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REPORT MAY 2023

MAKING CLEAN TECHNOLOGY VALUE CHAINS WORK FOR EU ECONOMIC CONVERGENCE

A CASE STUDY ON PORTUGAL

ARTUR PATULEIA, ALEKSANDRA WALISZEWSKA

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The report reflects the state of affairs as of 27 April 2023.

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EXECUTIVE SUMMARY

Recent developments on the world stage have accelerated investment in clean technology and manufacturing. The United States Inflation Reduction Act (IRA) and the European Union Green Deal Industrial Plan have turbo-charged this trend. Estimates suggest the IRA could generate $1.7 trillion in investment in US green tech over the next ten years.[1] The EU Green Deal Industrial Plan foresees €578 billion in public funding alone.[2] Demand for clean technology solutions has already sharply surged in response to the recent gas price hike with heat pumps (+38%[3]), battery storage deployment (+40%[4]) and electric vehicles market share (+33%[5]) setting new yearly records in 2022 in the EU. While this suggests a positive outlook for green industrial investment across the EU, it is unclear how these gains will be distributed among member states, and therefore how the transition will impact EU cohesion and solidarity.

This report assesses these challenges in the context of Portugal, a member state strongly reliant on cohesion funding[6] for public investment. With its potential for low-cost green hydrogen generation and extensive lithium deposits, Portugal is, in theory, well positioned to capitalise on green investment trends for economic growth. The relevance of low-cost renewables and the presence of mineral resources were also recently highlighted by the International Energy Agency as key competitive factors for the development of value chains.[7] However, these gains are not necessarily assured.

At the national level, the choices Portugal makes in the coming years will be critical. For example, the current green hydrogen project pipeline is mostly dedicated to exports of resources and feedstocks, or low added value uses, such as blending green hydrogen into the fossil gas grid. By contrast, focusing on higher value-added activities could generate many more green jobs and higher

[1] Financial Times, 2023, **The US plan to become the world's cleantech superpower**

[2] Credit Suisse, 2023, European Utilities Q2 Outlook: Sticking to our convictions

[3] European Heat Pump Association, 2023, **Heat pump record: 3 million units sold in 2022, contributing to REPowerEU targets**

[4] European Association for Storage of Energy, 2023, **EMMES 7.0**

[5] ACEA, 2023, **Fuel types of new cars: battery electric 12.1%, hybrid 22.6% and petrol 36.4% market share full-year 2022**

[6] European Regional Development Fund (ERDF), Cohesion Fund (CF), European Structural Fund (ESF) and Just Transition Fund (JTF).

[7] IEA, 2023, **Energy Technology Perspectives 2023**

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economic output. For example, using green hydrogen for green steel production to attract new industrial capacity in the electric vehicles or offshore wind manufacturing sector, two critical clean technology value chains. It can also contribute to scaling up the domestic production of electrolysers.

At the same time, the capacity equivalent to Portugal's largest lithium mining project (Barroso – 175 ktpa) could supply a standard-size battery gigafactory (40 GWh). This in turn could supply an automotive cluster with a yearly production that is around three times that of the Volkswagen Autoeuropa plant – a unit with an economic output equivalent to 1.5% of Portuguese GDP, 4% of the country's exporting value and directly employing nearly 5,000 workers. Battery production could also contribute to expanding the Portuguese grid technologies manufacturing sector. Conversely, betting on solely the lower value parts of the value chain, such as exporting mined and refined lithium, will generate nearly eight times less economic value and a fraction of the job creation.

A set of domestic barriers prevent Portugal from adopting an integrated value chain approach to seize the full opportunities of cleantech value chains.

> The lack of strategic orientation of the industrial policy landscape means there are no clear signals regarding policy priorities.

> Indicators show that Portugal still has challenges in scaling up innovation, despite the high share of STEM graduates, its high digital government index ranking and being one of the fastest growing member states in innovation capacity.

> There is no dedicated governance structure to address clean technology value chain development, thereby reducing the agility to respond to investment interest and exposing economic policy to path dependencies, resource-focused investment projects and influence of incumbents.

> There are few national champions of sufficient scale to create the necessary push towards clean industrial value chains. This makes new green industry creation largely dependent on foreign investment.

> Local communities close to potential lithium mining extraction project sites, which are situated in less developed regions, face environmental impacts and unclear socio-economic benefits. This situation constitutes a barrier to leveraging local resources to develop industrial value chains.

The existing EU industrial policy framework does not effectively incentivise clean technology value chain development across all member states. By operating largely through domestic financial contributions, it implicitly favours countries with larger fiscal resources. This reinforces existing path dependencies and deepens industrial power imbalances, extending the dependency of cohesion countries on EU-level transfers.[8] A recent example of this are the discrepancies in state aid awarded under the Temporary Crisis Framework, where industrial incumbents like Germany and France have profoundly dominated the scene, having spent respectively 53% and 24% of the total state aid under this scheme up to January 2023.[9] Even the Green Deal Industrial Plan's investment fails to provide adequate pillar support for cohesion countries. If poorly managed, the surge in green manufacturing investment unleashed by the GDIP risks aggravating existing economic imbalances, increasing the likelihood of two-speed decarbonisation and testing the block's solidarity and public support for climate action.

National-level recommendations

> **Adopt an integrated value chain approach to industrial policy**, thereby reducing the risk of missing out on higher value-added links in cleantech value chains. A green industrial strategy could be published ahead of the date foreseen in the Portuguese Climate Law (February 2024), building on the new clean technology context posed by the EU's response to the IRA. Such a strategy could set out industrial policy priorities and plan to attract investment aligned with the country's strengths and potential to become a clean economy leader.

> **Set predictable local demand targets to develop new clean technology value chains.** As an example, the forthcoming offshore wind auction could include green steel requirements. This will benefit the upscaling of electrolyser production in Portugal while helping to attract other green steel consumers within the clean technology value chains, like the automobile industry.

[8] For the 2021–2027 period, the Cohesion Fund concerns Bulgaria, Czechia, Estonia, Greece, Croatia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Portugal, Romania, Slovakia and Slovenia. It is reserved for member states whose gross national income (GNI) per capita is less than 90% of the EU average. In this report we will use the term "cohesion countries" for the group of countries that receive support from the Cohesion Fund.

[9] Euractiv, 2023, **EU Commission's Verstager proposes change to state aid rules**

- **Improve the current lithium investment framework to ensure it benefits local communities** by developing battery value chain production capacity at regional level. Projects should consider value added to communities while maintaining strong environmental safeguards. Portugal could use the Temporary Crisis and Transition Framework (TCTF),[10] which allows higher state aid support in "less developed regions", to incentivise the development of battery production value chains linked to the sourcing of lithium at local level.
- **Maximise the use of available EU funds to support the development of new clean technology value chains.** Eventually this should involve reshuffling existing sources of financing, like the Recovery and Resilience Facility (RRF), InvestEU, cohesion funds and the Innovation Fund, while ensuring other policy goals are not compromised. These could be used to support clean value chain development.
- **Put the development of clean technology value chains on the agenda of the yearly Iberian summits.** Portugal and Spain could cooperate on green industry, starting with identifying how value chains in both countries can reinforce each other, making the Iberian Peninsula a green industrial powerhouse.
- **Join international partnerships on international decarbonisation** to be part of the discussions that are shaping the development of global green markets, such as standard setting, green procurement and green buyer clubs. This could entail active participation in emerging partnerships such as the Clean Energy Ministerial Industrial Deep Decarbonisation Initiative, the G7 Climate Club, the Leadership Group for Industry Transition, Mission Innovation or Breakthrough Steel. Portugal should also consider strengthening its participation in European initiatives aimed at developing green industrial value chains (such as European Net Zero Europe Platform, Battery Alliance and Important Projects of Common European Interest (IPCEIs)).

EU-level recommendations

- **Ensure a level playing field in the financing framework by deepening the EU Green Deal Industrial Plan funding pillar**. This should go beyond expanding ceilings for cohesion regions under the revised temporary state aid rules and requires additional EU funds to fill the gap for these regions. As concluded by

[10] European Commission, **Support possibilities for schemes under section 2.8 of the Temporary Crisis and Transition Framework (PDF)**

the European Commission, existing EU budget funding isn't sufficient to ensure a level playing field between member states.[11] Cohesion country access to existing industrial policy instruments and funds, such as IPCEIs and the Innovation Fund, should be facilitated.

> **Establish a predictable framework for cross-EU green industrial value chain development to ensure investor certainty.** Member states can align their industrial policies accordingly, increasing their overall effectiveness. This dimension has been missing from the EU Green Deal and has not yet been robustly addressed through the European Green Deal Industrial Plan.

> **Introduce a requirement for member states to prepare integrated cleantech value chain development strategies under their national energy and climate plans (NECPs).** Preparation of such strategies, eventually with a cross-border scope, would incentivise countries to think strategically about industrial development according to their individual comparative advantages, while contributing to building resilient green European value chains.

> **Ensure that the EU hydrogen financing framework (e.g. European Hydrogen Bank) incentivises priority, high value-added uses of hydrogen.** The EU hydrogen framework has to set the right incentives for the development of hydrogen infrastructure. It must focus on priority uses,[12] and it should consider the value added of activities at local level.

> **Include local economic value creation when assessing impacts on communities of raw material projects considered for recognition as a Strategic Project in the Critical Raw Materials Act (CRMA).** Engagement with local communities to assess project impacts needs to go beyond environmental and social harm prevention, provision of quality jobs and compensation mechanisms. It should also include economic benefits projects will bring to the region.

