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Evidence on the Exposure and Impact of the Ongoing Energy Crisis on the EU Industry

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EVIDENCE ON THE EXPOSURE AND IMPACT OF THE ONGOING ENERGY CRISIS ON THE EU INDUSTRY

Chief Economist Team -GROW A1: *William Connell Garcia, Francesco Di Comite and Maria Garrone*[1]

Key Messages:

- **The European Union (EU)'s overall energy exposure almost doubles that of the United States (US), reflecting differences in structural composition of the economy. This structural composition highlights the vulnerability of EU economies with respect to the current energy shock.**
- **Gas prices are at the core of the ongoing dynamics in energy prices. While they have displayed high volatility across the globe since the beginning of the Russia (RU) invasion of Ukraine (UA), their increase in the EU has been larger than that in our trade partners - particularly in the US.**
- **There is heterogeneity in energy exposure across sectors with *Basic Metals, Air Transport and Chemicals* being the most exposed ones. These sectors also heavily rely on foreign sourcing, compounding their vulnerability.**
- **The EU shows a higher vulnerability of its supply chains to international disruptions in energy products than the US and China.**
- **The importance of the EU's 10 most energy-exposed sectors could be an indication of their vulnerability to the shock at macro level. They represent more than 10%, for both VA and investment in the economy and can have potential repercussions on upstream and downstram sectors along their relative supply chains. With a few exceptions, SMEs play an important role in these high energy exposed sectors.**
- **The different impacts of the crisis across sectors reflects their different energy exposure. Growing divergences are observed between the most energy-exposed industries and the other industries, with a particularly negative impact in terms of industrial production and overall confidence trends for the highly energy exposed ones.**
- **A model-based analysis provides indicative projections of an adverse impact of energy-price increase on domestic production, with some of the highly energy exposed industries being among the most affected ones.**

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[1] *The views expressed are the authors' alone and cannot be attributed to the European Commission.* *The authors are grateful to Román Arjona, Clement Serre, Ignacio Martinez, Josefina Monteagudo, Paolo Pasimeni, Bert Saveyn, Manuel Von Mettenheim, Serban Scriecium, Immavera Sardone and Jean Bergevin for their valuable comments and to Matthias Weitzel for providing input and comments to the modelling section.* *The authors remain the sole responsible for any mistake in this document.*

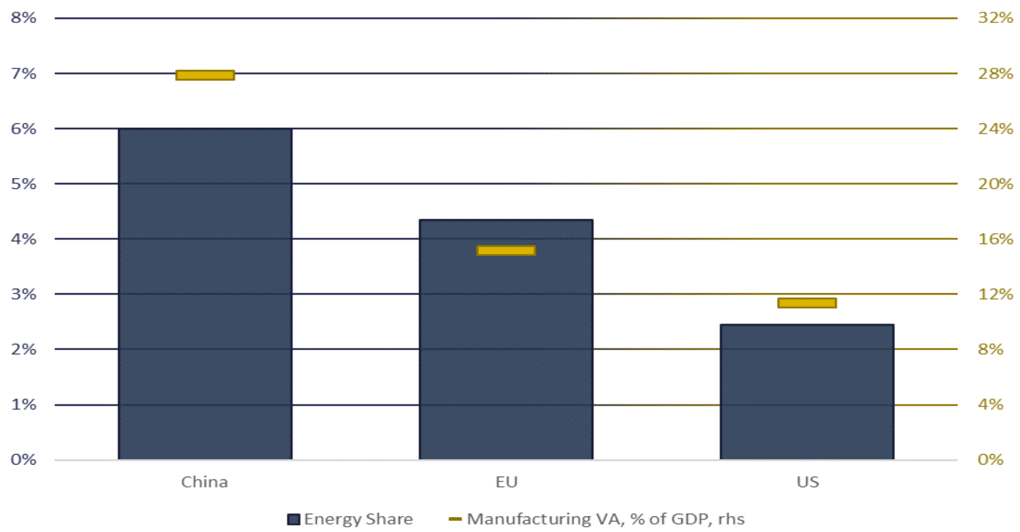
Russia's unprovoked and unjustified military aggression against Ukraine has had a dramatic impact on the global energy markets. This has triggered a sharp rise in energy prices and an increase in their volatility with severe repercussions for households and businesses in Europe.

This brief analyses this ongoing energy crisis with respect to the EU industry. First, it examines the overall EU's structural composition, price competitiveness and trade in the energy market *vis-à-vis* third partners. It then zooms in at a more granular level and assesses the energy exposure, taking into account global supply chain, and the impact of the crisis across sectors.

EU Competitiveness: structural composition of the economy and differentials in energy prices

The EU overall energy exposure almost doubles that of the US, reflecting structural differences in the economic composition. This structural composition highlights the vulnerability of EU economies with respect to current energy shock. We define the energy generating sectors as including raw materials (e.g., "energy producing minerals"), intermediates (e.g., coke and petroleum) and distribution of energy products (e.g., electricity). Using this definition, we look at the energy content needed to produce their total final demand for the EU and its main trading partners. In the EU, the overall energy exposure of the economy is around 4.4 %, which is significantly more than the US (2.5%), but less than manufacturing-oriented China (6%) (**Figure 1**).

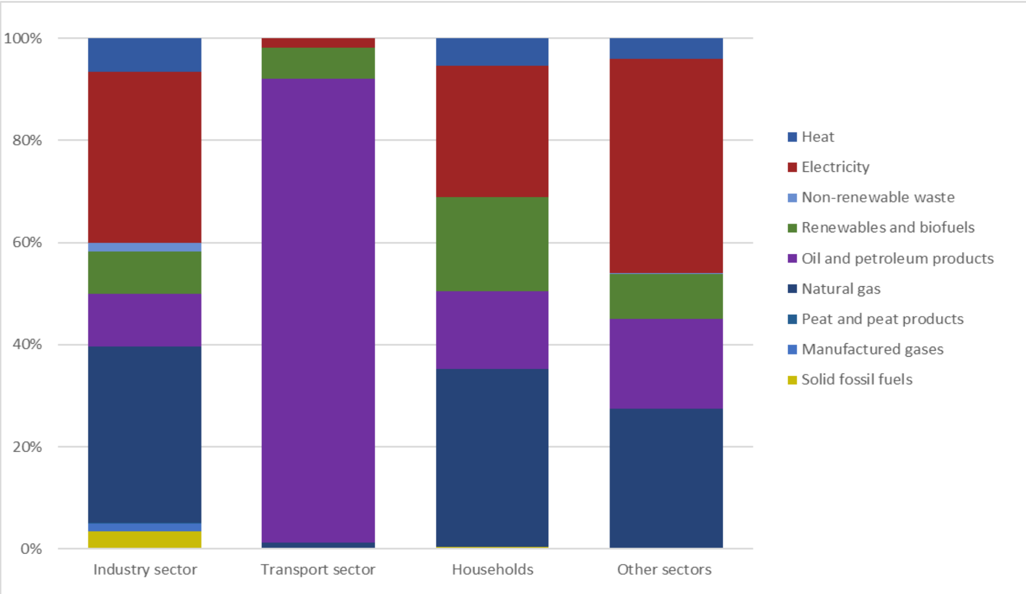
Figure 1: Share of energy in total production and share of manufacturing in the economy, 2018



Source: *Chief Economist Team – DG GROW based on World Bank national accounts data and OECD National Accounts data.*
Note: *Energy exposure is defined as the share of energy content needed to produce their total final demand in the economy. The energy content is computed as share of the valued added coming from the energy generating sectors, which includes raw materials (e.g., "energy producing minerals" (D05T06)), intermediates (e.g., mining support activities (D09), coke and petroleum (D19)) and distribution of energy products (e.g. electricity, (D35)), over total production in each sector. This definition is obtained in overall value added terms, which means that it includes direct exposure to energy and indirect use through intermediate inputs.*

Gas deserves a special attention because it drives the price of the entire energy market in our current marginal pricing market structure.[2] As such, it is a key energy product with its price dynamics being at the core of the ongoing energy crisis and spilling over the rest of the energy generating sectors and the economy**.** Natural gas is the first form of energy used by the EU industry, accounting for more than one third of its total energy demand in 2020. It is also the biggest share (35 %) of households' energy use.

