STUDY

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European Parliament

The impact of the gas supply crisis on the Just Transition Plans

Regional Development

Policy Department for Structural and Cohesion Policies
Directorate-General for Internal Policies
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RESEARCH FOR REGI COMMITTEE

The impact of the gas supply crisis on the Just Transition Plans

Abstract

The project provides information on the current and potential impact of the gas supply crisis on the Just Transition Plans (JTPs). The evidence is based on the analysis of EU gas and energy supply dependencies, trade linkages with Russia, the general EU's policy framework, Just Transition Mechanism (JTM), REPowerEU plan and the investigation of six case studies. It concludes with specified policy recommendations reflecting the implementation of the JTM, the JTPs in the light of risks of the energy crisis.

This document was requested by the European Parliament's Committee on Regional Development.

AUTHORS

ÖIR GmbH: Kinga HAT, Marvin BÖHNKE, Erich DALLHAMMER, Roland GAUGITSCH, Chien-Hui HSIUNG, Isabella MESSINGER
Sari RANNANPÄÄ
t33 Srl: Michele ALESSANDRINI, Elena IACOBUCCI, François LEVARLET
Tullio BUCCELLATO

Research administrator: Frédéric GOUARDÈRES
Project, publication and communication assistance: Kinga OSTAŃSKA, Jana BERGMAN, Stephanie DUPONT
Policy Department for Structural and Cohesion Policies, European Parliament

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ABOUT THE PUBLISHER

To contact the Policy Department or to subscribe to updates on our work for the REGI Committee please write to: Poldep-cohesion@ep.europa.eu

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DISCLAIMER

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LIST OF ABBREVIATIONS

CF	Cohesion Fund
CO_2-eq	Carbon dioxide equivalent
CP	Cohesion Policy
EC	European Commission
EEA	European Environment Agency
EGD	European Green Deal
EP	European Parliament
ERDF	European Regional Development Fund
ESF+	European Social Fund
GDP	Gross Domestic Product
GHG	Greenhouse gas emissions
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
JTF	Just Transition Fund
JTM	Just Transition Mechanism
JTP	Just Transition Plan
LNG	Liquefied Natural Gas
MA	Managing Authority
MMF	Money Market Fund
NRRP	National Recovery and Resilience Plan
NUTS	Nomenclature of Territorial Units for Statistics (French: Nomenclature des unités territoriales statistiques)
R&D	Research and Development
RRP	Resilience and Recovery Plan
SDG	Sustainable Development Goals
SME	Small and medium-sized enterprises

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EXECUTIVE SUMMARY

The European Union (EU) is dependent on energy supply from abroad. Russian gas supplies play a significant role in the EU-energy mix. The dependency reveals a significant regional risk in the face of the supply crisis caused by the Russian war in Ukraine since February 2022. The level of regional specialisation in economic sectors highly dependent on gas, executed in the course of the study, revealed that most of the regions specialised in these sectors are located in Italy, France, Belgium, and Croatia. Less specialised regions are by comparison in eastern Member States, and in Spain, Portugal and Sweden. Even if the dependency on Russian imports significantly decreased over the last year, the EU supply differentiation is still ongoing and the reliance on gas, in general, is still high. Therefore, the exposition to potential future energy-related crisis was also assessed. The assessment revealed that a diversification of energy supply is needed to limit EU regions' exposure to future crisis risks, especially for regions which are highly specialised in gas dependent sectors and those with low economic differentiation in their industrial specialisation structure.

The issue of energy supply is one of the key topics of EU policy – EU intends to become the first climate neutral continent in the world. The main lines of the transformational change to achieve this goal by 2050 are outlined by the European Green Deal (EGD). The EGD represents the EU's long-term strategy for achieving economic growth to create a modern, resource-efficient, and competitive economy with zero net emissions of greenhouse gases by 2050.

The EU Cohesion policy legislative package 2021-2027 has been aligned with the European Green Deal objectives. The Just Transition Mechanism (JTM), as part of the Cohesion Policy, is intended to support the transition process in the most affected regions to prevent further regional disparities. The JTM was designed to provide territories facing serious socio-economic challenges arising from the transition towards climate neutrality with tailored support. The JTM was announced in January 2020, to support changes in business models and address new skill requirements in these regions.

To unlock and use JTM resources, EU Member States must prepare strategic Territorial Just Transition Plans (JTP), as a part of their cohesion policy programmes. As of April 2023, there are 93 JTP territories in the EU. They are almost all agreed (apart from Bulgaria) and in the early phase of the implementation. The JTPs address different challenges of the transition. While the majority of the Member States have elaborated a separate JTP for each territory (e.g. Poland, Germany, Italy), there are also examples of countries with a single JTP for all the territories (e.g. Austria, Finland). The eligibility of the territories differs in the underlying conditions. The main factors for the identification of the JTP territories are as follows:

- Coal extraction and industry,
- CO_2 intensive industry in the region,
- Peat extraction,
- Other fossil fuel production.

The RePowerEU Plan, presented by the EC as an answer to the energy crisis induced by the Russian invasion of Ukraine, proposes a combination of investments and reforms. It aims at ending EU dependence on fossil fuels and gas imports from Russia with a target of reducing it by two thirds by the end of 2022 through promoting energy savings, diversifying supply and fostering the deployment of renewable resources. REPowerEU key measures include: improving energy infrastructure and facilities, energy efficiency, renewable energy deployment, biomethane and hydrogen development, energy transportation, distribution and storage, and requalification of the workforce. The level of synergy between the JTPs and REPowerEU is different from region to region. While the requalification of the workforce is included in all JTPs by default, improvement of energy infrastructure, energy

efficiency, and renewable energy deployment are also common measures in the JTPs. Whereas, investments in biomethane and hydrogen as well as energy transportation and storage are less often included in the JTPs.

The case study analysis reveals a wide range of implementation approaches for the Just Transition Fund. Some JTPs are very tailor-made, while others are more general and less adapted to the existing regional characteristics. The more a JTP reflects the regional characteristics, the fewer the concerns for its successful implementation are, especially in light of the existing crisis. All in all, the analysed JTPs are at the very early stage of implementation. Therefore, a direct impact of the gas crisis on the JTPs cannot yet be observed. The future scenarios reveal that various new drivers affect the development of regions. Existing implications stimulating negative development paths are rather short-term. If no appropriate, regionally specific, measures are taken to tackle them, they may influence the future in the long-term. The main new positive implication is the existing awareness of the importance and acceptance for the transition process and can be seen as positive indication that the regions can cope with the challenging situation. However, no direct need to adapt the JTPs themselves was observed. Potential improvements concern rather the delivery system and the exchange and communication between the regions and the EC.