[11] European Commission, 2023, **Staff working document – Investment needs assessment and funding availabilities to strengthen EU's net-zero technology manufacturing capacity SWD(2023) 68**

[12] IRENA, 2022, **Geopolitics of the energy transformation: The hydrogen factor**, page 14

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CHAPTER 1
INTRODUCTION

If the clean economy transition in the EU is to succeed, it cannot exacerbate existing structural economic imbalances. It must work for the less wealthy parts of the continent, contributing to the EU's economic convergence. The US Inflation Reduction Act (IRA) and the clean economy push that resulted from the Russian aggression against Ukraine accelerated green industry investment trends that were already in place. The response to this new context will define the EU's future industrial landscape and economic imbalances.

The response has both a European and a national dimension. An EU response that accelerates industry decarbonisation and boosts cleantech investment, providing security, will necessarily have to consider the EU's unity and solidarity. It must not add to existing uncertainty among cohesion countries, driven by a changing industrial landscape and exposure to higher value-add FDI from the wealthier parts of the continent. At national level, member states are facing the challenge of aligning their industrial policies with the accelerated green industry investment trends. Wrong decisions at national level can unintentionally add to economic imbalances within the EU.

This report looks at the case of Portugal. The country has strong comparative advantages in low-cost green hydrogen and has the EU's largest known lithium resources. However, its economy has traditionally followed a resource-focused model when adding value to its natural resources (Figure 1). A similar trend is visible with resources and raw materials for clean economy technologies. Most projects aim to export these premium products to wealthier parts of the continent or use them for low value-add activities like blending green hydrogen with fossil gas. Through this approach, Portugal risks missing out on being part of the global clean technology investment push.

The development of clean technology value chains provides opportunities to use national comparative advantages much more productively. This new context will require an integrated approach to the use of national comparative advantages, like green hydrogen or lithium, to develop high value-add productive activities.

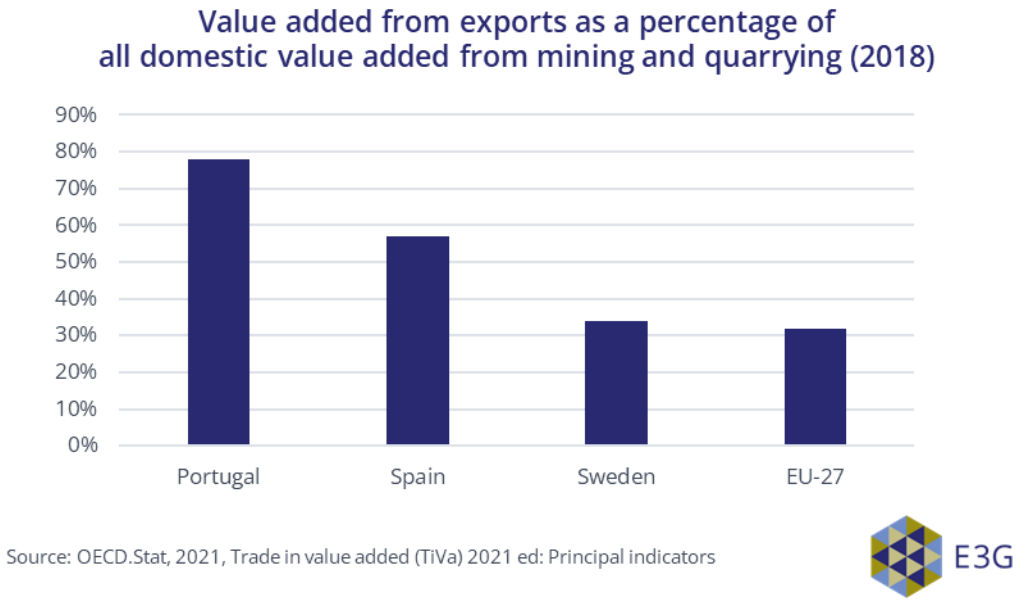

Figure 1: Portugal's mining sector is much more orientated towards exports than the EU generally. Here the value added from exports as a proportion of total value added is compared to selected other countries and the EU average.

Productivity in Portugal has been consistently below EU average over the years (Figure 2). One contributing factor is that its industrial landscape has a large representation of industry sectors with relatively low value added and technological intensity. The textiles and food industries represent the highest gross value added (GVA)[13] and employment share[14] among Portuguese manufacturing sectors. The overall share of high technology exports is also low[15] compared to other EU countries. However, the automobile sector, with a higher technological intensity, is the largest exporter[16] and attracts the most FDI,[17] with the Iberian Peninsula as a whole being an automotive powerhouse on a European scale.

[13] PORDATA, last updated 2022, **Gross value added: total and by industry (2016)**

[14] PORDATA, last updated 2022, **Employment: total and by industry, full time equivalent (2016)**

[15] OECD, 2021, **Strengthening FDI and SME linkages in Portugal**

[16] PORDATA, last updated 2022, **Exports of goods and services: total and by product (2016)**

[17] OECD, 2017, **International trade, foreign direct investment and global value chains – Portugal trade and investment statistical note**

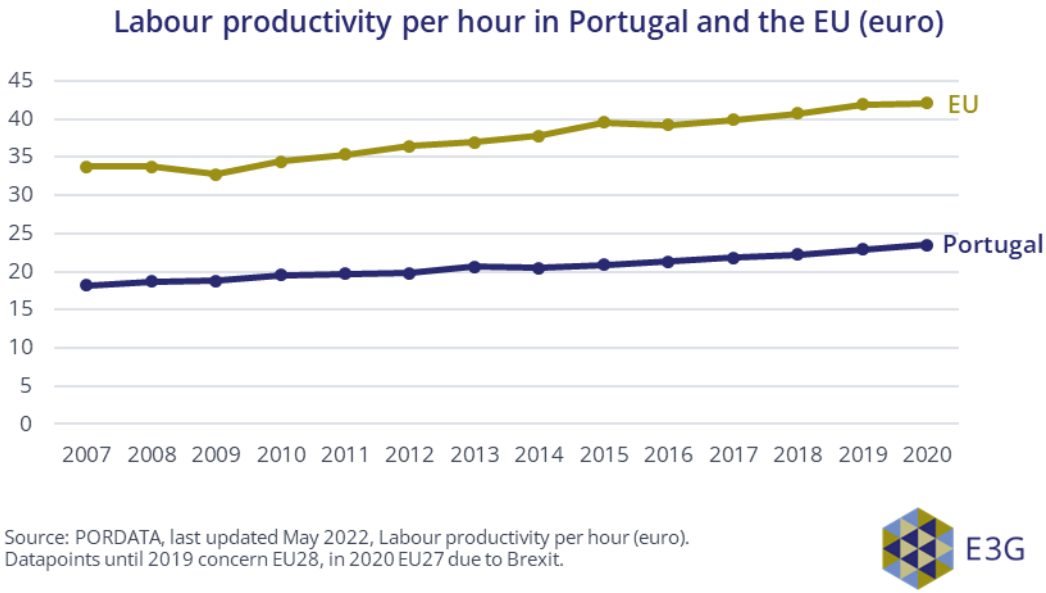

Figure 2: Labour productivity in Portugal has been consistently lower than the EU average.

The successive crises since the turn of the century – the financial crisis, the sovereign debt crisis followed by the troika[18] intervention, the COVID-19 crisis and the inflation crisis – impacted the fiscal space available for public investment and to support industry and innovation policies. Gross fixed capital formation by central government has been consistently lower than EU average since 2013, when the country was under the troika intervention.[19] Also, public investment has been increasingly leveraged by EU funds; Portugal receives the EU's highest rate of cohesion funding as a proportion of its public investment.[20]

In this report, we showcase the economic opportunities of building on national comparative advantages such as green hydrogen and lithium to establish new clean technology value chains in Portugal. We subsequently analyse the political economy barriers to a successful green industrial policy and recommend how to overcome them from a national and EU dimension.

[18] Ad hoc authority with a mandate to manage the bailouts of Cyprus, Greece, Ireland and Portugal, in the aftermath of their prospective insolvency caused by the world financial crisis of 2007–2008.

[19] OECD, **Investment by sector** (webpage; accessed April 2023)

[20] European Commission Cohesion open data platform, **% of cohesion policy funding in public investment per member state** (webpage, accessed April 2023)

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CHAPTER 2
THE OPPORTUNITY FOR CLEAN TECHNOLOGY VALUE CHAINS IN PORTUGAL

Summary

Portugal has multiple comparative advantages for the development of clean technology value chains. It has one of the EU's lowest production costs for renewable electricity and green hydrogen. It also has the EU's largest confirmed deposits of lithium,[21] a key material for battery production. These advantages make Portugal a competitive location for new clean technology value chains like electrolysers, batteries, electric vehicles and offshore wind technologies.

Main takeaways:

> While Portugal has been successfully developing its hydrogen production capacity, it can generate additional value by linking these policies with the development of clean technological industrial capacity. For example, the economic impact of using green hydrogen for green steel production, which can attract other industrial activities in the automobile or offshore wind sectors, is many times higher than using it for export or blending with fossil gas. Such use of green hydrogen will also contribute to achieving the national electrolyser capacity target, while generating high value added from the use of green hydrogen public support programmes.