Figure 2: EU final energy consumption by energy source and sector, 2020



Source: *Chief Economist Team – DG GROW based on Eurostat data.* ***Note****: Data are based on energy use expressed in tonnes of oil equivalent. Oil and petroleum products excludes biofuel portions.*

While gas prices have displayed high volatility across the globe since the beginning of the RU invasion of UA, their increases in gas prices in the EU have been larger than those in our trade partners - particularly in the US (**Figure 3**). Starting from the beginning of the summer, EU price displayed a marked increasing trend, peaking at above 300€/MWh in September. By late October, with mild weather and nearly-full gas storage - as a result of the EU joint policy action – the gas price fell below 100€/MWh for the first time since the RU invasion of UA, and decreased even further in early 2023 . However, the EU price differential *vis-à-vis* its trading partners remains still wider compared to previous years –particularly with the US (**Figure 3**).

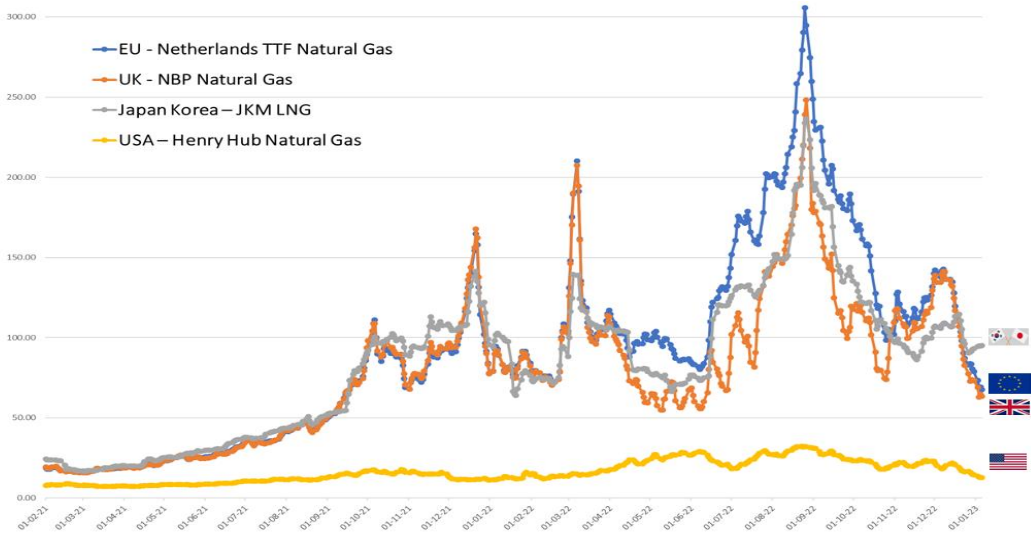
Since February, the wholesale gas prices in the EU have been exerting upward pressure on the wholesale electricity prices. Although these wholesale prices have decreased at the beginning of 2023, their sharp increase in the level and volatility registered over 2022 was gradually passed through to gas and electricity retail prices (**Figure 4**).[3] **This can raise concerns about competitiveness loss and a reallocation of global market shares.** It can also create risks that could push EU firms, notably in energy

[2] For a nice illustrative representation of the marginal pricing model in the energy market, see Jacques Delors Institute's "Overview of the European electricity market" Infographic 25.

[3] Interestingly a recent IMF paper by Ari et al.(2022) "*Surging Energy Prices in Europe in the Aftermath of the War: How to Support the Vulnerable and Speed up the Transition Away from Fossil Fuels*" shows how pass through from wholesale to retail for electricity prices and gas prices tend to be lower compared to crude oil prices, suggesting that the transmission of these price increases are usually lagged.

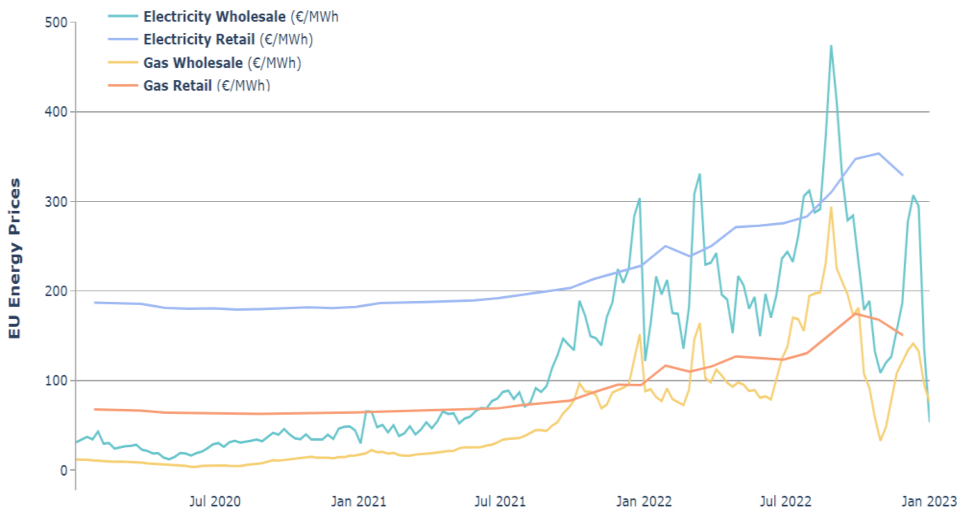
intensive sectors, to relocate abroad in order to have access to more favourable conditions for its inputs, particularly for the less energy efficient industries that are likely to be most affected by the price of energy. This also comes in addition to extra incentives received in third countries for their energy transition, such as the Inflation Reduction Act in the USA.

