Executive summary

, ALL European Union industrial employment and output increased above 2021 levels, despite rocketing energy prices. However, output declined from energy-intensfr, could bridge which seems to be the preferred strategy currently. is will avoid irreversible large-scale

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1 I

Russia's invasion of Ukraine in February 2022 made clear that Europe's dependency on energy imports from Russia was a grave strategic liability. e energy crisis that followed Russia's weaponisation of natural gas supplies showed how decoupling from Russian gas has become essential. In the decoupling e ort, European industry, which accounts for more than a third of total European Union nal demand for electricity and natural gas, has a major role to play.

Industry uses energy – primarily natural gas and electricity (Figure 1) – for four main purposes: production of heat in industrial processes and for space heating in buildings; as feedstock to make products including plastics and chemicals; generation of steam for process heating and generation of electricity to run industrial processes; and to power machinery and industrial motors, lights, computers and equipment for heating, cooling and ventilation.

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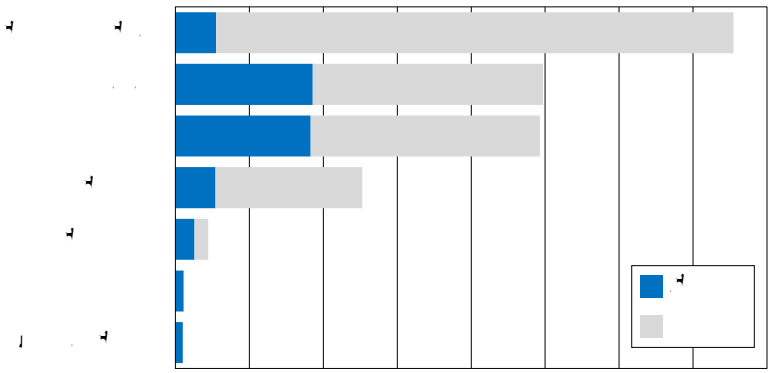

Source: Bruegel based on Eurostat. Note: In Eurostat's energy balance datasets 'industry' is the aggregate of manufacturing, construction and mining and quarrying.

e four most energy-intensive industries in terms of gas and electricity demand in the EU are basic metals, non-metallic minerals, paper, pulp and printing, and chemicals[1]. e EU countries with the largest industrial natural gas and electricity use are Germany, France, Italy, Spain, the Netherlands, Poland and Belgium. In these seven countries, the four most energy-intensive industries account for 62 percent to 71 percent of total industrial gas demand, and 43 percent to 66 percent of industrial electricity consumption (Figure 2).

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2 E ?

On aggregate, industrial output and employment have been una ected, but the crisis impact is visible for individual sectors. Europe's energy supply and price crisis started in September 2021, when Russia started to phase down gas ows to European buyers, resulting in 86 billion cubic metres of forgone supplies, or a 60 percent reduction in 2022 compared to 2021. In the rst yecuC2er6 T(d 22-3 h)7 (as)n bso 2021. In the d. Icenis en.9 m4 (e doi)1 (a s)1. f for jo 202ob lodoi(t)-102d1 (

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Source: Bruegel based on Eurostat.

3.

When thinking about how to maintain the competitiveness of energy-intensive industry in Europe, and whether it is worth doing so, two linked questions need to be answered. First, would it be better to outsource permanently some parts of energy-intensive value chains? Second, if the answer to the rst question is no, how can industrial energy prices be reduced to ensure the competitiveness of energy-intensive productions stages in the EU? To navigate the loss of Europe's main external energy supplier and the subsequent impact on prices, EU policymakers have three options.

First would be to defend energy-intensive industry in its current form by using subsidies and production targets to bridge the high cost period until new cheap energy arrives. is implies

very substantial public support[4], and might a ect negatively the production cost-competitiveness of industry. Similarly to what happened with subsidies rolled-out in the early 2000s for the solar industry, in the medium-term this strategy will likely bring down the cost of

European households and less energy-intensive sectors. Little to no harmonisation of the policies rolled out so far (Sgaravatti *et al*, 2023) risks undermining the fairness of the EU's single market.

Measures such as price caps on natural gas and electricity for industrial consumers, for example, are decided nationally and vary from country to country[6]. Energy-intensive sectors in countries with generous support schemes will be able to outcompete their peers in other countries. But if all countries provide generous support in a speci c sector to maintain a level playing eld, this sector will consume more energy and hence make energy more expensive for all other sectors, reducing their competitiveness. If governments decide to support all industrial sectors (to maintain their output/energy consumption), then household energy prices will have to rise. And all this will imply a great scal stimulus ultimately bene tting energy producers, many of which pay taxes outside the EU.