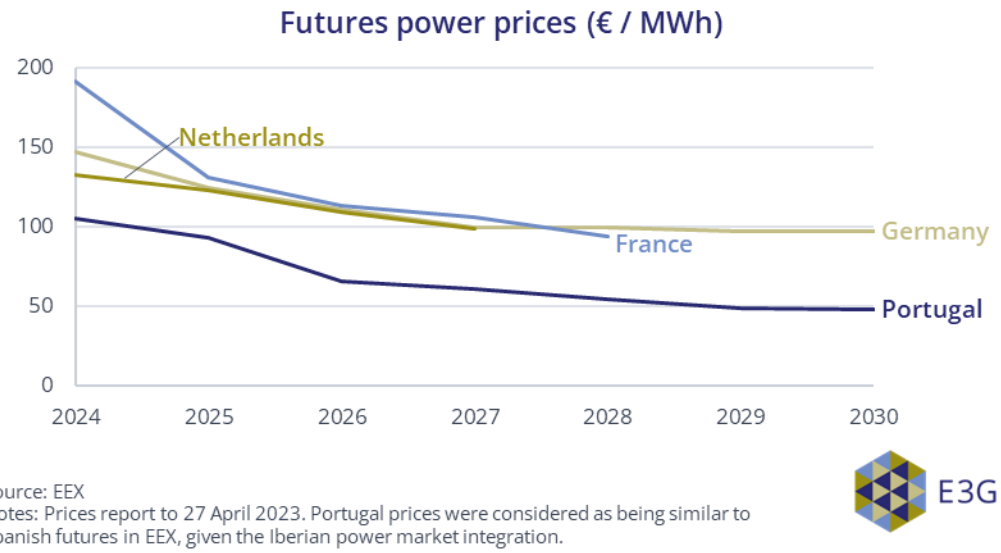
> The current approach to using lithium reserves has led to isolated exporting ambitions among the projects announced to date. Without an integrated value chain approach, the country will find it difficult to build on the comparative advantage of its lithium reserves to develop battery production and expand the automobile cluster.

[21] US Geological Survey, 2020, **Mineral commodity summary – Lithium (PDF)**

- Shifting from the current model is particularly relevant in the context of a global race for clean technological investment. Sub-optimal use of the country's comparative advantages may see it concentrate on lower value-added activities of the future clean technology value chains, missing the opportunity to upgrade the sophistication profile of the country's economy. This is a real example of how cohesion member states may be missing opportunities by not being incentivised to develop integrated cleantech value chain development strategies.
- Spain and Portugal already have integrated supply chains, especially in the automobile sector. A coordinated approach on clean technology capacity development can elevate the Iberian Peninsula's profile to attract cleantech investment.

Use of green hydrogen to develop clean technology value chains

Portugal has an outstanding potential to develop production value chains based on green hydrogen. This is due to the cost competitiveness of its renewable electricity, which supplies the electrolysers that generate green hydrogen (Figure 3).



Source: EEX
Notes: Prices report to 27 April 2023. Portugal prices were considered as being similar to Spanish futures in EEX, given the Iberian power market integration.

Figure 3: Futures power prices – comparison between Portugal and selected EU countries.

Portugal's hydrogen ambitions

The Portuguese national hydrogen strategy,[22] adopted in May 2020, sets out the following uses for hydrogen:

> Existing energy-intensive processes like cement and chemicals manufacturing (such as ammonia), hydrocarbon refining, mining, glassmaking, and ceramics.

> In the mobility sector, with a focus on heavy road transport and domestic shipping.

> Blending with fossil gas to abate emissions in areas where direct electrification would be a more efficient solution, like the residential sector.[23]

> Export of 35–40% of production. The bilateral agreement with the Netherlands[24] and the diplomatic push for the H2Med[25] pipeline indicates a preference for export to Northwestern European countries.

The current hydrogen project pipeline is essentially focused on exporting feedstock, blending hydrogen into the gas grid, and decarbonising existing industrial capacity (e.g. Sines oil refinery) or local heavy road transport (Table 1). This suggests investors' interest is following the uses foreseen in the hydrogen strategy. Overall, the existing hydrogen project pipeline is a significative boost for the Portuguese hydrogen sector.

The opportunity of using future hydrogen generation for clean technology value chains

Electrolyser production

The green hydrogen project pipeline is providing a boost to the development of electrolyser production capacity in Portugal. Fusion Fuel[26] is an example of a Portuguese technological company deploying green hydrogen production solutions at a global scale.[27]

[22] Portuguese government, 2020, **National hydrogen strategy (EN-H2)** (in Portuguese)

[23] IEA, 2021, **Net zero by 2050**

[24] IEA, March 2022, **Portugal and the Netherlands green hydrogen agreement**

[25] Offshore Energy, December 2022, **TSOs formalise intention to develop H2Med subsea hydrogen link**

[26] **www.fusion-fuel.eu** (webpage, accessed April 2023)

[27] pv magazine, November 2022, **Solar-to-hydrogen project to be first stop on a California-to-Texas "hydrogen highway"**

Table 1: Planned hydrogen (H_2) investments in Portugal (>100 MW electrolyser size ambition)

Location	Project	Electrolyser capacity (MW)	Hydrogen use	End use
Sines	MadoquaPower2X[28]	500	Ammonia export	n/a
	Neogreen Hydrogen[29]	60, evolving to 540[30]	n/a	n/a
	Green H_2 Atlantic[31]	100	Local / blending	Oil refinery process
	Galp H_2 Park[32]	100[33]	Local	Oil refinery process
	Sines Green Hydrogen Valley Alliance[34]	91, evolving to 606[35]	Local	Heavy transport, local energy community
Estarreja	H2Enable[36]	130, evolving to 500 (2030)[37]	Local / blending / export	Ammonia; Aniline production process
Nazaré	Nazaré Green Hydrogen Valley[38]	40, evolving to 600[39]	Local / blending	Decarbonisation Leiria region industrial cluster (glass/cement/ceramics)

Note: Most of these projects still are pending final investment decision.

[28] **Madoquapower2x.com** (webpage, accessed April 2023)

[29] **Neogreenhydrogen.com/home** (webpage, accessed April 2023)

[30] Expresso, November 2022, **Neogreen hydrogen project in Sines foresees start of production in 2026** (in Portuguese)

[31] **www.greenh2atlantic.com** (webpage, accessed April 2023)

[32] Expresso, November 2022, **Hydrogen: billions of euros are promised, but what is left to get out of the paper?**

[33] S&P Global Commodity Insights, February 2022, **Portugal's Galp targets 100-MW hydrogen project FID early 2023**

[34] Fusion Fuel, **H2 HEVO-SINES** (webpage, accessed April 2023)

[35] GlobeNewswire, 2021, **Fusion Fuel Green presents Sines Green Hydrogen Valley Alliance at 'Agendas Mobilizadoras' Event; Aims to develop 91 MW solar-to-hydrogen facility in Sines**

[36] Bondalti, July 2020, **Bondalti fosters hydrogen strategy**

[37] Bondalti, July 2021, **H2Enable – The hydrogen way for our chemical future (PDF)**

[38] **www.nghv.pt/en** (webpage, accessed April 2023)

[39] Reuters, February 2022, **Portugal's top cement, glass makers join new consortium for green hydrogen plant**

Green steel production

Portugal can generate additional economic value by using hydrogen to develop new clean technology value chains. Some of these may rely on the supply of green steel, which results from direct reduction using green hydrogen. With global steel production still heavily relying on the use of integrated blast furnace-basic oxygen furnaces using coal, steel production decarbonisation is critical for a pathway to keep global warming within 1.5 °C.[40] Using green hydrogen in the direct reduced iron (DRI) process is increasingly being considered a technologically advanced alternative to the current production processes.[41]

Developing green steel production linked to Portugal's favourable conditions for generating green hydrogen can generate higher output and jobs than using such a premium energy carrier for export or blending it into the gas grid. It will also lead to increased demand for electrolysers, contributing to the electrolyser capacity target foreseen in the Portuguese hydrogen strategy.

Reference data[42] suggests that 0.375 Mt/year hydrogen could be sufficient for a 7.5 Mt/year steel production process. This is a similar capacity to Tata Steel's plant in Netherlands,[43] which generates €5bn in output value, €2.9bn of gross value added and directly employs 11,000 people (2019 data).[44] Exporting this volume of hydrogen would lead to a much lower output value (€0.75–1.1bn, for a €2–3/kg green hydrogen price range) and no additional direct employment.

Developing green steelmaking capacity in Portugal can attract clean technology value chains, adding further economic value and job creation. For example, green steel can attract automobile production capacity, as carmakers are increasingly interested in procuring green steel.[45] Portuguese green steel can also be integrated in existing Portuguese–Spanish automobile value chains. It can additionally be used in wind turbine production, eventually helping to satisfy the demand for Portugal's announced 10 GW offshore wind development.[46] However, the availability of a premium resource like green hydrogen is a pre-condition for successfully developing such high value-added value chains. With a

[40] E3G, 2021, **1.5C steel: decarbonising the steel sector in Paris-compatible pathways**

[41] E3G, 2022, **G7 Steel Policy Scorecard – shifting the pathway for steel**

[42] European Parliamentary Research Service, 2020, **The potential of hydrogen for decarbonising steel production**

[43] Tata Steel – **IJmuiden** (webpage, accessed April 2023)

[44] Tata Steel, **Economic value of Tata Steel in the Netherlands 2018–2019 (PDF)** (in Dutch)

[45] The Wall Street Journal, September 2021, **Green steel becomes a hot commodity for big auto makers**

[46] OffshoreWIND.biz, September 2022, **Portugal preparing 10 GW offshore wind auction for 2023**

considerable volume of planned green hydrogen production already earmarked for export and blending with fossil gas, there may be a high opportunity cost in not linking this scarce energy carrier to the development of clean technology industrial capacity.