Figure 3: Evolution of gas prices (€/MWh) in EU and third partners, 5 January 2023



Source: *Chief Economist Team – DG GROW based on Refinitiv.* ***Note***: *data are presented on a 3 day moving average base.*

Figure 4: EU energy prices, wholesale and retail, up to 5 January 2023

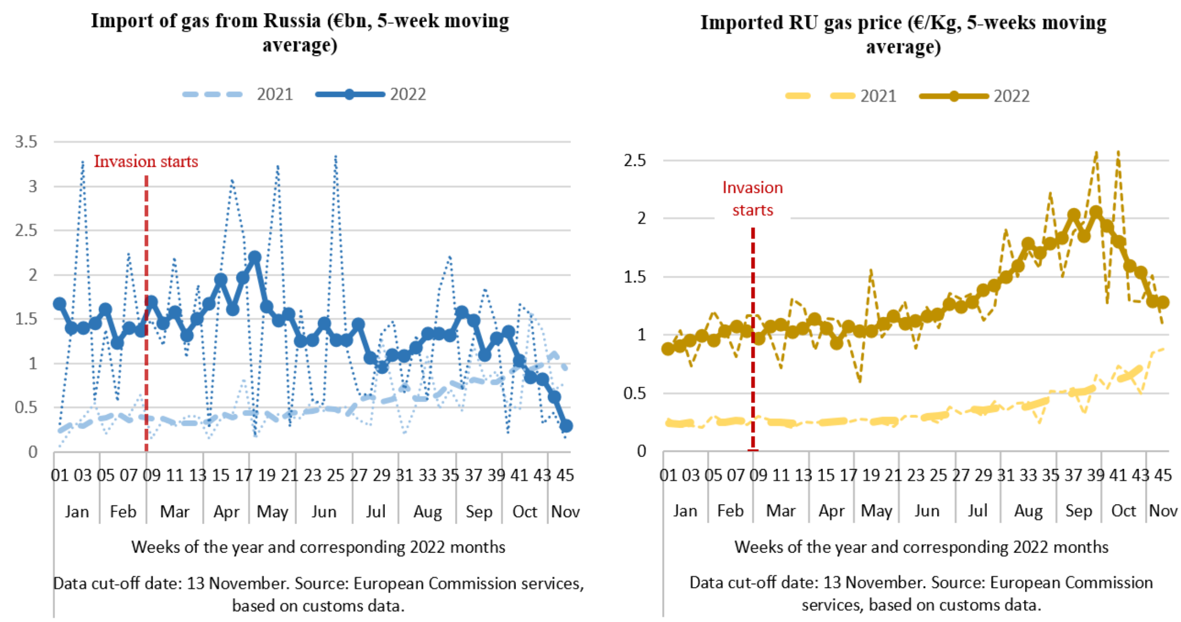


Source: *COM DG ENER, based on data from Platts and VaasaETT.*

One of the main reasons for the relatively higher increase in price in the EU is the shift in composition of gas imports in the course of 2022, as a result of the reduction of supply of cheaper Russian pipeline gas in favour of more expensive LNG sources. **EU import of Russian gas** remained stable for a few weeks after the invasion, **but has decreased significantly since May 2022 (Figure 5).** By September

2022**,** Russian imports of pipeline gas has decreased to 9% and 14% when including LNG compared to a 41% share of Russian pipeline gas and 45% when including LNG in 2021.[4]

Figure 5: Imports of Russian gas to the EU, quantity (M tonnes) and unit values (€/Kg), 2021 and 2022



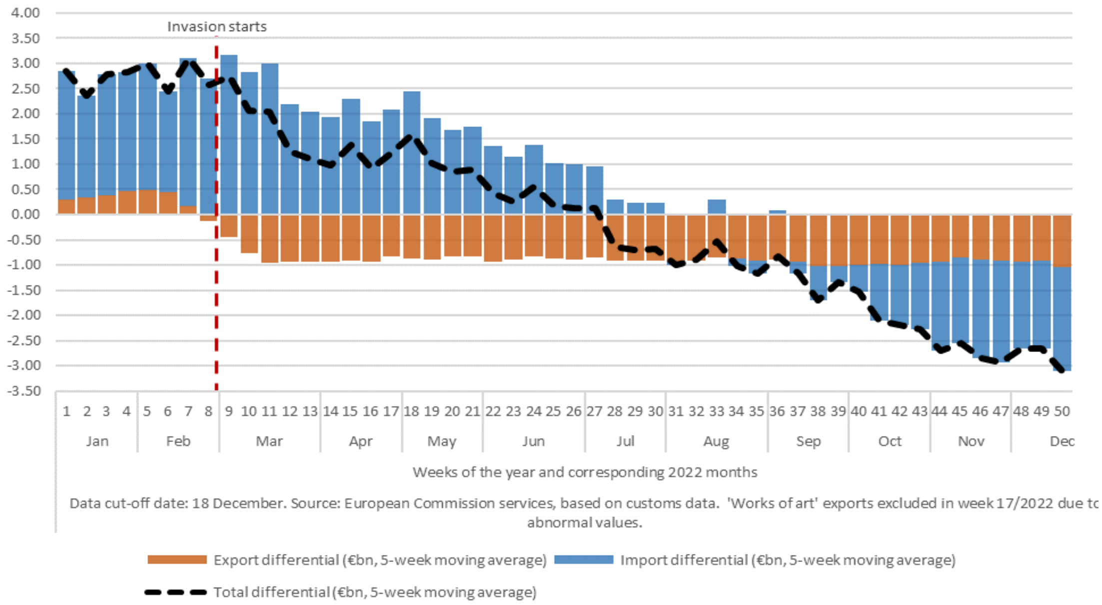
Source*: Chief Economist Team - DG GROW based on DG TAXUD customs data and elaborated jointly with DG GROW, DG TAXUD and DG TRADE. Last update 2 October.*

Total trade between the EU and Russia has been constantly shrinking in the course of 2022, both in absolute terms and in comparison with 2021 (Figure 6). While at the beginning of the year, both imports and exports *vis-à-vis* Russia were at very high levels (in the first weeks of the year, almost 80% higher than in the corresponding weeks of 2021), since the beginning of the invasion trade linkages have been increasingly disrupted. By the last weeks of 2022, total trade between the EU and Russia was just 50% of the value of the corresponding weeks of 2021.

In the first half of the year, the significantly high fossil fuel prices resulted in an increase in the value of imports from Russia with respect to 2021 (oil, gas and coal generally account for 85% of EU imports from Russia), but the constant reduction in volumes imported resulted in a change in the sign by the second half of the year. Starting from August, the EU imported less from Russia than it did in the corresponding weeks of 2021. As for the EU exports, the decision to limit exports of luxury goods and of investment, capital and technological goods that could have shored up the military industry of Russia resulted in a constant contraction of roughly 1 €bn/week, compared to 2021 levels.