Based on identification of the risks and uncertainties through the regional specialisation analysis and the analysis of the case study regions, recommendations for better supporting EU regions on their way to implementing the European Green Deal and, in particular, regions realising their JTPs were developed.

Findings and policy recommendations

The findings of the study can be used by regions that are likely to be particularly affected by the transition to climate neutrality. Since the regions setting up JTPs have already elaborated tailor-made strategies for the transformation, they act as the pioneers of the transformation. Therefore, a majority of the recommendations derived from the study apply to all EU regions.

Findings and policy recommendations at EU level focus on the necessity of diversification of the energy mix and energy supply chains, coordination between different EU programs supporting transition to lift more synergies, intensification of the knowledge exchange to enable mutual learning, adoption of implementation of the JTPs to exploit its opportunities as well as possible, and improvement of the knowledge base to broaden the regional knowledge and the mechanisms of implementation.

At national and regional level improvement of support structures for the regions to implement the JTP and improvement of the communication between national and regional authorities are recommended. Raising awareness and preparedness to reduce the vulnerability is relevant for all levels of governance.

1. INTRODUCTION

Russia's invasion of Ukraine in 2022 and subsequent disruptions to the supply of natural gas from the Russian pipelines to the EU have led to severe consequences for the capacity to sustain and meet energy demand in the EU. Russia's central role in the EU energy supply is attributed to several reasons: the importance of natural gas in the energy mix of the EU, the import dependency of the EU for most energy sources, and the central role of Russia as a partner country in energy imports.

Natural gas represents a crucial component of the EU energy mix, accounting for around one fifth of the gross available energy[1] in the last 20 years. This level has remained almost constant despite the increasing reliance on renewables and, since 2018, it has been experiencing an upward trend. As the energy mix and the energy production vary across the EU, the level of import dependency also varies. In 2020, no Member State had a negative dependency rate, this means that all countries in the EU rely, at least in part, on imports to meet their energy needs. Focussing the analysis on natural gas, all Member States depended on imports to integrate their energy production in this source. In 2020, most Member States had a natural gas dependency rate greater than 80%, historically only Denmark and the Netherlands have reached a production sufficient to meet their own needs. Most of the natural gas imports come from Russia. The outbreak of the war and the subsequent unprecedent gas price increases have resultantly caused the growth of electricity prices and led to the energy crisis situation in Europe.

Climate change is one of the most significant challenges of our times. The European Union intends to fight climate change through ambitious policies, strategies, and targeted use of EU funds. Climate neutrality is accordingly needed to mitigate and counteract the noxious impacts of climate change. Climate neutrality is about transitioning towards a more sustainable development course concretely by (inter alia) improving air quality, protecting biodiversity, creating local jobs, shifting towards cleaner energy sources and changing behaviours (IPCC, 2021). Climate neutrality is defined in line with the Paris Agreement, which asks for achieving "a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century" (*Regulation (EU) 2021/1119*, 2021, Art. 4 (1)). In June 2021, the EU specified in its Climate Law (Regulation (EU) 2021/1119, 2021) climate neutrality as a 2050 target. In Article 2, the EU states that the climate-neutrality objective intends to balance EU wide GHG emissions and removals reducing emissions to net zero. Thereafter, the EU aims to achieve net negative emissions.

The European Green Deal (EGD) (COM/2019/640 final, 2019) provides the blueprint for a transformational change of the current economic model, aiming to make Europe the first climate neutral continent in the world. Adopted in December 2019, the EGD represents the EU's long-term strategy for achieving economic growth to create a modern, resource-efficient, and competitive economy with zero net emissions of greenhouse gases by 2050. The EU Cohesion policy legislative package 2021-2027 has been aligned with the European Green Deal objectives. The Cohesion Policy Funds'[2] main areas of focus include a green and digital transition, a more connected, inclusive, and social Europe, and a Europe that is closer to its citizens. The Cohesion Policy, due to its overall share of the EU budget, plays a vital role in delivering on EU climate objectives, in paving the way for the green transition and in the same way contributing to reduction of the external energy dependency.

[1] Gross available energy is defined as the overall supply of energy for all activities on a specific territory. The measure includes energy transformation, support operations of the energy sector itself, distribution losses, final energy consumption and use of fossil fuel products for non-energy purposes. (Eurostat glossary).

[2] The European Regional Development Fund (ERDF); Cohesion Fund (CF); European Social Fund Plus (ESF+) and the Just Transition Fund (JTF)

The Just Transition Mechanism (JTM) was designed to provide territories facing serious socio-economic challenges arising from the transition towards climate neutrality with tailored support. The Mechanism was announced in January 2020 in the EC plans for a Sustainable Europe and the EGD (COM/2020/21 final, 2020), to mobilise investments in the regions most exposed to transition challenges for restructuring their economies, supporting changes in business models, and addressing new skill requirements.

In addition to the sanctions and other political measures, the EU presented the RePowerEU plan in May 2022 (COM/2022/230 final, 2022). The Plan aims at acceleration of achieving the independency from one-sided oriented fossil fuels imports (by diversifying energy sources and saving energy) and at the same time fostering the transition to climate neutrality by accelerating clean energy transition.

The regions with Just Transition Plans are especially challenged by the process of the restructuring of their economies. The energy crisis can potentially further complicate this process. The feasibility of the specifically tailored Plans may be negatively affected by the crisis situation and lead to further exacerbation of regional disparities within the EU. The purpose of the study is to investigate how far the JTPs are affected by the gas supply crisis. Furthermore, the identified drivers of possible future developments are addressed by recommendations for Members of the European Parliament as well as other governance levels.

1.1. Study objectives, structure and methods

The project provides information on the current and potential impact of the gas supply crisis on the Just Transition Plans (JTPs). The report is structured along the defined project objectives. It begins with the detailed analysis of gas and energy supply dependencies and trade linkages with Russia and the assessment of regional risk due to the gas crisis and levels of regional industrial specialisation within the EU. In the following section the EU's policy framework to meet the commitment of becoming climate neutral by 2050 is presented. Special attention is paid to the Just Transition Mechanism and REPowerEU plan as well as the potential synergies and overlaps between them. In Section 4 the investigation of relevant case studies of regions with JTPs is presented. Based on the collected evidence and formulated hypotheses concerning future development, the positive and negative drivers of successful implementation of the JTP are identified. The report concludes with the synthesis of findings and specified policy recommendations derived from the study reflecting the implementation of the Just Transition Mechanism (JTM), the JTPs and improvement of performance in the face of new risks of the current energy crisis.