Use of lithium to develop an EV battery value chain

Portugal has Europe's largest confirmed lithium resources,[47] an essential material for battery production. Industry data[48,49] indicates that the capacity equivalent to its largest mining project (Barroso – 175 ktpa) could supply a standard-size gigafactory (40 GWh) and an automotive cluster with a yearly production of around 730,000 vehicles.[50] This is approximately three times the production level of the Volkswagen Autoeuropa plant, a unit with an output equivalent to 1.5% of Portuguese GDP, 4% of the country's exporting value and directly employing nearly 5,000 workers.[51] With battery storage becoming a critical technology for the operation of fully decarbonised grids at global scale, the production of batteries can also be part of an effort to expand and upgrade the existing grid technologies value chain. With the country considering additional lithium mining projects (for example Minas da Argemela), it may have a considerable opportunity to develop green industrial capacity. It may, though, need to integrate resource-level policies with the development of green industry capacity.

The recent projects sourcing new lithium reserves mainly aim to export these resources, with each of the projects having isolated export ambitions. For example, the developer of the Barroso lithium mine (Savannah Resources[52]) is expected to export 86% of the planned 175 ktpa production.[53] Mining permitting obligations will require that upgrading the raw lithium into a battery-grade mineral takes place within the country. Other lithium-battery value chain projects announced recently include a 35,000-ton lithium refinery project (Galp-

[47] US Geological Survey, 2020, **Mineral commodity summary – Lithium (PDF)**

[48] Northvolt, April 2022, **Galp and Northvolt select Setúbal to build advanced lithium conversion unit**

[49] Investing News Network, August 2022, **Critical elements complete positive engineering study for a lithium hydroxide monohydrate plant**

[50] Considering an average battery pack of 55 kWh for a light duty battery electric vehicle, as included in IEA, 2021, **Global EV Outlook 2021 – Trends and development in electric vehicle markets**

[51] Afia, 2023, **A "Irmã" da Autoeuropa já tem o Futuro Garantido. E a Fábrica de Palmela?** (in Portuguese)

[52] Savannah, **Barroso lithium project, Portugal** (webpage, accessed April 2023)

[53] Universidade do Minho, July 2020, **O Projeto da Mina do Barroso Impactos Económicos e Desenvolvimento** (in Portuguese)

Northvolt) to supply Northvolt's battery factory in Sweden,[54,55] and the interest by CALB (China Aviation Lithium Battery Co., Ltd) to set up a 45 GWh battery production plant in Sines.[56] Both these projects seem to be integrated in the developers' own supply chains; it is unclear if they are connected to the Portuguese lithium mining initiatives.

The economic benefits of having a comprehensive value chain approach are much larger than making isolated investments. Figure 4 shows that mining activities do not lead to the most significant economic benefits in the battery value chain. If Portugal aims to maximise economic benefits from the battery value chain, it should critically consider building on the availability of lithium resources to develop battery and, additionally, electric vehicle production and develop its grid technologies manufacturing base. Focusing only on parts of the value chain, instead of pursuing an integrated approach, means that the country is not using its comparative advantages to fully capture the economic benefits, leaving value on the table.

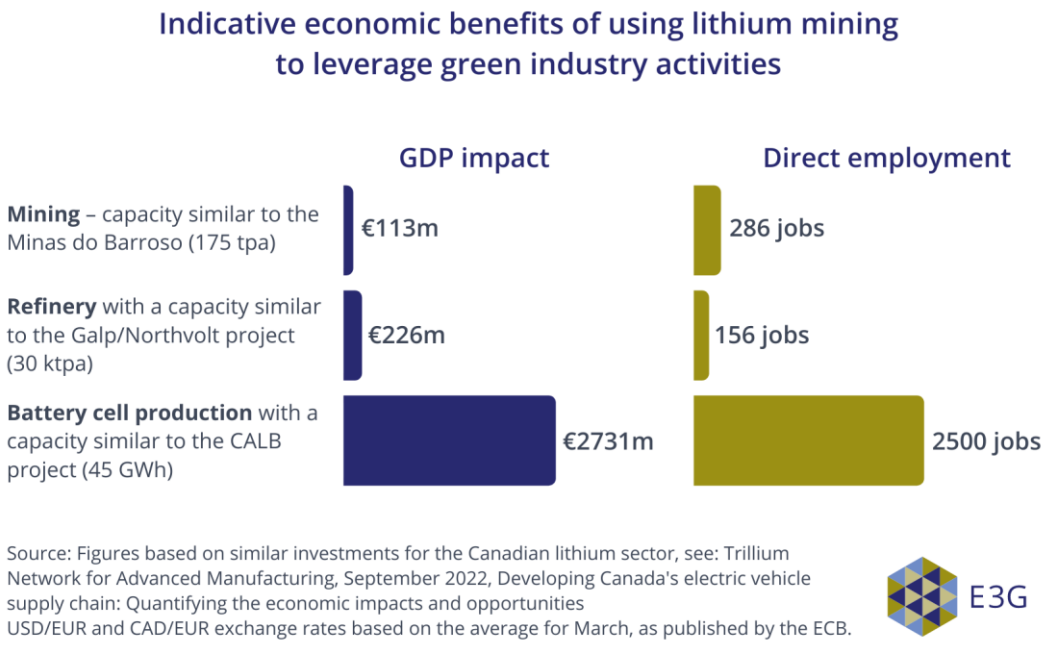


Figure 4: Adding battery plants to the lithium value chain brings far greater economic benefits than mining and refining alone.

[54] Publico, February 2023, **At the Swedish gigafactory, where Northvolt is waiting for lithium from Portugal**

[55] Northvolt, April 2022, **Galp and Northvolt select Setúbal to build advanced lithium conversion unit**

[56] Euractiv, November 2022, **Chinese battery plant to start operations in Portugal by 2025**

An Iberian perspective on green industry development

Spain is a major global value chain partner for Portugal. This means that part of Portuguese value added indirectly ends up through intermediaries as exports in Spain, and that parts of third countries' value added arrive in Portugal. In both gross and value-added terms, Spain is responsible for most exports from and imports to Portugal and this dependence is only growing (Figure 5). Over 76% of Portugal's domestic value added embodied in manufactured products comes from Spain (with only 7.1% from France, the next biggest trading partner).[57]

The interdependencies with Spain can be an opportunity to develop clean technology capacity at the Iberian scale. Spain is the second largest automobile producer in the EU. It also has lithium reserves and has been securing investment in battery production. Two battery factories are planned for Extremadura,[58,59] a region with lithium reserves close to the Portuguese border. This creates a context to explore how supply chain interdependencies can attract new investment in the electric vehicle value chain, creating the conditions to develop an Iberian electric vehicle powerhouse.

Figure 5: Contribution to Portugal's value added from gross imports from and exports to its top trading partners. Spain is by some distance Portugal's biggest trading partner.

[57] OECD, 2022, **Trade in value added: Portugal (PDF)**

[58] Phi4tech, 2021, **Extremadura will host the first battery cell factory in southern Europe, with 400 million euros of investment and 500 jobs** (in Spanish)

[59] El Pais, 2022, **The battery megafactory of Extremadura will have an initial investment of 1,000 million** (in Spanish)

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CHAPTER 3

POLITICAL ECONOMY BARRIERS FOR CLEAN TECHNOLOGY VALUE CHAIN DEVELOPMENT IN PORTUGAL

Summary

While there is a strong economic case for establishing clean technology value chains in Portugal, there remain structural barriers in need of addressing. These present themselves in the form of specific national conditions characteristic to modern Portugal: its policy framework and macroeconomic conditions; as well as the spheres of influence that various stakeholders hold within domestic and EU politics.

Main takeaways:

> The lack of cross-sectoral clean technology policy at national level risks Portugal missing out on the unprecedented global push for clean technology investment and increased interest by multinationals to invest in Southwestern Europe.

> Portugal has one of the fastest growths in innovation capacity at EU-level and R&D investment has been surging, but there are still challenges in scaling up innovation.

> The low qualification legacy has been addressed and the country is now performing above OECD and EU average on tertiary education attainment and STEM graduate numbers, respectively. However, the expected shortage of low- to medium-skilled workers may be a barrier for new green industrial capacity.

> The transformative impact of developing clean technology value chains requires solid governance and cross-sectoral coordination. The current sectoral approach may not be up to such a transformational challenge.

- There is high influence of businesses in traditional sectors and FDI is concentrated in more technologically advanced value chains. Larger Portuguese companies in the energy and chemical sectors are focused on resource and feedstock related activities.
- The country has a relatively small number of companies of a scale to lead the development of industrial clean technology value chains. This reinforces the need for an integrated value chain development approach with strong governance and sectoral coordination that provides certainty and direction for FDI. This should also build on the potential of the country's existing industrial capacity.
- The existing EU industrial policy does not effectively incentivise clean technology value chain development EU-wide. The recent relaxation of state aid rules for cleantech projects shows they can even constitute an additional barrier for leveling the playing field as they implicitly favour member states with larger fiscal space.

Table 2: Summary of the political economy barriers to establishing new green value chains in Portugal

Area	Category	Barrier
National conditions	Industrial (policy) landscape	Lack of strategic orientation of industrial policy. Reduced fiscal space for green investment when compared with financial capacity of larger EU member states.
	Technology & innovation	Difficulties in scaling up new concepts, especially in goods and products innovation. Underutilisation of the Innovation Fund
	Skill availability	Labour-intensive manufacturing sectors Projected increasing supply shortage of low- to medium qualification jobs

Area	Category	Barrier
Political system and influence	Governance	Lack of a dedicated structure to develop integrated clean technology value chains. Below OECD average regulatory quality Lack of intermediate level of government diminishing engagement with regional industrial clusters and development of economic benefits for local communities
	Business	Influence of domestically owned business groups centred around traditional low technology sectors Lack of national champions to develop clean technology industry value chains Large companies in the energy sector do not extend focus from core business activities to green industry projects Dependence on foreign-owned companies in developing clean technology value chains
	Civil society	Lack of political buy-in by local communities due to missing economic benefits at local level
EU dimension	Industrial policy	Policy framework exacerbates existing intra-EU industrial power imbalances instead of incentivising EU-wide clean technology value chain development

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National conditions

Industrial policy and its coherence with broader economic policy

Portuguese policymakers recognise the need to upgrade the Portuguese economic structure as an important objective. However, the approach to developing value chains for hydrogen and lithium is primarily sectoral; it is less clear how these sectoral approaches relate to broader industrial policy priorities. The overall framework may therefore not be fit to reap the full benefits from Portugal's comparative clean economy advantages, as set out in the preceding chapters.