[4] COM(2022) 553 final

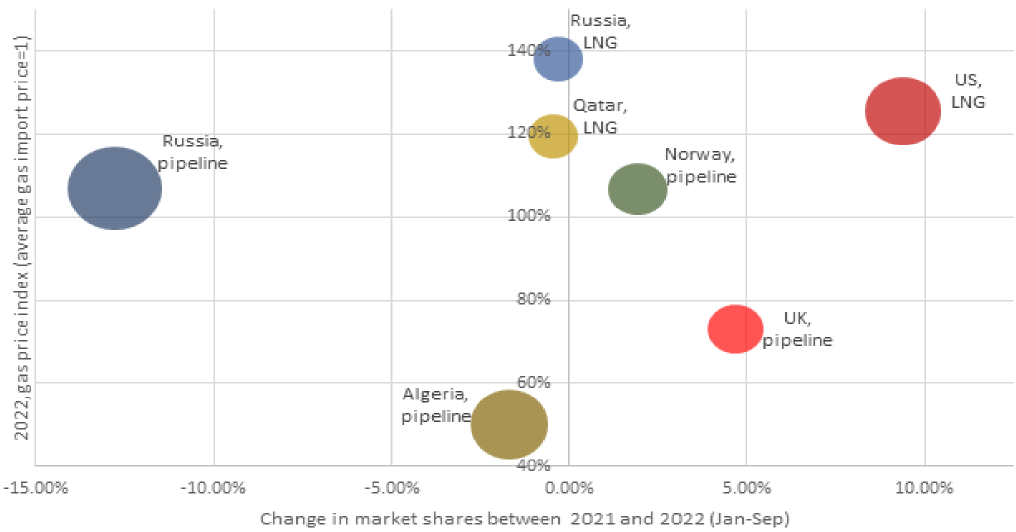
Figure 6: EU total trade with Russia, 2022-2021 differential (€bn, 5-week moving average)



***Source**: Chief Economist Team - DG GROW based on TAXUD. **Note**: The exact timing of reporting reflects firm invoicing, data are presented on a 5 week moving average base.*

This decoupling will require EU businesses to diversify their sources of supply in the present and near future, in particular as far as fossil fuel inputs are concerned. Diversification has indeed already happened in the current months, with gas from the US (LNG), Norway and UK (pipeline, mostly redirecting US LNG shipments beyond the current EU regasification capacity) gaining 10%, 5% and 3%, respectively, of the energy market-shares in the EU, following the massive drop of gas pipeline from Russia (**Figure 7**).

Figure 7: Market share changes and prices of gas suppliers in the EU energy market, 2021-2022



***Source**: Chief Economist Team - DG GROW based on COMEXT.*

Sectoral exposure and impact

Most exposed EU sectors by a shock in the energy sector

The current crisis has a high sectoral dimension. There is heterogeneity in energy exposure across sectors in the EU with *Basic Metal, Air Transport* and *Chemicals* being the most exposed ones. We adopt a data-driven approach to identify the most-energy exposed sectors. This analysis is based on input-output data, which has also the advantage to factor in supply chain considerations. Although the most updated OECD input-output data refers to 2018, it allows us to calculate the pre-crisis energy exposure for each sector, where the relative exposure is unlikely to change over a short period of time. We look at the energy content of a sector, i.e. the share of energy needed to produce the final demand of the sector in question. As previously mentioned, this includes raw materials (e.g., "energy producing minerals"), intermediates (e.g., coke and petroleum) and distribution of energy products.[5]

We find that that the sector (outside the energy generating sectors) with the highest share of energy products is observed in *Basic Metals*, which contains an exposure of 12% (i.e., one unit of production incorporates 12% of value added generated in the energy sector). In monetary terms, this means that 12 cents of energy inputs are needed to produce 1 euro of final demand of basic metals. After *Basic metals*, ***Air Transport* and *Chemicals***, with 9% and 8% respectively, **are the second and third most exposed sectors**. Indeed, the high share of energy in these sectors is the result of the direct use of energy products in the forms of fuel (e.g. *Air Transport*) and input of production (e.g. *Chemicals*) **(see Figure 8 -** reporting the 10 most energy exposed sectors).[6]

The most energy exposed sectors also highly rely on foreign sourcing, compounding their vulnerability. The analysis of the origin of the energy input provides a further sign of an additional layer of risk of exposure. We can observe that most value added of energy input is generated abroad for sectors such as *Basic metals*, *Air Transport*, *Water Transport* and *Chemicals* (**Figure 8**). To continue with the example of the *Basic Metals*, this means that 8 cents out of the 12 cents of energy inputs needed for 1 euro production of the final demand comes from abroad.

It is important to notice that **in addition to a direct impact on these highly energy-exposed sectors, an energy shock, such as the current one, also has repercussions on upstream and downstram sectors along their relative supply chains.** An analysis of these progagtion effects is usually quite complex, requiring highly detailed data, fine methodologies and assumptions. Nonetheless, we can give an idea of these transimissions, looking at the input-output data in terms of valued added and the contribution of the highly energy exposed sectors to the downstream sectors.

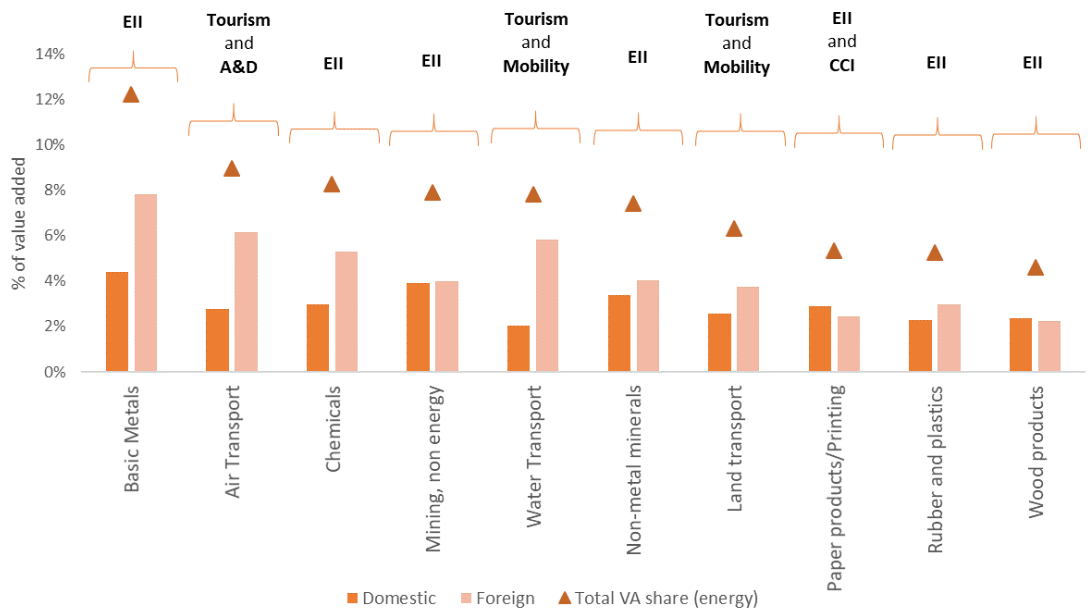
To give an example,we **focus on the main downstream sectors of three most EU energy exposed sectors** (i.e. *Basic Metals*, *Air Transport* and *Chemicals*) **and see how these sectors are affected directly and indirectly by an energy shock**. In particular, we see that while "Fabricated Metals" has an energy exposure of 4% (outside the top 10 sectors with a high energy exposure), it is heavily exposed (5%) by inputs from the top 3 energy exposed sectors. The same occurs with "Electrical Equipment" or "Motor

[5] For more details on sectors covered by this definition see note of **Figure 1** and **Figure 8**

[6] The sector classification follows the NACE Rev.2 Statistical Classification of Economic Activities in the European Community. For example, Manufacture of Basic Metals includes "*the activities of smelting and/or refining ferrous and non-ferrous metals from ore, pig or scrap, using electrometallurgic and other process metallurgic techniques. This division also includes the manufacture of metal alloys and super-alloys by introducing other chemical elements to pure metals*" (p.154 of the publication).