Methods

Literature review, document analysis

As the basis for further work, the objectives, strategies and policies of the EU was analysed. For an overview of the challenges and strategies included in the Just Transition Plans a typological analysis was done for all the Plans across the EU.

Data analysis

To analyse the dependency on Russian gas of the EU regions and possible risks due to the crisis the statistical data on gas and other fossil fuels was analysed. In detail, the data on Russian imports dependency for different sectors in the EU, gas imports from Russia and recent gas price development in Europe were analysed. The final risk assessment at regional level is based on three factors: the regional industrial structure in terms of employment in gas-intensive sectors, the level of differentiation

of the regional manufacturing sector, and the degree of import dependency for natural gas of the Member State where the region belongs. More details on the methodology are illustrated in annex A.1.

Case studies & Meta analysis

The case studies are the main source of empirical evidence in this research project. Six representative examples of regions with Just Transition Plan were analysed in-depth. The case study design applied in in the study follows a multiple-case design with single units of analysis (Yin, 2014), corresponding to the six selected regions. In order to collect the data according to the specified project objectives, an analysis framework comprising the guidelines, a common data collection template as well as an interview guide were developed.

The selected case study regions were analysed in detail based on the framework. The data was gathered by desk research, primary and secondary data publicly available or provided by the destinations as well as 1-3 semi-structured interviews with relevant stakeholders. The interview partners represented predominantly regional and national Managing Authorities and one representative of research in the field of energy technologies. The data collection and interviews were carried out in January and February 2023.

Scenario development

In order to understand the possible future developments, especially additional difficulties the regions may face due to the crisis on their way of implementation the Plans scenarios of future developments were discussed within each of the case studies. The formulation of the possible development paths (positive, negative and neutral) allowed identification of the drivers of each kind of the development. In further steps, the difficulties as well as new opportunities were addressed in the process formulation of the recommendations.

Expert workshops

The triangulation of the evidence was initiated during a workshop reflecting the analysis of policies, regional risk assessment and trade and energy supply interdependencies with Russia. Further workshop was done with the case study experts and was dedicated to the cross-case analysis as well as identification of drivers of negative and positive developments in the JTP regions in face of the crisis. The recommendations discussed in the case study interviews were synthetised and put in more general context of the broad variety of JTP-regions. In a final workshop the recommendations for EU institutions on how to better support EU regions in the implementation of their ambitious plans for the just transition towards climate neutrality were revised and completed.

2. GAS SUPPLY CRISIS AND RUSSIAN GAS DEPENDENCIES

KEY FINDINGS

- Natural gas represents a crucial component of the EU energy mix;
- The EU has a high energy import dependency for what concerns its major fuel sources (natural gas, oil and petroleum products) that has grown over time;
- The gas supply to the EU used to rely predominantly on Russian imports;
- These factors have exposed the EU economy to uncertainties and price fluctuations due to external shocks (COVID pandemic, invasion of Ukraine);
- Despite significant decrease in gas imports from Russia in the last year, the overall gas supply to the EU is still not diversified;
- While the initial negative prediction on gas shortages in winter 2023 did not materialise, the forecast is still uncertain for the future;
- In the medium term, the EU will need to diversify its energy mix and its energy suppliers, even if this could imply high costs in terms of infrastructure and trade relations;
- Diversification is especially needed to limit EU regions exposure to future crisis risks, especially for those highly specialised in gas dependent sectors and with low economic differentiation in their industrial specialisation structure.

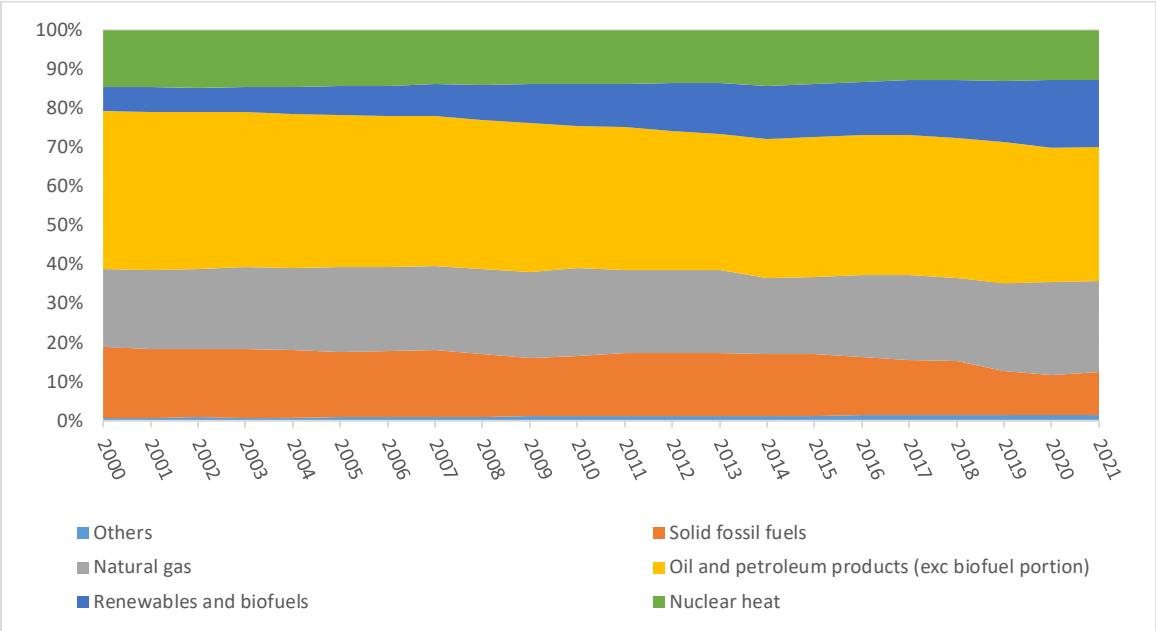
2.1. EU energy dependency on natural gas

Natural gas represents a crucial component of the EU energy mix, accounting for around one fifth of the gross available energy[3] in the last twenty years. This share has remained almost constant despite the increasing reliance on renewables and, since 2018, it is experiencing an upward trend (Figure 1).

Nonetheless, the level of dependence on natural gas is not homogenous around the EU. Figure 2 illustrates this disparity by providing both the percentage of the reliance on gas on the energy mix of each Member State and its use in petajoules (PJ). Germany, Romania, Croatia, Ireland, Hungary, the Netherland and Italy rely on natural gas for around one fourth or more of total petajoule use to satisfy their energy demand. On the other hand, in the case of Sweden, Finland and Estonia natural gas is responsible for less than 10% of the overall supply of energy of the country. Both Finland and Sweden rely on nuclear heat, as well as the import of oil and petroleum products, more than natural gas. Estonia, on the other hand, relies more on energy from coal. However, overall, more than 30% of the electricity produced in the EU comes from fossil fuels (including natural gas), and in some countries this percentage reaches more than 50%.