Although the country has a structured set of industrial policy instruments in place,[60] these don't necessarily address higher-level policy priorities. This lack of strategic orientation may make the use of public funds less efficient. It may also lead to policies conflicting or being misaligned across different sectors, including investment support, and result in public administration procedures not meeting policy needs. These undesired policy outcomes can be especially impactful given the context of limited fiscal space,[61] emigration of high skilled labour[62] and government regulation burden.[63]

Some national stakeholders, including civil society, voice their concerns about the possibility of Portuguese comparative advantages being used to develop industrial capacity elsewhere at the cost of local environmental impacts, instead of being used domestically to generate value from new industrial supply chains. Meanwhile, multinational companies are pointing out the potential for investment of industrial value chains in Southwestern Europe due to advantageous location factors,[64] and the interest in clean technology investment has never been this high. Yet, this context is not reflected in any official government policy to coordinate such industrial policy efforts, like a green industry strategy.

[60] Tax credits for industrial investment, R&D tax benefits, public procurement, participation in the equity structure of companies, and a mix of innovation policies, like the development of technological centres, or an active knowledge interface between universities and industries.

[61] European Commission, 2022, **2022 Country report – Portugal**

[62] Gomes, R. et al., 2021, **Brain drain and academic mobility from Portugal to Europe (PDF)** (in Portuguese), in Three studies on the new Portuguese emigration, Lisbon: Observatório da Emigração, CIES-Iscte, pp. 37–60, DOI: 10.15847/CIESOMEE012021_3

[63] World Economic Forum, 2019, **Global competitiveness report 2019**

[64] Bloomberg, September 2022, **Volkswagen warns of production shift from Germany over gas shortage**

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Technology and innovation

Portugal is a relatively innovative country and has significantly increased its R&D funding over the years. The growth in its innovation capacity is one of the fastest in the EU,[65] and it is part of the top tier group of the OECD digital government index.[66] It stands especially strong regarding the number of scientific publications and recent higher education graduates – yet the number of patent applications and design applications is still much lower than the EU average.[67] Portugal is more innovative when it comes to services compared to goods and products.[68] A particular weakness is its low performance on climate- and circularity-related innovation.[69]

Public direct expenditure and tax support for R&D has been increasing as a proportion of GDP (0.24%) and is higher than EU and OECD averages.[70] Overall R&D expenditure is set to nearly double by 2030,[71] from 1.62% in 2019 to 3%. Although R&D policy instruments, like the SIFIDE I tax scheme, aren't tailored to priority sectors, R&D funding in Portugal ends up being spent in a limited number of industries,[72] such as electronics, chemicals and pharmaceuticals. In general, public support for innovation is also unevenly distributed across national regions,[73] which emphasises differences in economic development.

EU countries receive additional R&D funding streams from EU sources such as the Innovation Fund. Portugal, however, has so far only benefitted from this support with one small-scale project[74] related to an incumbent sector – pulp. Another single large-scale solar energy project has been selected for project development assistance.[75] The predecessor of the Innovation Fund – NER300 – also only saw one Portuguese wind project supported.[76] The underutilisation of the Innovation Fund's resources in general (Figure 6), and the lack of project

[65] European Commission, 2022, **European innovation scoreboard 2022 – Country profile: Portugal**

[66] OECD, 2020, **Digital Government Index 2019 – Results and key messages**

[67] European Commission, 2022, **European innovation scoreboard 2022 – Country profile: Portugal**

[68] European Commission, 2022, **European innovation scoreboard 2022 – Country profile: Portugal**

[69] European Commission, 2022, **European innovation scoreboard 2022 – Country profile: Portugal**

[70] OECD.Stat, **R&D tax expenditure and direct government funding of BERD** (webpage, accessed April 2023)

[71] STIP Compass, last updated August 2021, **Higher education, research and innovation in Portugal – perspectives for 2030**

[72] **Agência Nacional de Inovação – Incentivos Fiscais: SIFIDE** (webpage; accessed April 2023)

[73] Agência National de Inovação, 2020, **National innovation report (PDF)**

[74] **Innovation Fund – Project Portfolio** (webpage; accessed April 2023)

[75] European Commission, 2022, **Innovation Fund – Key statistics from the first call for large-scale projects (PDF)**

[76] European Commission, 2022, **NER300 annual report 2021 (PDF)**

applications in new categories, beyond the power sector and incumbent industry, show Portugal's difficulties in scaling up innovation and getting new products to market, as well as its overall low innovation capacity in goods.

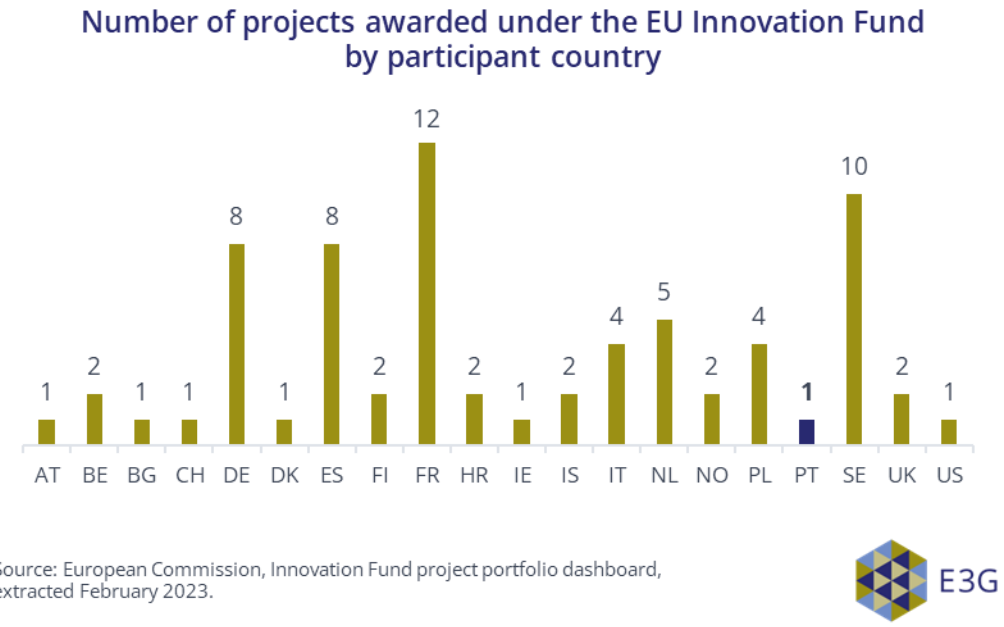

Figure 6: Portugal is making little use of the EU Innovation Fund.

Skill availability

Portugal is catching up with its OECD and EU peers in terms of workforce qualification level, addressing its qualification legacy.[77] Between 2000 and 2021 the share of young people with tertiary degrees jumped from a mere 12.9% to 47.5%,[78] slightly above OECD average. Also, on STEM graduates the country is now part of the top tier group of EU member states (21.7 out of 1000 inhabitants aged 20–29 years).[79]

Portugal does not have a large established energy-intensive industrial base and is moving more towards service-oriented activities. Yet, the overall share of employment in manufacturing is still above EU average.[80] This reflects the impact of labour-intensive, low-wage sectors like textiles, while the share of employment in medium- and high-tech manufacturing remains below EU

[77] OECD, **Educational attainment and labour-force status**

[78] Eurostat, last updated June 2022, **Tertiary education statistics**

[79] Eurostat, last updated June 2022, **Tertiary education statistics**

[80] The World Bank Data, **Employment in industry (% of total employment) (modelled ILO estimate)** (webpage, accessed April 2023)

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average.[81] Given Portugal's above EU average share of STEM graduates, the potential mismatch between this supply of qualified workforce and job positions that match their qualifications could form an incentive for young professionals to pursue work opportunities outside of the country.[82]

The projected significant shortage[83] of plant and machine operators and assemblers, trade workers and labourers[84] could constitute a barrier for the development of new green industrial capacity, like steelmaking or battery value chains. Despite this, the share of low-skilled workers is projected to stay a lot higher than the EU average, with training programmes such as Qualifica[85] aiming to fill the gaps.

Political system and influence

Governance

Transformative impact of developing new green industrial value chains built around the country's comparative advantages would require solid governance and a coordinated cross-sectoral strategy. The current approach is excessively based on individual sectoral strategies, such as the hydrogen strategy. There is no formal coordination structure on industrial policy to align the different ministerial responsibilities in the areas of innovation, industrial policy, energy, foreign investment, diplomacy, finance and education.[86]

While this mode of working may be suited to attracting investment in the energy and mining sector, it is less useful in aggregating efforts to create integrated clean technology value chains. The recent diplomatic push by Portugal to secure the hydrogen pipeline H2Med,[87] which may export the green hydrogen volumes eventually needed to develop its own clean technology value chains, illustrates how coordinated action could avoid policies that can have conflicting impacts in

[81] European Commission, 2022, **European innovation scoreboard 2022 – Country profile: Portugal**

[82] Lusa, 2020, **Portugal: PM warns of brain drain risk if no long-term agreement to lift incomes**

[83] Cedefop, 2020, **Portugal –2020 skills forecast**

[84] Major Groups 7, 8 and 9 according to the International Standard Classification of Occupations by the International Labour Organisation.