Vehicles" reporting a 3.5% and 2.8% exposure to these sectors, respectively. Furthermore, other sectors such as *Rubber* and *Plastics* are particularly highly exposed as they rely heavily on energy, as well as on highly energy exposed sectors.

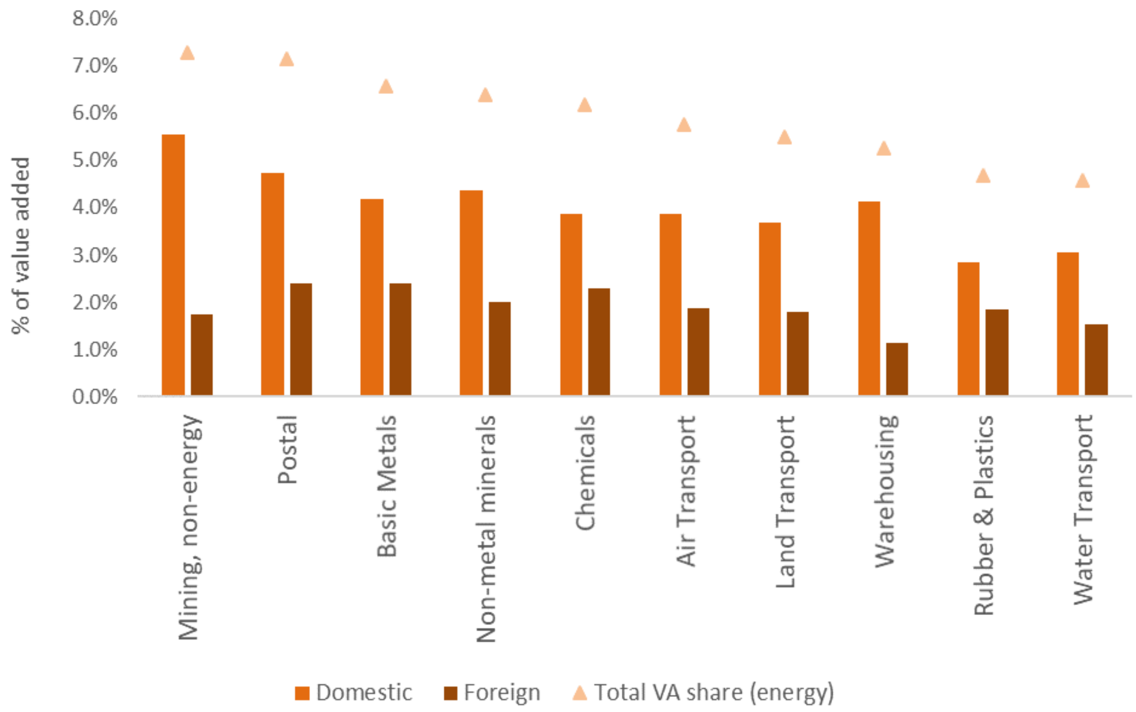
Figure 8: EU 10 most energy exposed sectors - total, domestic and foreign (% of energy content in sectoral production)



***Source**: Chief Economist Team - DG GROW based on OECD TiVA tables (2021 version). 2018 data. **Note:** Energy exposure is defined as the share of energy content needed to produce their total final demand in each sector. The energy content is computed as share of the valued added coming from the energy generating sectors, which include raw materials (e.g., "energy producing minerals" (D05T06)), intermediates (e.g., mining support activities (D09), coke and petroleum (D19)) and distribution of energy products (e.g. electricity, (D35)), over total production in each sector. This definition is obtained in overall value added terms, which means that it includes direct exposure to energy and indirect use through intermediate inputs. The total content of energy in each sector is decomposed into its domestic and its foreign share. On top, ecosystems each sector belongs to are reported – A&D= Aerospace and Defence; EII= Energy Intensive Industry; CCI= Creative and Cultural Industry. This classification is based on the primary activity of the sector, for the official definition of the ecosystems see Annual Single Marker Report 2022.*

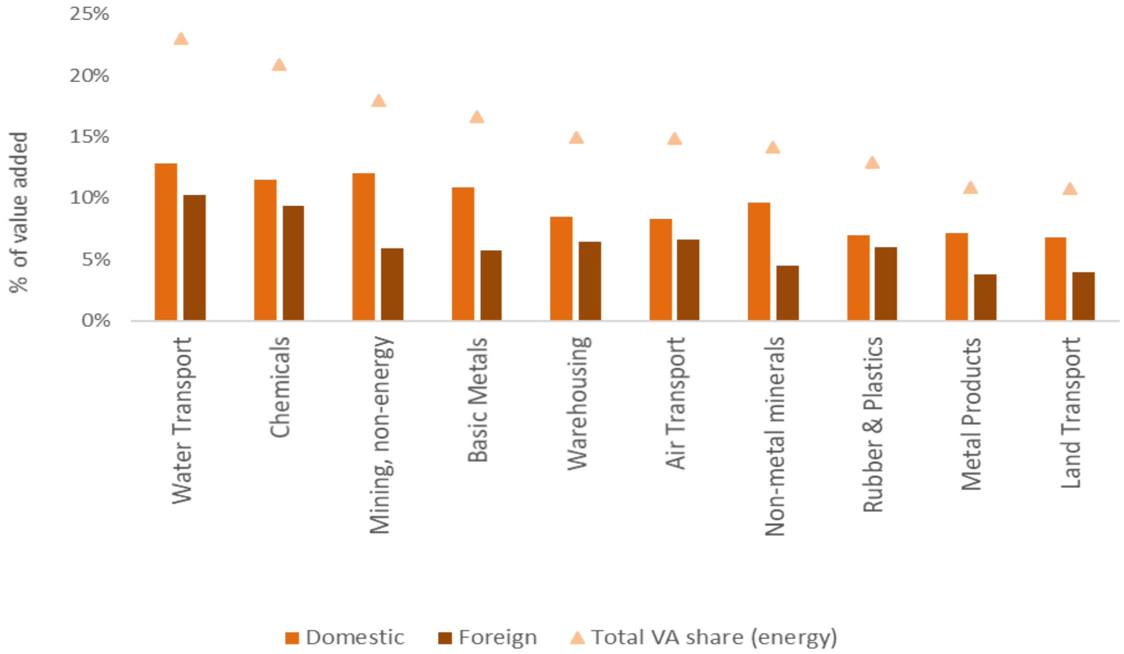
The EU shows a higher vulnerability of its supply chains to international disruptions in energy products than the US and China. In the US, the most energy-exposed sectors are mining of non-energy products and postal services, while basic metals only appears on the third **(Figure 9).** On the other hand, in China, water transport, chemicals and mining of non-energy products are the three most energy exposed sectors **(Figure 10).** One remarkable difference is that both China and US use mostly domestically sourced energy, whereas in the EU the opposite is true for almost every major energy-exposed sector (paper products and non-energy producing mining being the only exceptions).