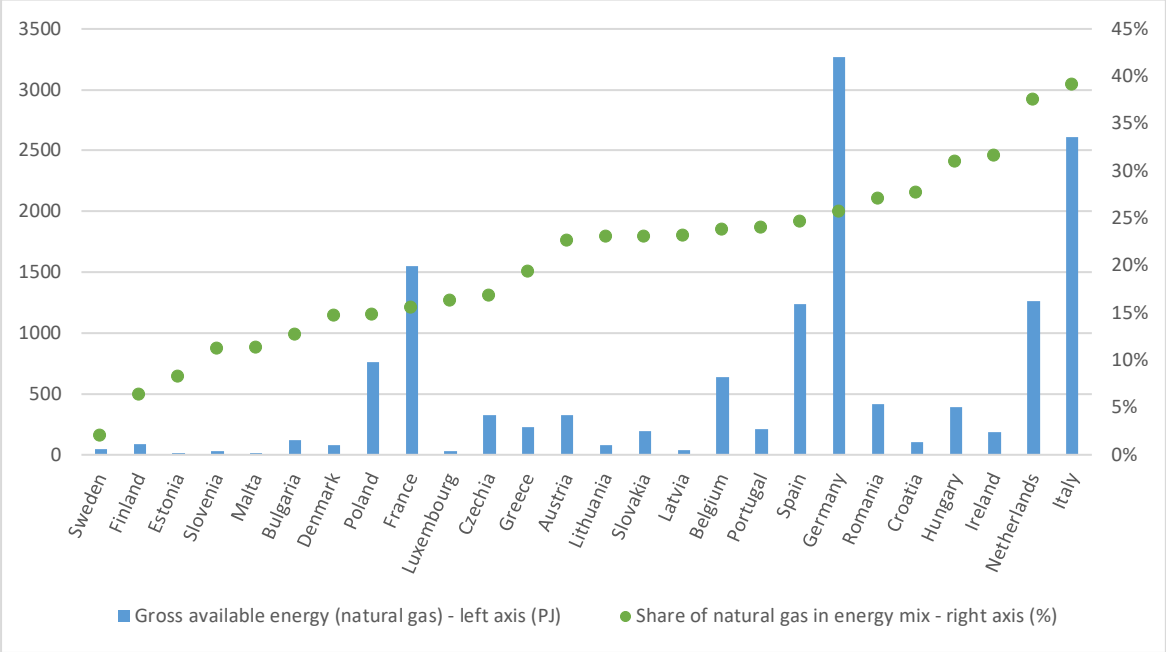
[3] Gross available energy is defined as the overall supply of energy for all activities on a specific territory. The measure includes energy transformation, support operations of the energy sector itself, distribution losses, final energy consumption and use of fossil fuel products for non-energy purposes. (Eurostat glossary).

Figure 1: EU-27 Energy mix, 2000-2021



Source: Gross available energy, key energy sources, elaboration from NRG_BAL_S Eurostat

Figure 2: Dependency on Natural gas by Member State (2021)



Source: consortium elaboration on Eurostat dataset "Gross available energy" (NRG_BAL)

The reliance on natural gas, as well as oil, strictly depends on the industrial structure of each Member State and its energy infrastructures. Focusing on manufacturing sectors alone (Table 1), it is evident that the dependency on hydrocarbons is higher for sectors such as "chemical and petrochemical", "iron and steel", "non-metallic minerals", but also "food, beverage and tobacco". The balance between gas and oil often differs across sectors. In construction, for instance, the use of oil for energy production is markedly higher when compared to gas. The opposite applies in sectors such as "food beverages and tobacco", "iron and steel", and "paper, pulp and printing".

Table 1: Dependency on hydrocarbons by industries

	Gas	Oil
Chemical and petrochemical		
Construction		
Food beverages and tobacco		
Iron and steel		
Machinery		
Mining and quarrying		
Non-ferrous metals		
Non-metallic minerals		
Not-elsewhere specified		
Paper, pulp and printing		
Textile and leather		
Transport equipment		
Wood and wood product		

Source: consortium calculation based on Eurostat dataset ENG_BAL

In 2021, the total energy import dependency rate[4] in the EU was around 55.6%. Historically, the EU has a high import dependency for what concerns its major fuel sources (oil and petroleum products as well as natural gas). Considering the total energy production of the EU, in 2020 natural gas represented only 7.2% while crude oil only 3.7%. The distribution of the primary energy production in the EU is therefore very different from the required energy mix, even if countries producing energy through nuclear power plants exhibit on average much lower dependency on net energy imports.

In 2021, the EU net import energy mix was around 83% for natural gas and 97% for oil and petroleum products. Moreover, the level of import dependency for natural gas has increased since 2005, despite the contraction seen in 2021 (Figure 3). This trend is attributed to a decrease in European production greater than the increase in the use of natural gas as a source of energy, which, as explained above, has in fact remained almost constant over the last two decades.

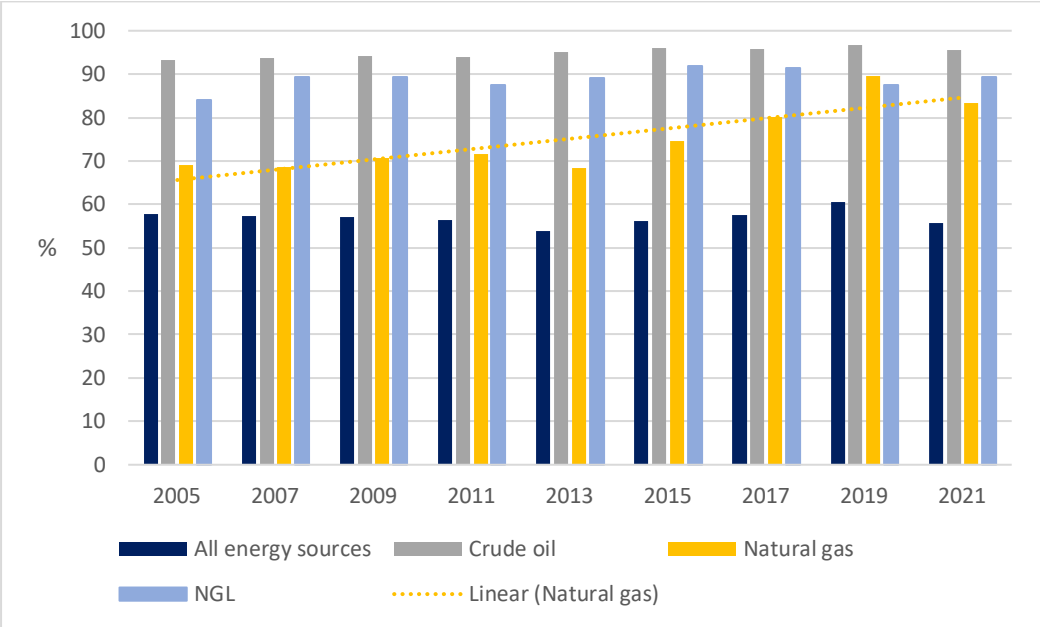
Naturally, data at the aggregate level masks important differences among Member States, as the energy mix and energy production vary across the EU, the level of import dependency for natural gas also varies (Map 1). For instance, natural gas accounts for the largest share of production in the Netherlands (63%), while in Denmark the energy mostly comes from crude oil.[5] Nonetheless, in 2021, no Member State had a negative dependency rate, this means that all countries in the EU rely, at least in part, on imports to meet their energy needs. Focusing on the analysis on natural gas, in 2021, most Member States had an import dependency rate[6] greater than 80% (18 out of 27); historically only Denmark and the Netherlands have reached a production sufficient to satisfy their demand (until 2019 and 2017 respectively).