If energy prices remain high, supporting energy-intensive activity would mean subsidising energy prices permanently

e massive increase in electricity and gas prices implied a drastic loss of competitiveness for European energy-intensive companies in 2022, and some of the e ect is expected to persist. e price of natural gas in the EU is still substantially higher than before the crisis, despite having retreated from the mid-2022 peak. Financial markets expect this will remain the case for another three years, with prices at around €50/MWh, or four times the US price (Figure 5). Notwithstanding high uncertainty (ows from Russia could resume, bringing prices down, or stop completely with the opposite e ect), in the baseline scenario the situation will not di er greatly from today and the EU will rely structurally more on lique ed natural gas than in the past (LNG deliveries have substituted about half of the loss of Russian pipeline ows). is development will result in a permanent increase in gas prices for EU companies as US LNG shipments are 52 percent per unit more expensive than average pipeline gas imported into the EU (Di Comite and Pasimeni, 2023).

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erefore, national policies to temporarily bridge a gap in energy-price competitiveness might be made permanent if high EU energy prices relative to competing economies continue, providing an ongoing justi cation.

A re-allocation of industrial output might be already happening

In 2022, energy-intensive industries experienced a reduction in industrial production, while

Policies to address the current energy price crisis cannot be discussed in isolation from the substantial climate policy measures applied in these sectors. e value of allowances in some production processes corresponds to a high share of the product sale price. For example, 1 tonne of hydrogen produced from natural gas is worth €1500, of which the related 10 tonnes of emitted carbon dioxide account for €1000. ese sectors are typically covered by the emissions trading system and obtain free allowances related to the requirement to avoid carbon leakage. However, in the current ETS phase, free allocation volumes are set to decline quickly.

Heavy industry transition is needed anyway

e energy crisis o ers an opportunity to foster the green transition: promoting energy and material e ciency and switching from hydrocarbon-based production processes to carbon-free routes. e IEA (2023) estimates that emission reductions needed by 2030 to be in line with a scenario of net-zero emissions by 2050 can be achieved with existing technologies. By 2030, the European Commission expects a reshu ing of energy sources used by industry and e ciency gains that will reduce EU oil consumption by 90 terawatt hours (TWh), coal and waste by 220 TWh and natural gas by 310 TWh (European Commission, 2022b). In the short-term policymakers should thus focus on setting the right incentives to enable the transition.

There are three main technology pathways to replace natural gas: electrification, gentortrypic (t30 (W (h an1 (h and n)7F)2]Jdf)11 (y 20ction 0)-10 ( )[on-b)1 (ask-p)-30 (ek)]TQb)-2 (he)

advantage of being in line with European's climate targets. Pioneers in industry may bene t from the rst-mover advantage by building business relationships with industrial buyers[13].

Producing ammonia-based fertilisers in Europe requires considerable volumes of natural gas, but the workforce involved is limited: in 2019, total direct and indirect employment in the whole fertiliser sector (not only nitrogen-based fertilisers) in the EU (including then-member the UK) was 75,800[17], or just 7 percent of the employees in the EU chemical industry (excluding the UK).

Importing products with high energy content may save energy while having limited impact on the output of downstream industries

Substituting industrial output of commodities with imports, for products in which energy represents a large share of the cost, allows companies to maintain the production of nal products even when domestic energy prices reduce economic margins or force production curbs. Mertens and Müller (2022) found that if Germany were to import products with high gas intensity and import substitutability, industry could reduce gas demand by 26 percent, while losing only 3 percent of nal sales. For 2022, Chiacchio *et al* (2023) found that the EU's imports/production ratio in energy-intensive sectors increased on average by 11 percent compared to non-energy-intensive sectors as energy producer prices rose. is indicates that imports partly replaced domestic output in sectors where energy costs increased. Looking at how the EU's net imports (imports less exports) changed in 2022 for some of the most energy-intensive inputs into basic metals, non-metallic minerals, paper and chemicals helps understand some of these movements (Figure 7).

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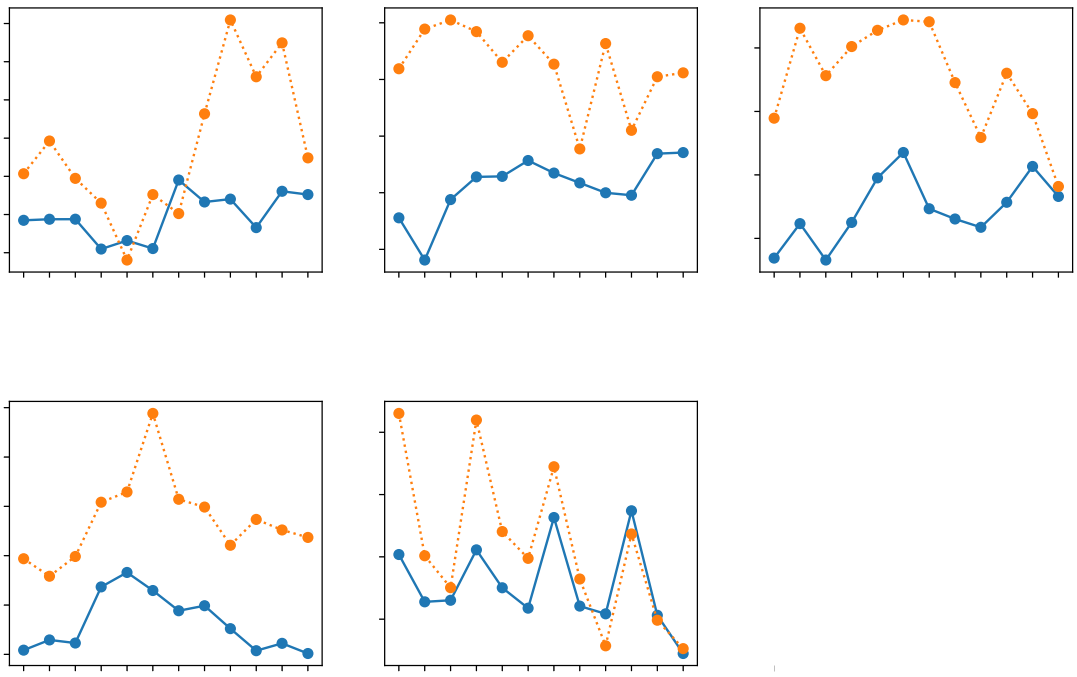