Figure 9: US 10 most energy exposed sectors- - total, domestic and foreign (% energy content in sectoral production)



***Source**: Chief Economist Team - DG GROW based on OECD TiVA tables (2021 version). 2018 data. Note: The total content of energy in each sector is decomposed into its domestic and its foreign share. **Note**: Energy exposure is defined as the share of energy content needed to produce their total final demand in each sector. The energy content is computed as share of the valued added coming from the energy generating sectors, which include raw materials (e.g., "energy producing minerals" (D05T06)), intermediates (e.g., mining support activities (D09), coke and petroleum (D19)) and distribution of energy products (e.g. electricity, (D35)), over total production in each sector. This definition is obtained in overall value added terms, which means that it includes direct exposure to energy and indirect use through intermediate inputs. The total content of energy in each sector is decomposed into its domestic and its foreign share.*

Figure 10: China top 10 most energy exposed sectors- - total, domestic and foreign (% energy content in sectoral production)

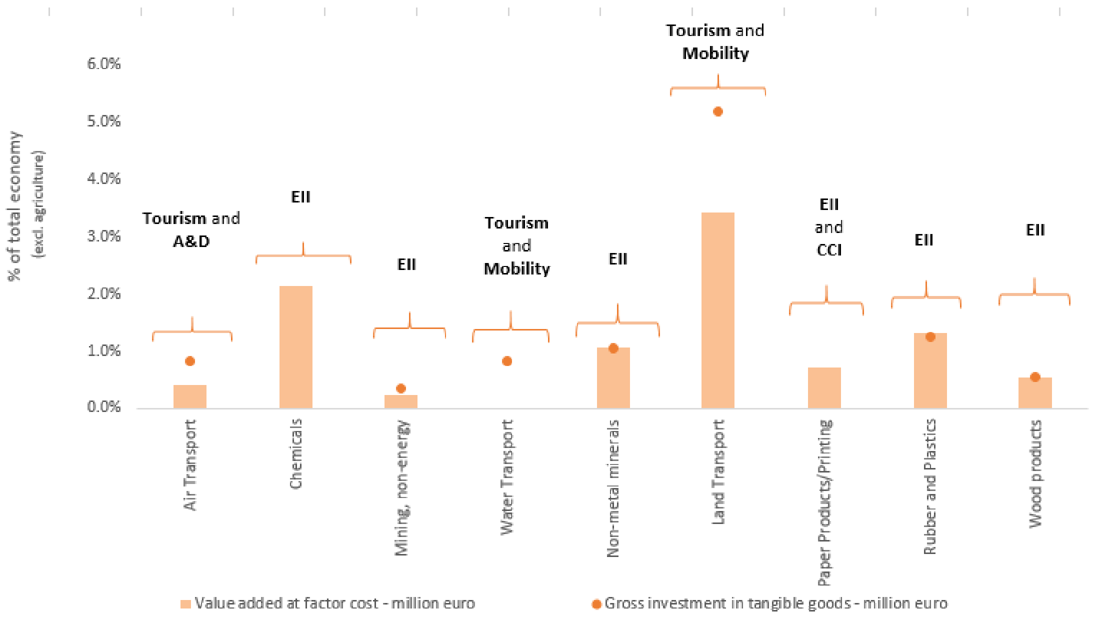


***Source**: Chief Economist Team - DG GROW based on OECD TiVA tables (2021 version). 2018 data. Note: The total content of energy in each sector is decomposed into its domestic and its foreign share. **Note:** Energy exposure is defined as the share of energy content needed to produce their total final demand in each sector. The energy content is computed as share of the valued added coming from the energy generating sectors, which includes raw materials (e.g., "energy producing minerals" (D05T06)), intermediates (e.g., mining support activities (D09), coke and petroleum (D19)) and distribution of energy products (e.g. electricity, (D35)), over total production in each sector. This definition is obtained in overall value added terms, which means that it includes direct exposure to energy and indirect use through intermediate inputs. The total content of energy in each sector is decomposed into its domestic and its foreign share.*

The economic importance of the 10 most energy-exposed sectors in the EU

To better understand the vulnerability from an aggregate macroeconomic perspective, we examine the importance of these sectors for the EU economy in terms of value added, investment, employment and number of firms. We find that **the 10 most energy-exposed sectors represent more than 10% of both total VA and total investment in the EU economy.** Out of these sectors, we highlight the important role of *Land Transport*, representing around 3.4% of total economy (excluding agriculture) in terms of value added and 5.2% in terms of total investment. Other important energy-exposed sectors in terms of value added are *Chemicals* (with 2.1%; investment data is not available) and *Rubber and Plastics* (with 1.3% in terms of value added and investment) **(Figure 11).**

Figure 11: Value added and investment for the EU 10 most energy-exposed sectors, 2019

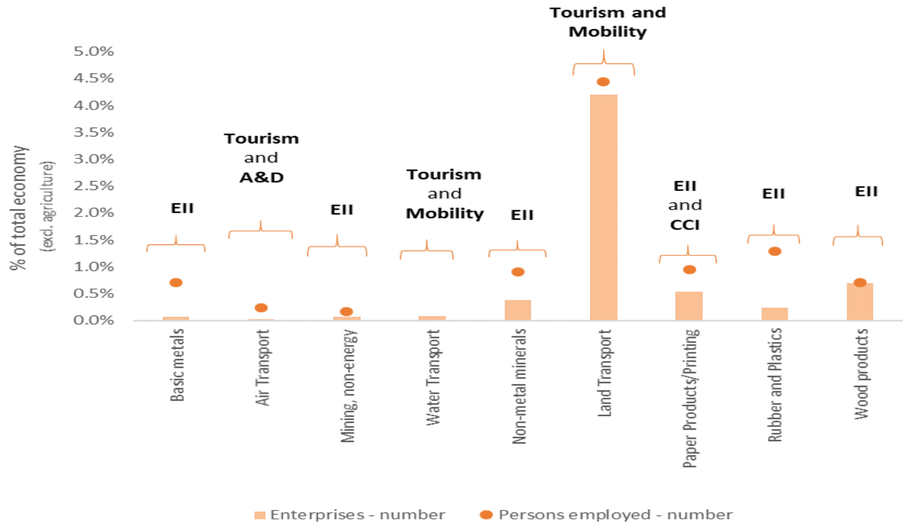


***Source**: Chief Economist Team - DG GROW calculations based SBS-Eurostat data. **Note**: information is missing for Basic Metals and Water Transport on value added, for Basic Metals, Chemicals and Paper Products/Printing on investment. On top, ecosystems each sector belongs to are reported – A&D= Aerospace and Defence; EII= Energy Intensive Industry; CCI= Creative and Cultural Industry.*

The two most energy-exposed sectors (i.e. *Basic Metals* and *Air Transport*) taken together do not surpass the 1% in terms of employment. Next, we look at demographics by looking at the number of enterprises, the people employed in these sectors (**Figure 12).** Out of the 10 most affected sectors, we continue highlighting the important role of *Land Transport*, representing around 4.4% of total economy (excluding agriculture) in terms of employment and 4.2% in terms of number of firms. Another highly energy exposed sector exceeding the 1% in any of these two demographics variables is *Rubber and Plastics* (with 1.3% of total employment).