[85] **Qualifica** (in Portuguese) (webpage, accessed April 2023)

[86] Mamede, R.P., Godinho, M.M., Simões, V.C., 2014, **Assessment and challenges of industrial policies in Portugal** (PDF), in: Structural change, competitiveness and industrial policy: painful lessons from the European periphery, London, Routledge, pp. 258–277

[87] La Moncloa, December 2022, **Spain, Portugal and France launch H2Med to supply green hydrogen to Europe**

the future. The global context of a green industrial investment boom elevates the need to consider a strategic shift.

Good governance in industrial policy requires not only a systemic approach but also appropriate accountability structures and a high level of regulatory quality. Portugal scores high on most governance indicators,[88] including political stability and absence of violence, except control of corruption and regulatory quality. Portuguese public administration faces particularly low levels of public trust compared to other OECD countries, with integrity being judged the most negatively.[89] This suggests potential deficits in public scrutiny, which can pose a risk of state capture by interest groups.[90] The country could align its interest in digitalisation and innovation with a structural simplification of public administration procedures, making simple and predictable administrative processes an additional comparative advantage. This would increase certainty for investors and improve the country's agility in developing the critical infrastructures needed to enable clean technology value chains. It would also increase the trust of citizens in public administration procedures.

Lastly, the absence of an intermediate level of government with administrative autonomy to develop economic policy diminishes the capacity to engage with businesses, set up regional value chains and promote R&D clusters. Regional wealth imbalances persist, as certain areas are awarded permits for mining or solar plant projects, while most value added is fed into industries located in other regions.[91]

[88] World Bank, 2021, **World Governance Indicators**

[89] PlanAPP, 13 July 2022, **How much trust is there in public institutions?**

[90] Mamede, R.P., Feio, P.A., 2012, **Institutional conditions for effective and legitimate industrial policies: the case of Portugal (PDF)**

[91] European Commission, 2022, **2022 Country report - Portugal (PDF)**

Business

Analysis of the manufacturing sector's business environment shows high influence of traditional low technology incumbents due to their large employment,[92] GVA[93] and export share,[94] as well as domestic ownership (Figure 8).[95] Over the last decades, there has also been greater influence of foreign direct investment (FDI) in electronics and transport manufacturing. FDI tends to be focused on more technologically intense sectors, and could therefore add to industrial investment through building on existing human capital to develop higher added value projects. Looking at the example of the Portuguese automobile industry,[96] it can also help create specialised clusters of advanced manufacturing capacity across a supply chain, attracting new industrial investment. FDI can also build on incumbent energy and industrial firms' capacity to develop clean technology value chains, as well as further upgrade the sophistication profile of existing industries.

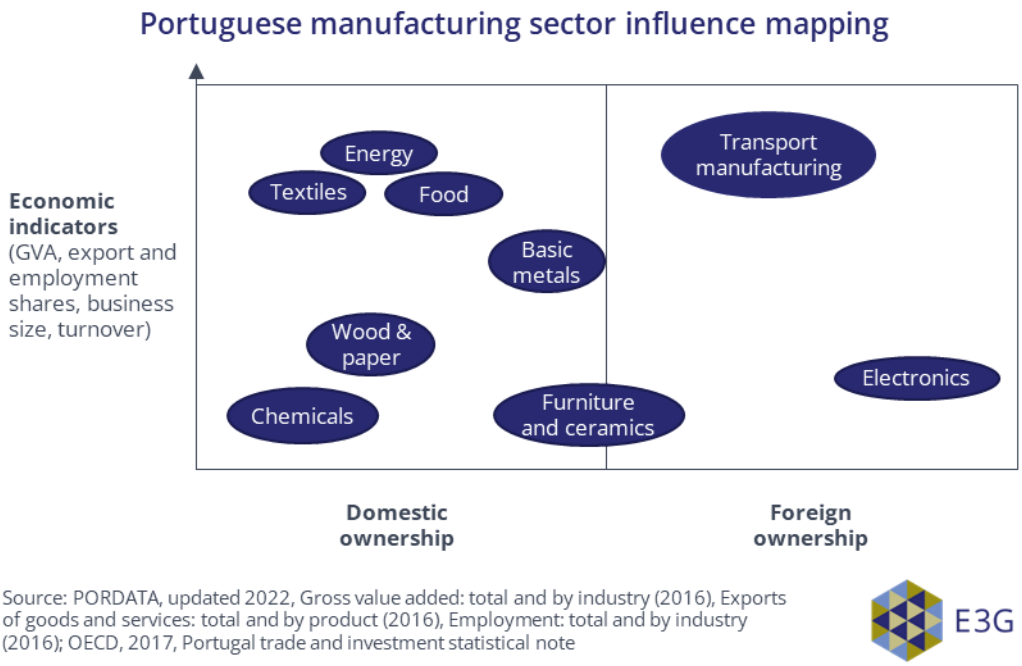

Figure 8: Analysis of the Portuguese manufacturing sector shows high influence of traditional low technology incumbents.

[92] PORDATA, last updated 2022, **Employment: total and by industry, full time equivalent (2016)**

[93] PORDATA, last updated 2022**, Gross value added: total and by industry (2016)**

[94] PORDATA, last updated 2022, **Exports of goods and services: total and by product (2016)**

[95] OECD, 2022, **Trade in value added: Portugal (PDF)**

[96] Mamede, R.P., Godinho, M.M., Simões, V.C., 2014, **Assessment and challenges of industrial policies in Portugal** (PDF), in: Structural change, competitiveness and industrial policy: painful lessons from the European periphery, London, Routledge, pp. 258–277

Transport, textiles, food, and basic metals are highly influential manufacturing sectors in Portugal. Transport not only brings the highest share of exports[97] and FDI,[98] but also good quality jobs – especially compared to the textile and food industries, which are largely dominated by minimum wage or temporary jobs.[99] Yet, the latter two sectors employ the largest number of people[100] and dominate domestic manufacturing in terms of the overall GVA share.[101] The third biggest employer,[102] with significant value added[103] and relatively high export share[104] is the basic metals industry.

Three further sectors with medium influence are rubbers and plastics, ceramics, and paper. The latter is also represented by one of Portugal's largest firms in terms of sales (Navigator).[105] Finally, while the chemical industry's contribution to the economy remains marginal, it is represented by, among others, an experienced and influential family-owned company (Grupo José de Mello).[106]

Lastly, entities linked to the generation, distribution and retail of electricity and gas traditionally exercise large influence, especially regarding regulatory and infrastructure policies, as they include two out of the four largest Portuguese companies (EDP and Galp).[107]

While the firms highlighted above can have a big influence on policy making, business initiatives in clean technology value chains may have limited power as new entrants. This creates the need for an integrated approach to industrial policy to overcome existing path dependencies and influencing gaps as a way to develop integrated value chains. Without such an approach, existing influential companies may excessively shape Portugal's policy options, eventually aligning them with their core business activities – usually closer to resource or feedstock generation and export, than developing industrial value chains.

[97] PORDATA, last updated 2022, **Export of goods and services: total and by product (2016)**

[98] OECD, 2017, **International trade, foreign direct investment and global value chains – Portugal trade and investment statistical note**

[99] International Labour Organization, 2018, **Decent work in Portugal 2008–18: From crisis to recovery**

[100] PORDATA, last updated 2022, **Employment: total and by industry, full-time equivalent (2016)**

[101] PORDATA, last updated 2022, **Gross value added: total and by industry (2016)**

[102] PORDATA, last updated 2022, **Employment: total and by industry, full-time equivalent (2016)**

[103] PORDATA, last updated 2022, **Gross value added: total and by industry (2016)**

[104] PORDATA, last updated 2022, **Export of goods and services: total and by product (2016)**

[105] Hit Horizons, **Industry breakdown of companies in Portugal** (webpage, accessed April 2023)

[106] **José de Mello** (webpage, accessed April 2023)

[107] Forbes, 2022, **The Global 2000**

Potential green industry champions: roles for domestic business and FDI

The development of new clean technology value chains could benefit from the network and spillover effects that may result from the expansion of existing industrial large-cap businesses into new activity areas. The largest Portuguese companies, which operate in the energy sector, concentrate on production, resource processing and trading, which creates a lock-in effect into resource exports and reduces the business incentive for developing domestic industrial capacity down the value chain. Nevertheless, some of these firms may see opportunities in building on the country's comparative advantages, while generating societal spillovers. For instance, EDP's ambitious plans for future investments in offshore wind energy[108] could benefit from the development of domestic green steel capacity for wind turbine manufacturing.

The remaining Portuguese industrial business environment is dominated by SMEs. The country has a limited number of domestic industrial conglomerates with the necessary scale to effectively push for green industrial capacity in the green steel and battery value chains. To address this, an innovation consortium backed with NextGenerationEU funding, led by DST Solar,[109] a renewable energy generation company, aims to develop a battery supply chain with a large group of Portuguese SMEs and research institutions. The biggest Portuguese industrial cleantech actor active in the area of e-mobility and grid technology systems – Efacec – has the expertise and scale to be a natural leader in aligning the development of an eventual battery production value chain with its grid technologies business. However, its current financial problems cause uncertainty about the prospects of assuming such a role.[110]

The necessary push, especially in the case of establishing a battery production value chain, could come from foreign companies in the automobile value chain, building on the successful examples of Volkswagen's and Renault's investments in the 1980s and 1990s.[111] Existing

[108] Reuters, June 2022, **Ocean Winds plans to invest $3.15 billion in offshore wind by 2025, EDP says**

[109] **DST Solar** (webpage, accessed April 2023)

[110] Reuters, December 2022, **Portugal says eight groups interested in Efacec reprivatisation**

[111] Mamede, R.P., Godinho, M.M., Simões, V.C., 2014, **Assessment and challenges of industrial policies in Portugal** (PDF), in: Structural change, competitiveness and industrial policy: painful lessons from the European periphery, London, Routledge, pp. 258–277

FDI in the automobile cluster from European manufacturers like Volkswagen, Renault and Stellantis may eventually expand into battery production and generate demand for green steel production. Especially Stellantis, who is making the switch to EV production in Portugal,[112] could be an important champion. The company is further looking to locate a new battery plant in the Iberian Peninsula.[113] Portugal's comparative advantages on green hydrogen and lithium can be further complemented by its favourable geographical location for global trade to attract FDI from non-European automobile manufacturers.