[4] The energy dependency rate shows the proportion of energy that an economy must import. It is defined as net energy imports (imports minus exports) divided by gross inland energy consumption plus fuel supplied to international maritime bunkers, expressed as a percentage. A negative dependency rate indicates a net exporter of energy while a dependency rate in excess of 100% indicates that energy products have been stocked. (Eurostat glossary)

[5] Data on primary production by type of fuels is based on Eurostat dataset

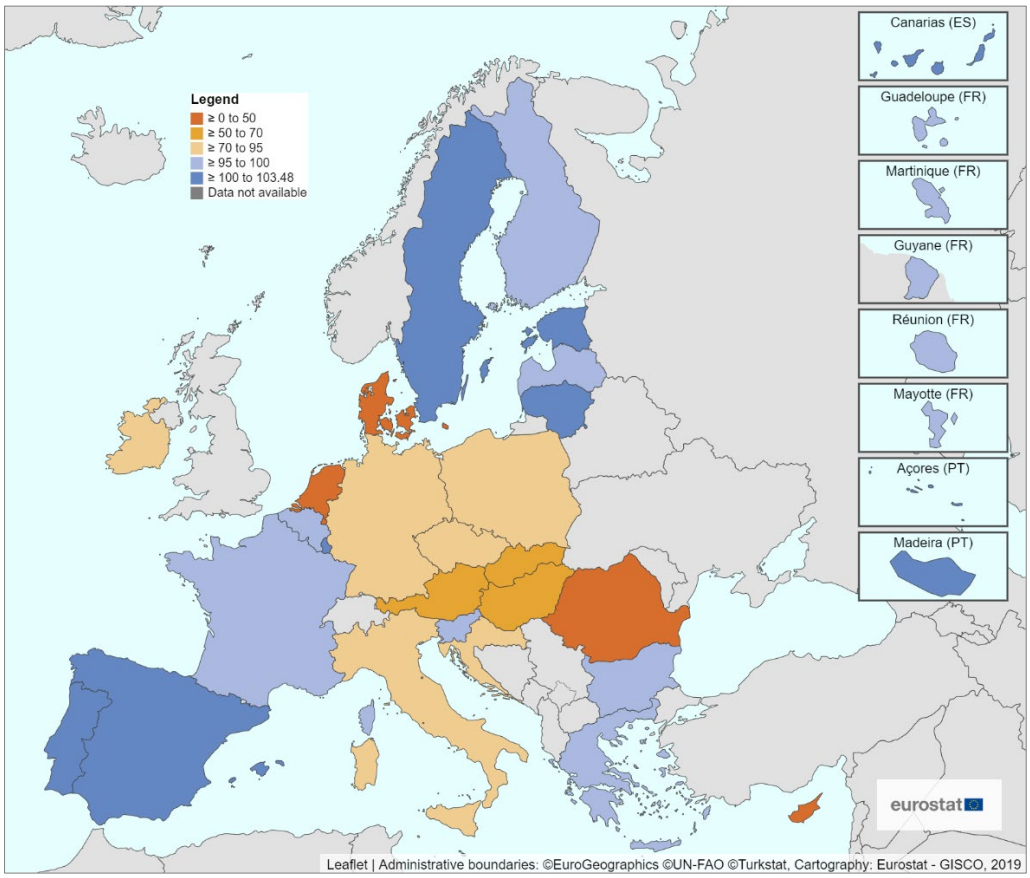
[6] Eurostat Import dependency rate is calculated by export-import on gross available energy. Dataset: NRG_IND_ID

Figure 3: EU-27 import dependency over time



Source: Consortium elaboration on Eurostat data (dataset "Energy import dependency" NRG_IND)

Map 1: Natural gas import dependency by Member State (2021)



Source: Eurostat data on import dependency, values are expressed as percentages[7]

[7] A value higher than 100% in the import dependency rate means that the energy products have been stocked

Table 2: Energy import dependency by Member State and hydrocarbon (2021)

Member State	Natural Gas	Oil
Austria		
Belgium		
Bulgaria		
Croatia		
Cyprus		
Czechia		
Denmark		
Estonia		
Finland		
France		
Germany		
Greece		
Hungary		
Ireland		

Member State	Natural Gas	Oil
Italy		
Latvia		
Lithuania		
Luxembourg		
Malta		
Netherlands		
Poland		
Portugal		
Romania		
Slovakia		
Slovenia		
Spain		
Sweden		

Legend			
0 - 30		30 - 80	
80 - 95		95 -100	

Source: consortium elaboration on Eurostat data, energy import dependency is calculated as net import on GAE