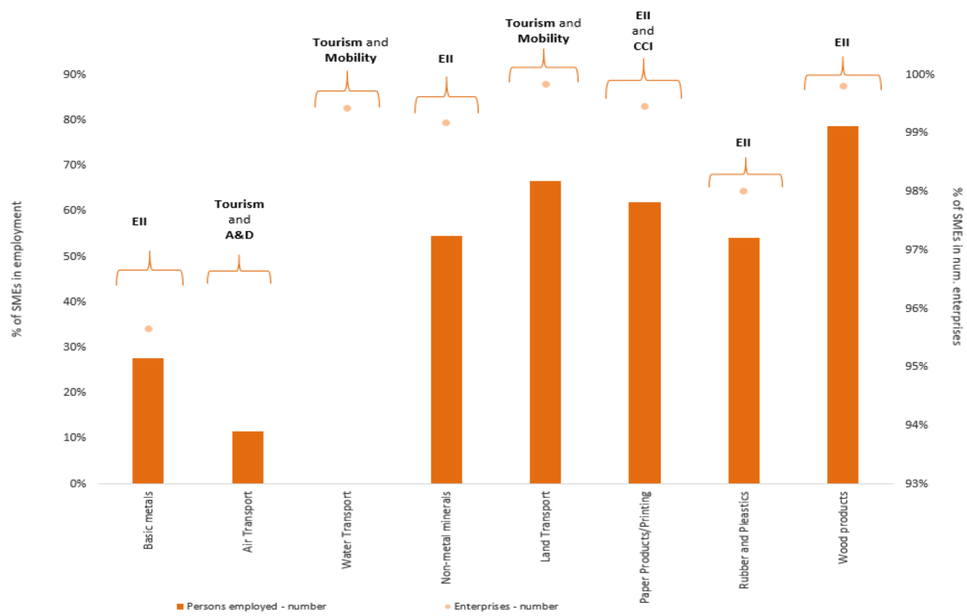
With a few exceptions, SMEs have an important role in these high energy intensive sectors. The left axis of **Figure 13** shows the share of people employed in SMEs for those sectors identified as being more vulnerable to energy shocks. With the exception of *Basic Metals* and *Air Transport*, where SMEs have a share of less than 30% in terms of employment, the majority of the SMEs account for more than 50% of the employment of the sector. This is particularly highlighted in the *Wood* and *Land Transport* sectors, where the share of employment is 79% and 67%, respectively. In terms of the number of SMEs (the right axis of **Figure 13),** it is clear that the majority of the firms in those sectors where data was available are SMEs. The lowest number observed is for *Basic Metals* as the share in total number of firms goes to 96%.

Figure 12: Demographic variables for the EU top 10 most energy-exposed sectors, 2019



***Source**: Chief Economist Team - DG GROW calculations based SBS-Eurostat data. **Note**: information is missing for Chemicals and Water Transport on employment, for Chemicals and Air Transport on number of firms. On top, ecosystems each sector belongs to are reported – A&D= Aerospace and Defence; EII= Energy Intensive Industry; CCI= Creative and Cultural Industry.*

Figure 13: Demographic variables for the 10 most energy-exposed sectors in the EU with a focus on SMEs, 2019



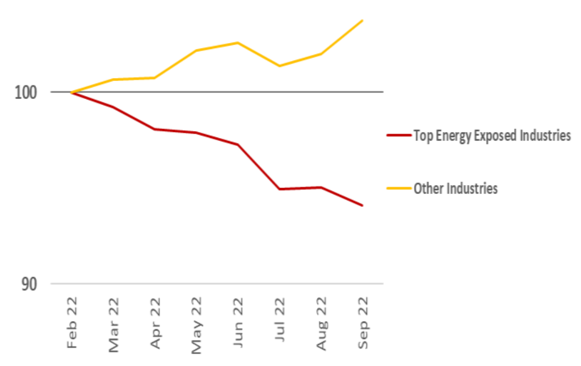
***Source**: Chief Economist Team - DG GROW calculations based SBS-Eurostat data. **Note**: information is missing for Chemicals, Mining non-energy and Water Transport and information on employment and for Chemicals, Mining non-energy and Air transport on number of firms. On top, ecosystems each sector belongs to are reported – A&D= Aerospace and Defence; EII= Energy Intensive Industry; CCI= Creative and Cultural Industry.*

Divergences in production and confidence trends and projected impact across sectors

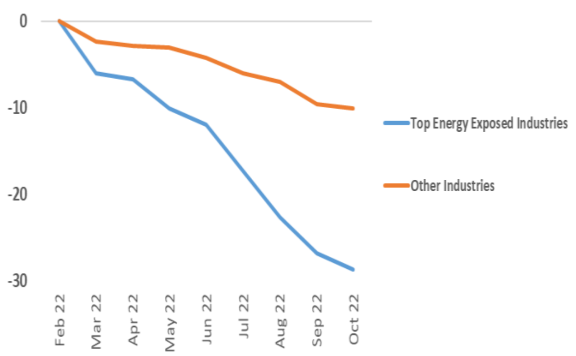
Growing differences in the production level and confidence indicator between the most energy-exposed sectors and the other sectors reflects the sectoral dimension of this current energy crisis. Since the beginning of the crisis, the production index of the EU most energy-exposed mining and manufacturing industries [7] has experienced a strong decline. Between February and September 2022, these sectors have lost more than 5% of their production, while the others have increased (**Figure 14a**). Similarly, the industry confidence has decreased much strongly for the most energy-exposed industries (-29) than for the other industry (-10) (**Figure 14b**).**[8]** These divergences clearly reflect the direct impact in terms of energy related costs.[9]

Figure 14: Industrial Production Index and Confidence Indicator for the 10 most energy-exposed industries and other industries in the EU, normalised to February 2022

13a. Production Index



13b. Confidence Indictor



***Source**: Chief Economist Team - DG GROW calculations based Eurostat and DG ECFIN data. **Note**: both graphs have been normalised using February 2022 as base. In line with the input and output analysis of the previous section, we calculated the average unweighted Industrial Production Index and the confidence indicator for the most energy-exposed mining and manufacturing sectors as identified in **Figure 8.** Note that the confidence indicator does not include Mining non-energy, Non-metal Minerals as data for these sectors are not available.*

The model-based analysis by JRC-GEM-E3 projects impact of energy crisis on the domestic production across EU sectors up to 2030.[10] The adverse effect is larger in 2025 than in 2030, as energy

[7] In line with the input and output analysis of the previous section, we calculated the average unweighted Industrial Production Index for the most energy exposed mining and manufacturing sectors as identified in **Figure 8**, i.e. *Basic Metals*, *Chemicals, Mining non-energy, Non-metal Minerals*, *Paper Products*, *Rubber and Plastics*, *Wood Product.*