Civil society

The local impact of lithium mining and utility scale solar projects has received opposition from local communities. With large-scale projects not being linked to the creation of economic value at the local level, communities fear they might be exclusively left with the negative consequences. The perception that large solar plants or extracted lithium may primarily add value elsewhere, instead of creating local value, increases the lack of trust from local communities and national NGOs.

In particular, strong grassroots movements have formed in opposition to lithium mining (for example Minas do Barroso[114] and Serra da Argemela[115]). Some civil society actors (for instance in the area of clean mobility[116]) have made efforts to influence this narrative through emphasising the potential climate-positive impacts of lithium mining.

The lack of local value creation contrasts with the example of the Spanish region of Extremadura, which borders Portugal. Here, lithium mining has been linked to the development of a battery value chain at regional level.[117]

[112] Stellantis, March 2023, **Stellantis allocates electric van to Mangualde to support light commercial vehicle leadership in Europe**

[113] Eco, 2023, **Líder da Stellantis admite fábrica de baterias na Península Ibérica** (in Portuguese)

[114] RTP News, August 2022, **Botical. Demonstration against lithium exploitation (in Portuguese)**

[115] Publico, November 2021, **António Costa received in Covilhã with vigil against lithium exploration in serra da Argemela** (in Portuguese)

[116] **Ecomood Portugal** (in Portuguese) (webpage, accessed April 2023)

[117] El Mundo, June 2022, **Extremadura will host a gigafactory of batteries that will be operational in 2025** (in Spanish)

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EU dimension

The lack of due inclusion of the cohesion dimension in EU industrial policy is not only damaging for cohesion countries but may also contribute to fragmenting and weakening the single market. Europe's common internal market is one of the most important forces behind the European Union's cohesion. So far, the benefits of the single market have been large but unequal.[118] Negative effects on the single market result from large countries with existing adequate industrial and skills bases funding domestic companies and incentivising large players to locate production within their territory, backing this support with large fiscal resources. Combined with clear commitments from governments on creating cohesive business and innovation ecosystems, this acts as an incentive for investors to orient their interest to those geographies. These deepening discrepancies in industrial power further reinforce path dependencies in less developed regions. Conversely, a large, integrated market would allow innovation to speed up, and the productivity necessary to support the green transition to increase. If the European Commission is serious about establishing cleantech ecosystems across all member states, it needs to reflect this in its new Green Deal Industrial Plan (GDIP).

Most direct EU grants for industry investment across different stages of value traditionally flow in via cohesion funds, of which Portugal historically has been one of the largest beneficiaries,[119] or temporary packages like the Recovery and Resilience Facility (RRF) or NextGenerationEU. A core pillar of the GDIP – the NZIA – explicitly encourages member states to make use of RRF, InvestEU, cohesion funds and the Innovation Fund for investment in net zero technologies. In the short term, leveraging those instruments might suffice, particularly for existing projects. However, repurposing the current pool of EU funds will not only be insufficient to achieve EU Green Deal goals, but even to meet the NZIA's ambition, as assessed by the Commission.[120] Moreover, solely repurposing existing funds could undermine the achievement of other important environmental or social policy objectives. The aforementioned temporary packages also consist in large part of loans, which are not a helpful option for highly indebted countries, in addition to running out in a couple of years. They could therefore only be used for currently planned investments. An opportunity for leveraging more funding to cover the investment gap and to level the playing

[118] Bertelsmann Stiftung, 2019, **Estimating economic benefits of the Single Market for European countries and regions**

[119] Cohesion Open Data Platform, last updated 2020, **Historic EU payments by MS & NUTS-2 region**

[120] EU Commission, 2023, **Commission Staff Working Document. Investment needs and funding availabilities to strengthen EU's Net Zero manufacturing capacity**

field between member states could still arise under the European Sovereignty Fund in the medium term.

While the GDIP has triggered amendments to state aid rules under the Temporary Crisis and Transition Framework (TCTF), cohesion countries will still be disadvantaged in the green subsidy race. The scope of the regulation has been expanded to strategic cleantech sectors identified in the Net Zero Industry Act. SMEs and companies in less developed regions are eligible for even higher funding, especially if they are at risk of relocation outside of the EEA. While these are welcome developments, in practice they might be of little significance, if countries struggle with fiscal capacity or do not have the structures in place to develop clean technology value chains. Such relaxation of rules may still reinforce already existing industrial power imbalances within the EU through benefitting mainly incumbents. A recent example of this has been the vastly uneven application of energy crisis price support to industry, which has mainly benefited German and French businesses.[121]

On top of direct EU funding, member states have been able to take advantage of additional instruments for developing new green industrial value chains, such as industrial alliances under the auspices of the Commission (e.g. Battery Alliance). Some multi-country initiatives arising from those forms of cooperation have ended up being funded as IPCEIs (Important Projects of Common European Interest), most notably in the hydrogen and battery value chains – Portugal has participated in the former. Despite higher ceilings for state aid, the requirement to use domestic capital has put countries with less robust fiscal capacity, such as Portugal, in a disadvantaged position to use this instrument. In an attempt to address this, the Commission later allowed the use of RRF funds for IPCEIs in national plans (NRRPs). However, this was not successful in levelling the playing field. Many smaller countries, including Portugal, still did not make use of the funds for IPCEI. This is likely due to the uncertainty of the one-off financial instrument, often combined with a lack of existing national companies with financial scale in the suggested areas or strategies and structures in place to develop such value chains.

The EU hydrogen framework can also set wrong incentives for cohesion member states to develop low value-added uses of hydrogen. The European Hydrogen Bank will award a subsidy to hydrogen producers in the form of a fixed premium

[121] Bruegel, 13 February 2023, **National fiscal responses to the energy crisis**

without considering priority uses or value added.[122] This may incentivise the use of hydrogen in low value-added activities at local level, like export or blending into the gas grid. This can divert the use of hydrogen away from the development of higher value-added activities at local level.

Cleantech sectors eligible for preferential administrative treatment under the NZIA and the complimentary Critical Raw Materials Act (CRMA) that are relevant in the context of this report include battery grade lithium, battery manufacturing, electrolyser manufacturing, grid technologies, and wind energy manufacturing. These benefit from easier access to financing and shortened permitting times. While the CRMA mandates member states to submit national exploration programmes, prompting them to think strategically about mineral extraction, the NZIA refers to national energy and climate plans (NECPs).[123] The Energy Union Governance regulation does not clearly require member states to submit integrated cleantech value chain development strategies, nor does it include clear, robust criteria for subsequent Commission assessment of the research, innovation and competitiveness section in relation to the NZIA. Some of the elements of the guidelines on the submission of NECPs for 2021–2030,[124] such as consideration of potential value added of future cleantech value chains, could be taken into consideration. This is a reflection of the more general problem that the current EU industrial policy framework, and the Green Deal Industrial Plan in particular, lacks clear, strategic, operational objectives.

While the CRMA considers overall EU value added as a criterion of Commission evaluation of this regulation, and highlights the importance of local value-added in partnerships with third countries, it does not consider regional value creation for communities affected by mining activities within the EU. This dimension could become relevant in countries like Portugal. Without appropriate safeguards, communities from regions where mineral extraction takes place might not experience the benefits coming from this economic activity. Engagement with communities, foreseen as part of the recognition process for critical raw materials projects, does not mention the need to ensure economic

[122] European Commission, March 2023, **Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the European Hydrogen Bank**

[123] European Union, December 2018, **Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the governance of the energy union and climate action (Document 32018R1999)**

[124] Official Journal of the European Union, December 2022, **Commission notice on the guidance to Member States for the update of the 2021–2030 national energy and climate plans (PDF)**

benefits to regions beyond compensatory measures. Such economic benefits could come, for instance, from developing further value chain steps locally.

Finally, the NZIA does not robustly address cleantech deployment and industry decarbonisation. For instance, it misses the opportunity to boost demand for intermediate green products, such as green steel, through cleantech manufacturing. It also does not sufficiently tackle other potential barriers to deployment, such as the necessary administrative capacity for a ramp-up of permitting not only for manufacturing, but also for deployment of cleantech.

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CHAPTER 4
RECOMMENDATIONS

Without an integrated perspective on clean technology value chain development, cohesion countries may leave substantial value on the table. As can be concluded from the political economy barriers in the Portuguese case, existing dependencies on low value-added activities, and a lack of industrial policy priorities and appropriate governance structures, may risk excluding a cohesion country from the most productive parts of new clean technology value chains. This may contribute to increased economic and industrial power imbalances within the EU and extend the dependence of cohesion countries with low fiscal space on EU cohesion funds for public investment. It may also add to the emigration of qualified workforce, who will seek better jobs elsewhere.

The new context provided by a global interest in clean technology investment requires agility, solid structures and financial resources for EU member states to attract investment and develop value chains. Having an isolated approach to each of the clean technology value chain processes may leave a country out of major cleantech investment decisions. Portugal's case shows that the existence of a governance structure for the development of strategic value chains and the definition of clear industrial policy priorities is particularly important for the effective use of the available financial resources in fiscally constrained EU member states. The upside of having aligned policy priorities is especially important in cohesion countries, as moving domestic productive structure towards specialisation in high value-added tradable goods can bring increased long-term economic resilience and lower dependence on EU cohesion funds for public investment.

