://www.consilium.europa.eu/media/46822/st13026-en20.pdf.

features), the EU could prioritise the deployment of clean technologies produced to European standards, without having any form of local content requirement[60].

5.4 Skills

The speed of manufacturing and roll-out of clean technologies is correlated closely with the simultaneous development of a qualified workforce to implement clean projects. Ensuring enough skilled workers is of prime importance for Europe, to avoid shortages and to ensure a prominent level of productivity for its clean-tech industry. This also is a crucial item when it comes to the just transition, as part of the workforce currently employed in carbon-intensive sectors can be re-skilled and re-employed in green-energy projects (IEA, 2022).

Recognising these factors, the EU has a European Skills Agenda (European Commission, 2020) intended to help individuals and businesses develop more and better skills in these sectors. It has earmarked sizeable funds to support worker training: the €61.5 billion European Social Fund Plus (ESF+), and the Just Transition Fund (JTF) and the RFF.

The European Commission (2023a) has stressed that the EU and its members can do more. For instance, as Europe seeks to develop pan-European clean-tech supply chains, it would be efficient to have integrated continuous monitoring at EU level of the supply of and demand for green skills and jobs. The EU single market for clean skills could be promoted by developing a Europe-wide strategy for clean-tech higher qualifications, and by easing intra-EU mobility of talent, linked also to Erasmus+ funding. Sector-level efforts should also be made through links

60 Environmental criteria in public procurement should be handled carefully, as they might expose officials to lobbying and electioneering (for instance, to protect local producers against competition; Blanchard *et al*, 2022). But this risk could be mitigated by using precise and easy-to-verify award criteria (eg CO2 emissions of cars or carbon intensity of electricity) rather than imprecise and hard-to-verify criteria (eg environmental criteria related to the suppliers). This requires a clear categorisation of green criteria and adequate investment in the training of public authorities that must apply them (Sapir *et al*, 2022).

to European industrial alliances. The establishment in February 2023 of a large-scale skills partnership for onshore renewable energy[61] was a welcome first step.

6 Conclusions

In early 2023, the European Commission published a Green Deal Industrial Plan (European Commission, 2023a), intended to leverage the single market and improve the competitiveness of Europe's net-zero industry. Its main plank was a proposal for a Net Zero Industry Act (NZIA) that serves three main purposes.

First, it identifies the net-zero technologies deemed of strategic importance, including renewable energy technologies, batteries, electrolysers and carbon capture and storage (CCS) technologies. Second, it defines a target for manufacturing capacity of at least 40 percent of the EU's annual deployment needs of these technologies by 2030. Third, it would establish a governance system resting on Net-Zero Strategic Projects (NZSPs) identified by EU countries, and a regulatory framework to facilitate their rapid implementation, including fast-track permitting and administrative procedures, evaluation of public procurement procedures against a 'sustainability and resilience' criteria, and a streamlined process for EU countries to grant aid to accelerate the green transition.

Yet, the design of the governance framework falls short. The NZIA would still rely on the dispersed assemblage of policy tools and initiatives, instead of delivering a systematic green industrial policy. Even more troubling is the how the proposed NZIA prioritises net-zero technology sovereignty and the pursuit of strategic autonomy over efficiency and the imperative of global decarbonisation. The US IRA is a wake-up call for the EU that a more coherent framework and public support is required for the manufacturing and deployment of clean technologies. However, rather than following the paths taken by others, the EU must

61 Under the Pact for Skills. See industriALL press release of 10 February 2023: https://news.industriall-europe.eu/Article/860.

leverage its strengths to meet the challenge of the green industrial transition, particularly by boosting the single market.

Policies should aim to improve the attractiveness of the single market as a location for green investment, with horizontal measures to enhance market functioning and specific measures in support of clean technologies. Examples of these measures include better regulation, better green procurement rules and EU-level financing to promote new or early-stage clean tech, in which EU firms can achieve sustainable competitive positions. Finally, a stronger governance model is needed to ensure better coordination and longer-term commitment.

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