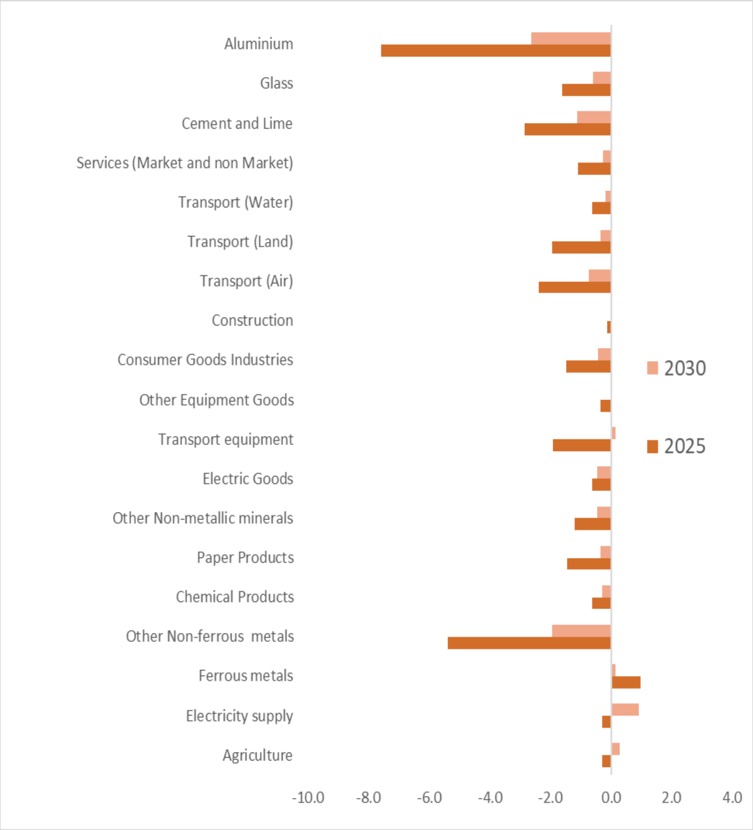
[8] We also calculated the average unweighted confidence indicator for these sectors, except for *Mining non-energy, Non-metal minerals,* as data are not available

[9] Complete and systematic data on energy prices and costs for the whole EU industry during this current period is not available, however, even before the crisis data reveals the importance of the energy-cost component for production of these highly energy exposed industries, e.g. in the EU in 2013, the electricity prices accounted for around 40 % of total aluminium production costs (JRC, 2016).

[10] The results are based on a scenario run for DG GROW using the JRC-GEM-E3 model in the context of rising energy prices due to gas shortages and under the assumption of tax recycling (to reduce labour costs) and imperfect labour markets. JRC-

system is expected to adjust to higher fossil fuel prices. In terms of domestic production, **the most affected sectors are energy intensive industries (e.g. aluminium, other non-ferrous metals, cement and lime), transport sectors (air and land) (Figure 15).** The asymmetric responses across these industries reflects a number of factors and assumptions – such as for instance energy intensity of production, shares of each fuel in sectoral energy use (i.e. coal, gas, oil and electricity) and trade intensities (as well as fuel/energy intensities of key trading partners). As with any general equilibrium model, the results have to be interpreted as indicative trends, being based on a number of assumptions on future technological transformation, including decarbonisation-related innovation.

Figure 15: Sectoral projections of domestic production– High Energy Price compared to the Fit-for-55 Scenario (in % change)



***Source**: Chief Economist Team - DG GROW elaboration on JRC-GEM-E3 model*

Conclusions

Europe is currently experiencing an exceptional energy crisis, combining a sharp global upsurge in energy prices with the need to adjust its sources of input away from Russia and tight global energy supply, which has compromised Europe's energy security.

GEM-E3 is an applied general equilibrium model that covers the interactions between the Economy, the Energy system and the Environment. The scenario is modelled taking the Fit-for-55 package (FF55) proposed in July 2021 as a baseline to compare the results against a "High energy prices" scenario, which incorporates projected changes in gas, oil, coal and electricity prices from the PRIMES model; for more details on the price trajectories used in this scenario, please see the Annex I.

This brief provides evidence on how the exorbitant energy prices are weighing on the competitiveness of European businesses, especially those in the most energy-exposed sectors. Recent data shows indeed growing divergences industrial production and confidence indicators between the 10 most energy-exposed sectors and the others. Since February, these have lost around 5% of their production. They also highly rely on foreign energy source, potentially increasing their vulnerability.

Within this context, the EU has proposed and adopted measures to fight the current energy crisis, with the REPowerEU Plan[11] being the centrepiece. The plan was presented by the Commission in May 2022 and further stresses the EU's commitment on delivering the European Green Deal. Additional emergency support measures were proposed by the Commission in October[12] and November[13] and subsequently agreed by the Council on 19 December 2022.[14] This political agreement on a market correction mechanism[15] will complement the many steps taken already to further tackle high gas prices in the EU and ensure security of supply in the EU, including measures on filling gas storage, reducing gas demand and reducing energy bills, the creation of an EU energy platform, and the initiatives proposed in the REPowerEU.

In terms of stability of gas supply, in the course of 2022 the EU has managed to gradually diversify its sources of gas supply, reducing its dependency on Russian gas from 45% in 2021 to 14% by September 2022.[16] Going forward, given the rigidity in the capacity of pipelining gas from alternative sources, the EU sourcing of gas will increasingly depend on its capacity to compete LNG gas shipments away from other destinations of the world, which may influence future price dynamics of this commodity. Continuous efforts to save and substitute gas with other energy sources, diversify sources of supply and ensure long-term contracts are thus warranted.

[11] COM(2022) 230 final
[12] COM(2022) 553 final
[13] COM/2022/668 final
[14] https://www.consilium.europa.eu/en/meetings/tte/2022/12/19/
[15] For an overview of the timeline of the actions, measures and agreement please see https://energy.ec.europa.eu/topics/markets-and-consumers/action-and-measures-energy-prices_en
[16] COM(2022) 553 final

Annex I: JRC GEM-E3 Model

GEM-E3 is an applied general equilibrium model that covers the interactions between the Economy, the Energy system and the Environment.

The note reports the results of “Higher Energy Prices” scenario to model the macroeconomic impact taking the Fit-for-55 (FF55) package’s MIX scenario proposed in July 2021 as a baseline. The Fit-for-55 (FF55) package’s MIX scenario proposed in July 2021 as a baseline to compare the results against. The MIX scenario is described in SWD(2021) 601; for more details of the JRC-GEM-E3 implementation, see Annex 4 of SWD(2021) 643.

The price increase is modelled as a mark-up on (fossil) energy production, which increases (fossil) fuel prices globally. However, as e.g. gas prices have not risen (substantially) in exporting countries (e.g. RUS, USA etc.) we offset the price paid by industries and consumers by corresponding through transfers that offset the mark-up on domestic use. For crude oil, the price increase was assumed to be global. For coal price increases, a global increase was assumed, but scaled to 50% in China, as much of it is a domestic market. The change of electricity prices in the EU then follows increased cost for fossil fuel and is in line with PRIMES. Electricity generation, transport fuel demand and fleet composition as well as household heating were taken exogenously from PRIMES.

Further details on the price trajectories used in this scenario can be found in Annex 7 of SWD(2022) 230. We provided the extract of this Annex below.

Extract of Annex 7 of SWD(2022) 230

“Figure 2 shows the price trajectories between 2020 and 2050 for gas, oil and coal. Oil and coal prices are based on historical data for 2020-2021, combined with estimates of prices in 2022 and complemented by a linear interpolation to the long-term trajectory assumed in the EU Reference Scenario 2020 for the following years. The same approach is followed for gas prices except that these are expected to remain higher than in the Fitfor-55-scenario in the long run.”

Figure 2: Fuel price trajectories used for REPowerEU and Fit-for-55 analysis. Note that the "Higher Energy Prices" scenario described in the note uses the same price trajectory as REPowerEU but not the additional RePowerEU policies.

Source : Annex 7 of SWD(2022) 230

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