Source: Bruegel based on Eurostat.

17 S https://www.fertilizerseurope.com/wp-content/uploads/2019/07/Industry-Facts-and-Figures-2019-Digital-version.pdf.

Figure 7 shows, first, that net imports increased for all the selected energy-intensive prod-

Facilitate substitution between domestic production and imports of intermediate goods in energy-intensive sectors

e European energy-price shock might have made energy-intensive commodities[19], such as primary steel, commercially unviable in Europe. Industrial policy might more usefully support high value-added parts of value chain, such as complex gearboxes, instead of persistently subsidising the production of energy-intensive commodities. Energy-intensive intermediary products generally have low margins and, as their price is set on international markets, an increase in the cost of inputs can lead to market exit (Bataille, 2019). erefore, consistently higher energy costs compared to other parts of the world would represent for Europe a major source of comparative disadvantage. On the other hand, goods in the upper part of the value chain tend to be characterised by more product di erentiation, require a higher degree of specialisation for their production, and o ering higher value added.

Aggregate industrial output may have outperformed expectations, but parts of the production capacity of energy-intensive products may be gone for good

Some of the production curtailments in energy-intensive products witnessed in the midst of the crisis have not receded in line with falling natural gas prices. For plants producing ammonia for example, the production capacity that came back online after natural gas prices

Strategic autonomy policies and trade barriers can hamper imports of energy-intensive intermediate products

In the new European high energy price environment, imposing new trade barriers on energy-intensive products[22] could have unwanted consequences for European value chains. The EU's ambitions of becoming a leader in hydrogen production – and hydrogen-based intermediate products[23] – also seeks to defy foreign cost advantages (IRENA, 2022). Revising trade and industrial policies might be needed to enable European companies to get competitive access to energy-intensive intermediate products.

Despite this, there remain some sound reasons to abstain from a purely short-term cost-driven approach to imports. For example, retaining a sufficiently large and high-quality steelmaking production capacity may be important for national security reasons. Moreover, the EU's stringent environmental standards generally make products produced in the EU more environmentally friendly than imported products. Outsourcing some energy-intensive production must be complemented by strategic and environmental considerations on the origin of imports.

Value chain spill-overs need to be assessed

Finally, losing certain energy-intensive production might not only carry risks of increased unwanted dependencies, it might also impact important domestic value chains. For example, while the main product of an energy-intensive process might be replaced by imports, certain co-products (for example, AdBlue, a chemical compound used in diesel-fuelled vehicles to reduce emissions[24]) might not be easily accessible on international markets. Moreover, industrial hubs often exploit proximity and cluster effects among factories (Valle, 2020). The closure of some energy-intensive factories could spill-over to neighbouring companies, in terms of both know-how and production processes. Examples of such clusters in Europe include Germany's Ruhr Valley for steelmaking and the Belgian chemical cluster. If such spill-overs cannot be quickly internalised (through prices), governments might have a role in temporarily protecting essential nodes in the value chain.

Instruments including the European Cohesion Fund and the European Just Transition

4 C

e EU has historically been a net importer of energy, with imports of primary energy representing 57 percent of the EU's domestic consumption in 2020 according to Eurostat. e outsized dependency on Russian energy supplies proved to be a dramatic vulnerability in face of the Russian invasion of Ukraine in 2022. By cutting its gas supplies to the EU, Russia pushed up the commodity's price, while EU's sanctions a ected the imports of coal and oil, both of

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e ect. In 2022, the EU reduced industrial natural gas demand by 15 percent compared to the 2019-2021 average (McWilliams and Zachmann, 2023), while aggregate industrial output increased by 5 percent, also compared to 2019-2021.

F 10: I , 2022 2019-2021

Source: Bruegel based on Eurostat.

All else being equal, this output increase should have raised industrial gas consumption by 2 billion cubic metres (bcm). is did not happen because industrial production was curtailed in energy-intensive industries, with output increasing in some industrial sectors while decreasing in others.

Fuel switching

Gas can be substituted by another energy carrier, such as electricity or fuel oil, to create heat in a turbine or furnace. While it is di cult to obtain exact gures on fuel switching, there are clear instances of this happening. For example, German steelmaker yssenkrupp has