The EU-level policy framework adds to existing industrial and economic imbalances and is an implicit barrier for cohesion member states aiming to develop higher added value activities. In fact, the current EU framework for industrial investment, even with the newly increased ceilings for less developed countries under the revised temporary state aid framework, can have negative cohesion impacts. As such, it risks fragmenting and weakening the single market. Cohesion financing can contribute to mitigating some of these impacts, but cannot by itself level the playing field, especially when comparing the available fiscal space of larger EU member states with cohesion member states. EU-level

policy can contribute to levelling this playing field by reinforcing the financing pillar of the Green Deal Industrial Plan. A stronger and balanced financing framework should be followed with a requirement for member states to develop clean technology value chain plans, contributing to reducing national-level barriers for the development of higher value-added activities.

National-level recommendations

1. **Accelerate the presentation of the green industrial strategy to address the new clean technology context created by the EU response to the USA IRA.** Instead of February 2024, as foreseen in the Portuguese Climate Law, the green industrial strategy should have a timeline that builds on the EU's response to the IRA and the unprecedented interest by businesses in green industry investment. The strategy is the ideal framework for an agile response to the current context and to develop an integrated approach to the development of clean technology industrial capacity. It could also show the country's commitment to building on its potential to become a clean economy leader offered by its digital sophistication, highly educated population and cleantech opportunities, by focusing on attracting investment aligned with these areas. Clean technology is becoming a key element of international trade and competitiveness and can be a driver to upgrade the Portuguese economic structure. It would also signal a shift from the current resource-focused approach to integrated value chain development, with economic or territorial planning considerations being factored in. It could include the following themes:

    > **Setting priorities for clean technology value chain development**. This would contribute to an alignment of public financing resources, government decision making, private finance mobilisation and business decisions around the identified priority areas.

    > **Solid governance**. This will ensure public institutions and ministries work towards the same purpose and reduce the risk of excessive influence by incumbents, countering existing path dependencies. It also sets the structure for policy coordination, reducing the risk of conflicting policies.

    > **Financing**. Access to finance is a barrier preventing Portuguese SMEs scaling up and large businesses expanding into new activities. The various sources of finance, including at national and EU-level, and the national development bank (Banco de Fomento), should be aligned with the purpose of developing clean technology value chains.

- **Streamlining administrative processes**. With Portugal scoring low on regulatory quality, a green industrial strategy could set out investment-friendly processes, reducing timelines for public investment in critical infrastructure and increasing predictability for investors. This could be linked to a broader strategy of simplifying government processes, making this an additional comparative advantage for the country to attract investment. It would also ensure that the critical public infrastructure needed for clean technology value chains can be timely deployed.
- **Workforce qualification**. As well as continuing the highly positive investment in STEM graduates, the strategy should address the medium-level or vocational qualifications needed to implement the strategy across the priority value chains.

2. **Develop local demand for priority clean technology value chains.** The announced offshore wind auction could be an opportunity to set green steel requirements that may help to upscale domestic electrolyser production. It may also contribute to attracting other green steel consumers, like the automobile or wind offshore industries. Current hydrogen support schemes, which include low value-added activities – like blending hydrogen with fossil gas – could be adapted to support the development of local demand for priority clean technology value chains.
3. **Address the concerns of local communities by ensuring that the current lithium investment framework brings them socio-economic benefits**. Projects should consider value added to communities while maintaining strong environmental safeguards. A structured and coherent value chain approach can help develop industrial capacity at local level – following the example of the region of Extremadura in Spain – and can be integrated in the Iberian battery and EV value chains, also benefitting from the favourable geographical location of these lithium regions, mostly situated in Portuguese–Spanish border regions. With demand for investments in lithium and EVs expected to be high for the foreseeable future, Portuguese decision makers should be confident of their negotiation position in shaping the development of these value chains. A partnership with a global automobile manufacturer could be considered to implement integrated value chains with territorial considerations. Portugal could use the Temporary Crisis and Transition Framework (TCTF),[125] which allows higher state aid support in less

[125] European Commission, **Support possibilities for schemes under section 2.8 of the Temporary Crisis and Transition Framework (PDF)**

developed regions, to incentivise the development of battery production value chains linked to the sourcing of lithium at local level.

4. **Put clean technology value chain development on the agenda of the yearly Iberian summits**. Portugal and Spain could cooperate on green industry, starting with identifying how value chains in both countries can reinforce each other, making the Iberian Peninsula a green industrial powerhouse. For example, Portuguese or Spanish batteries produced in the border regions (also cohesion regions) can easily supply both markets.

5. **Maximise the use of available EU funds to support the development of new clean technology value chains**, eventually by reshuffling existing programmes. Remaining sources of financing, like the RRF, InvestEU, cohesion funds and the Innovation Fund, could be mobilised to support the establishment of new green industries with high value added. This could help to capture the opportunity of easier access to funding for "strategic net zero technologies" under the Net Zero Industry Act.

6. **Join international partnerships** to be part of the discussions that are shaping the development of global green markets, such as standard setting, green procurement and green buyer clubs. This could require active participation in emerging partnerships such as the Clean Energy Ministerial Industrial Deep Decarbonisation Initiative, the G7 Climate Club, the Leadership Group for Industry Transition, Mission Innovation or Breakthrough Steel. At EU level, Portugal could consider joining European initiatives aimed at developing green industrial value chains (such as the European Net Zero Europe Platform, the Battery Alliance and IPCEIs). Considering its clean technology potential, Portugal has been underrepresented in these partnerships, which are the basis for the development of future supply chains and new markets. It would be strategic for the country to increase its influence at this level, thereby increasing opportunities to attract investment and develop value chains.

EU-level recommendations

Climate action needs to work across the EU and not deepen existing economic imbalances. In addition, reducing economic and fiscal imbalances shouldn't be exclusively addressed through cohesion policy, but also by shaping industrial policies. It can also be argued that, in the interests of EU competitiveness and welfare, industrial policy mechanisms should not overlook the competitive edge of developing supply chains where production costs are the lowest.

1. **Ensure a level playing field in the financing framework through deepening the EU Green Deal Industrial Plan investment pillar** to address existing imbalances between member states, as identified by the European Commission.[126] This should go beyond expanding ceilings for cohesion regions under the revised temporary state aid rules.

    a. **Present additional sources of funding**. The European Sovereignty Fund currently under discussion could play a key role in filling the EU funding gap for cohesion regions under the Multiannual Financial Framework. Any new funding should be accompanied by robust environmental requirements and social safeguards, for instance building on NextGenerationEU's strong governance model. Provision of technical assistance to address bottlenecks and improve quality of spending should be considered.

    b. **Facilitate more equitable access to IPCEIs.** The current IPCEI structure implicitly favours fiscally powerful countries. There is a need for more inclusive and coherent IPCEI governance. This could be achieved through strengthening dedicated EU administrative capacity, by allowing greater use of EU funds for countries lacking the necessary fiscal capacity and removing barriers for SME uptake.

    c. **Address regional disparities in the attribution of the Innovation Fund.** This can be done either through allocation quotas, increasing overall accessibility for SMEs, or by working with member states to address structural fragilities in scaling up research initiatives.

2. **Establish a predictable framework for green industrial cross-EU value chain development, ensuring investor certainty.** This dimension has been missing from the EU Green Deal and has not yet been adequately addressed through the EU GDIP. The EU needs to set out a systematic framework with clear, time-bound targets that incentivise cleantech value chain development, while addressing decarbonisation needs and skills bottlenecks. Member states can align their industrial policies accordingly, increasing their overall effectiveness.

    a. **Set procurement requirements for the use of primary industrial products in cleantech manufacturing in the Net Zero Industry Act.** Use the build-out of manufacturing capacity for priority sectors in the NZIA to create the necessary demand pull for decarbonised primary materials,

[126] European Commission, 2023, **Staff working document – Investment needs assessment and funding availabilities to strengthen EU's net-zero technology manufacturing capacity SWD(2023) 68**

such as green steel. This will contribute to speeding up industrial decarbonisation.

   b. **Adequately address potential administrative capacity bottlenecks in the Net Zero Industry Act.** Present an assessment across member states of potential bottlenecks to speedy permitting for cleantech manufacturing and deployment, while ensuring strong environmental protection criteria, and duly address these, for instance through providing financial and technical support.

3. **Introduce a requirement for member states to prepare integrated cleantech value chain development strategies under their national energy and climate plans (NECPs) .** Preparation of such strategies, eventually with a cross-border scope, would incentivise countries to think strategically about industrial development according to their comparative advantages, while contributing to building resilient green European value chains and strengthening the single market. This should be included in the NZIA andmade into a clear obligation under the Energy Union Governance Regulation.

4. **Ensure that the EU hydrogen financing framework (e.g. European Hydrogen Bank) incentivises priority, high value-added uses of hydrogen.** The EU hydrogen framework has to set the right incentives for cost-effective use of such a scarce and premium energy carrier. It must focus on priority uses,[127] and contribute to the development of clean technology value chains and new decarbonised industrial processes.

5. **Include local economic value creation when assessing impacts on communities of raw material projects considered for recognition as a Strategic Project in the CRMA.** While the CRMA encourages engagement with local communities, it should go beyond preventing environmental and social harm, provision of quality jobs and compensation mechanisms. These interactions should also assure locals of economic benefits that projects will bring to the region.

[127] E3G, 2021, **Hydrogen factsheet – Blending**