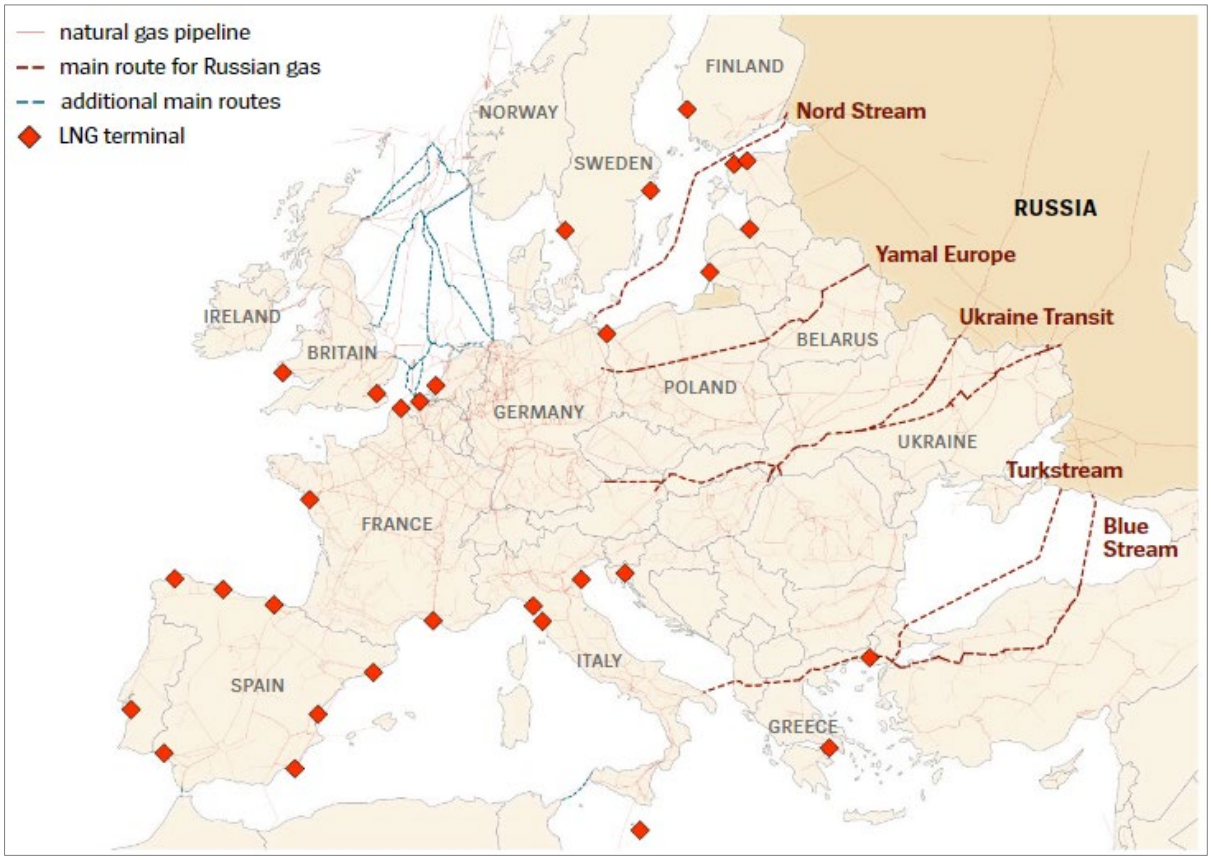
2.2. Global markets and EU-Russia trade linkages

2.2.1. Russia and the global markets for hydrocarbon

Most of the natural gas imports for the EU market are guaranteed by Russia. In fact, the importance of oil and natural gas in the EU energy mix is coupled by the high reliance on Russian supply of these sources that has increased in the last decade, despite several disruptions.

Russia is at the centre of global hydrocarbon trade network, as the country is the second-largest producer of natural gas, behind the United States, and has the world's largest gas reserves. Russia is the world's largest gas exporter and has been developing a far-reaching extraction, production, and export infrastructure. Russia has in fact a wide-reaching gas export pipeline network, both via transit routes through Belarus and Ukraine, and via pipelines sending gas directly into Europe. In particular, Russia exports natural gas to the EU through the Nord Stream I pipeline (Germany), the Yamal pipeline (Poland, also known as Belarus transit), Ukraine Transit, and the Turkstream and Blue Stream pipelines (Turkey) (Map 2). Russia completed work on the Nord Stream II pipeline in 2021, but the German Government decided not to approve certification in the wake of the Russian invasion of Ukraine.

Map 2: Main gas pipelines for the EU market

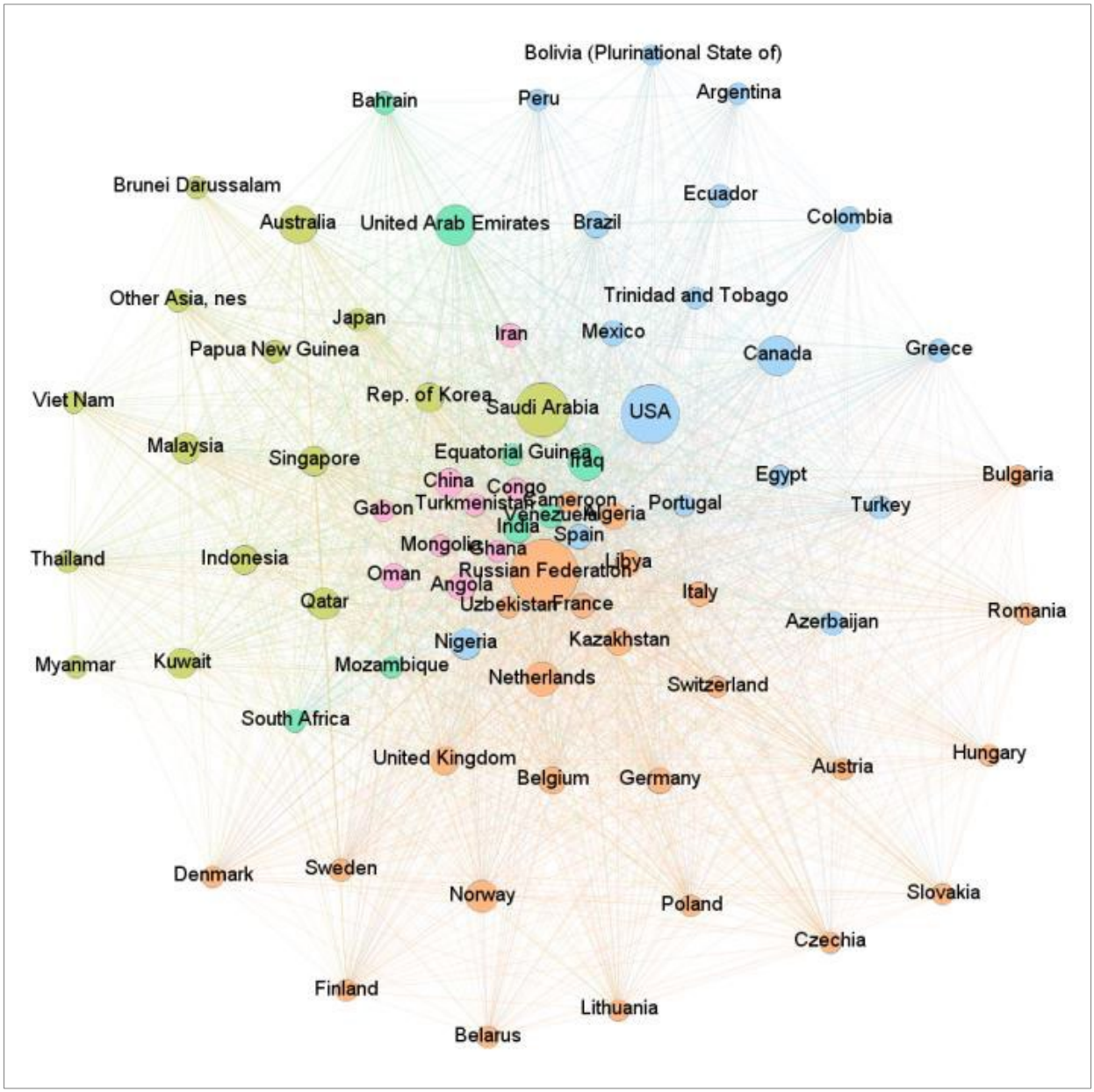


Source: Reproduced from 'Real-Time Statistics on Europe's Gas Supplies', Spiegel International

Moreover, in late 2019, Russia launched a major eastward gas export pipeline, the roughly 3,000 km-long Power of Siberia pipeline, which has a capacity of 38 billion cubic meters, to send gas from far east fields directly to China. Russia has also been expanding its LNG capacity, in order to compete with growing LNG exports from the United States, Australia and Qatar. Finally, in recent years, Russia has increasingly focused on the Arctic as a way to increase oil and gas production and offset declines at existing and older production sites. Gazprom and Novatek are Russia's main gas producers, but many Russian oil companies, including Rosneft, also operate gas production facilities.

The key position of Russia in the global hydrocarbons trade can be appreciated from the network analysis presented in Figure 4, where the neighbourhood of nodes represents stronger trade ties, the dimension of the node is proportional to the share of global hydrocarbon export.

Figure 4: Network analysis of global hydrocarbon trade



Source: reproduced from (Buccellato, 2022), elaboration based on BACI-CEPII data

The US is the key world competitor of Russia in the trade of hydrocarbons, but its export is more oriented at satisfying the demand of the North and Central American states, and, in Europe, countries on the Atlantic coast such as Spain and Portugal. The third largest exporter is Saudi Arabia, whose hydrocarbon exports are directed mostly toward Asian countries.

As a key hydrocarbon consumer, China is located in an intermediate position between Russia and Saudi Arabia and belongs to a cluster which includes geographically neighbouring countries, such as Mongolia and Turkmenistan, and other African states, such as Gabon, Congo and Angola, as well as Iran. India also appears to be included in Russian supply chains, albeit belonging to the cluster of countries with other major producers, including Iraq and the United Arab Emirates.

2.2.2. The EU-Russia trade linkages

Overall, trade relations between the EU and Russia have been historically significant, not only concerning the EU need to import gas and oil from Russia. However, trade relations started to deteriorate in 2014, after the annexation of Crimea by Russia and the economic sanctions imposed first by the Western block of countries including EU Member States and then those imposed by Russia in retaliation. Nonetheless, EU-Russia trade recovered quickly in 2021, following the contraction caused by the Covid-19 pandemic in 2020. In fact, in 2021, the EU was Russia's first trade partner, accounting for 37.3% of the country's total trade in goods with the world (36.5% of imports and 37.9% of its exports respectively). Moreover, in 2021, Russia was still the EU's fifth largest trade partner, with traded goods amounting to EUR 236 billion (i.e. 5.9% of the EU's total trade in goods globally). Imports from Russian accounted for EUR 147.6 billion (of which mineral fuels amounted to EUR 104 billion, i.e. 70%). While EU exports to Russia totalled EUR 88.4 billion, led by machinery and equipment, motor vehicles, pharmaceuticals, electrical equipment and machinery, and plastics.[8]

A more in-depth analysis of the trade balance of EU Member State with Russia is based on the Lafay Index (LFI), an index of revealed comparative advantages.[9] The analysis of trade data between Russia and the EU in 2021 (last available year for trade disaggregated data) shows the top and bottom sectors, at the 2-digit level of the HS, in terms of comparative advantages. One of the benefits of utilising the LFI is that it allows for the evaluation of both import and export links between the EU and Russia. The sector mineral fuels and mineral oils[10], that includes natural gas and oil, presents the lowest level of the LFI, appearing negative for all Member States, and significantly negative for several, except in the case of Luxemburg (see Table A.1 and Table A.2 in annex A.2 displaying the entire database based on the LFI of EU-Russia trade). A comparison with the same LFI values in 2019, before the pandemic, denotes the same level of comparative disadvantages for the EU and a very similar trade structure with Russia for all Member States. However, as the EU has a significant comparative advantage in several manufacturing sectors, some economies, even at regional level, could be affected on their export side. The deteriorating trade relation with Russia, following EU sanctions, can in fact impact those territories more specialised in manufacturing activities and with a high export share to Russia.

The EU import dependency on Russian hydrocarbons

Natural gas from the Russian Federation accounted for 39.3% of extra-EU imports and almost 40% of EU gas demand in 2021, positioning itself as, by far, the most important gas partner for the EU (see Figure 5). Russia's invasion of Ukraine in 2022 and subsequent disruptions to the supply of natural gas from the Russian pipelines to the EU have led to profound changes in the hydrocarbon supply network to sustain and meet energy demands in the EU. In the third quarter of 2022, Russia became the third partner for the EU, representing 15% of EU gas imports, after Norway (nearly 31%) and United States

[8] Data are taken from Eurostat, dataset 'EU trade since 1988 by HS2-4-6', DS-045409

[9] The LFI is an index of specialisation or revealed comparative advantages, which also considers the import flows between countries (Lafay 1992). In this analysis the LFI index is used to assess the trade specialisation of each EU Member State compared to Russia. The index is represented by the formula:

$$\mathrm{LFI}_j = 100\left(\frac{x_j - m_j}{x_j + m_j} - \frac{\sum_{j=1}^{N}(x_j - m_j)}{\sum_{j=1}^{N}(x_j + m_j)}\right)\frac{x_j + m_j}{\sum_{j=1}^{N}(x_j + m_j)}$$

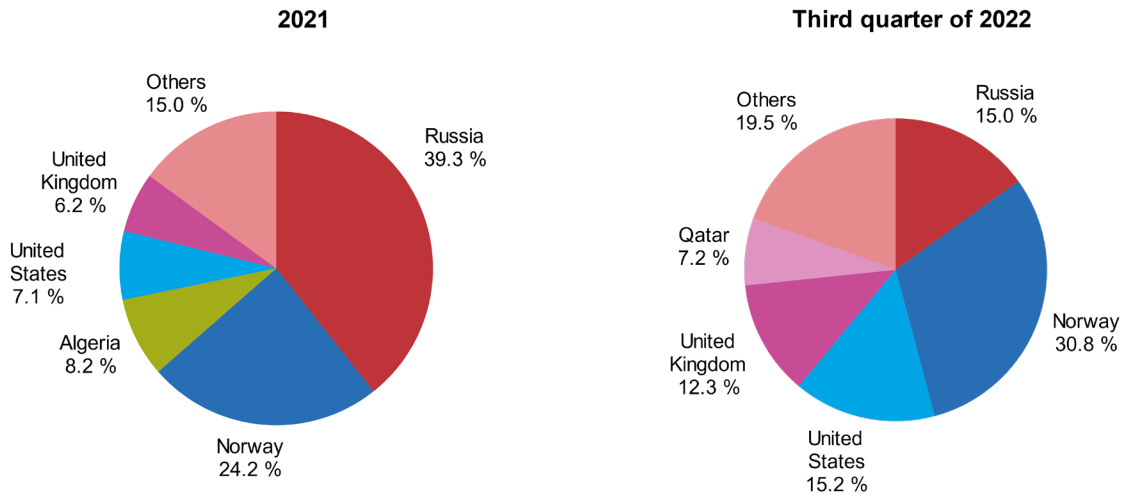
Where x_j is the country exports of product j towards Russia, m is the country imports from Russia and N is the number of sectors considered for the analysis. The LFI captures the difference between each sector's normalised trade balance and the overall normalised trade balance multiplied by the share of each traded product over total trade. A positive value of the LFI implies a comparative advantage of a country in a specific sector compared to Russia, while a negative value of the LFI implies a higher reliance on imports from the Russia in these specific sectors or that the sectoral trade balance is lower than the overall country trade balance. By construction, the sum of LFI across sectors is equal to zero.

[10] 2-digit Harmonized System code 27 – MINERAL FUELS, MINERAL OILS AND PRODUCTS OF THEIR DISTILLATION; BITUMINOUS SUBSTANCES; MINERAL WAXES

(15.2%). Additionally, the UK, now an extra-EU partner, increased its position as a gas supplier to the EU, from 6.2% in 2021 to 12.3% in 2022.

Before the war in the Ukraine, the central position of Russia in EU energy supply has steadily grown over time, starting in the early 2000s. This is attributed to several reasons: the general reliance of the EU on import for hydrocarbons; the convenience in terms of price and geographic proximity of importing gas from Russia; the importance acquired by natural gas in the energy mix of the EU for some key manufacturing countries. Moreover, European domestic natural gas production declined, despite rising tensions and crises, including the supply cuts in January 2009 and Russia's annexation of Crimea in 2014 (IEA, 2022a). Although consumption remained broadly flat over this period, production has fallen by two-thirds since 2010 and the gap has been filled by rising imports.

Figure 5: EU-27 natural gas imports, main partners, evolution over time



Source: reproduced from Eurostat, "EU imports of energy products – recent developments"

The European reliance on Russian hydrocarbons also varies across countries and sectors.[11] Geographic neighbourhood is a key determinant of the dependency path across EU countries. Before the invasion of the Ukraine, countries including Hungary, Latvia, Finland, Estonia, Czechia, Slovenia, and Slovakia imported more than 75% of their natural gas on gross available energy from Russia. Some of these imports were also further re-exported to other Member States. Other Member States, such as Germany and Italy, while further away geographically, still account for a substantial amount of import from Russian.

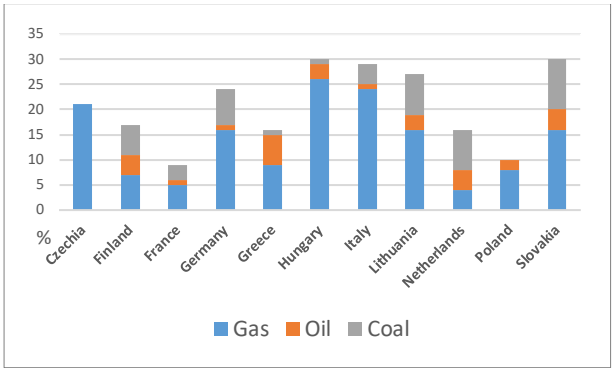
The International Energy Agency (IEA) has elaborated a tool to analyse how energy imports from Russia are used in final consumption for selected countries (IEA, 2022a). In 2019, gas was a key source for manufacturing activities (Figure 6) and reliance is particularly marked in countries such as Italy (24%) and Hungary (26%), but also in Germany (16%), where Germany and Italy represent the highest share of value of sold industrial production within the EU. Marked dependency of manufacturing activities

[11] The International Energy Agency has developed a tool to assess how various countries used energy imports from Russia in 2019. By following the path taken by energy commodities from their importation to their final use, it reveals which sectors and countries would be most vulnerable to international bans on imports from Russia. To best identify which individual sectors are most affected, the tool allocates primary fuels used for electricity generation to the actual end-users of that power. The formula behind the figures provided in the following paragraphs are based on the following formula:

$$Reliance_{russia} = \frac{(TES - Production)}{TES} * \frac{Imports_{from\ Russia\ only}}{Imports_{Total}}$$

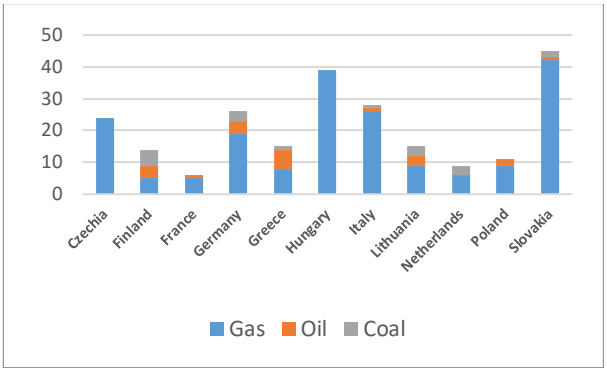
are also present in Lithuania (16%) and Slovakia (16%). However, the dependence on Russian gas is even higher for the residential use of households (Figure 7), especially in Eastern Europe (with peaks of 42% in Slovakia and 29% in Hungary) and highly populated countries such as Germany (19%) and Italy (26%). A similar pattern of dependence is found for service-related activities. Finally, Russian gas is a key source for energy generation in Italy (21%) and Hungary (20%).

Figure 6: Russian import dependency for manufacturing, selected Member States



Source: Consortium elaboration on IEA data (2019)

Figure 7: Russian import dependency for residential, selected Member States



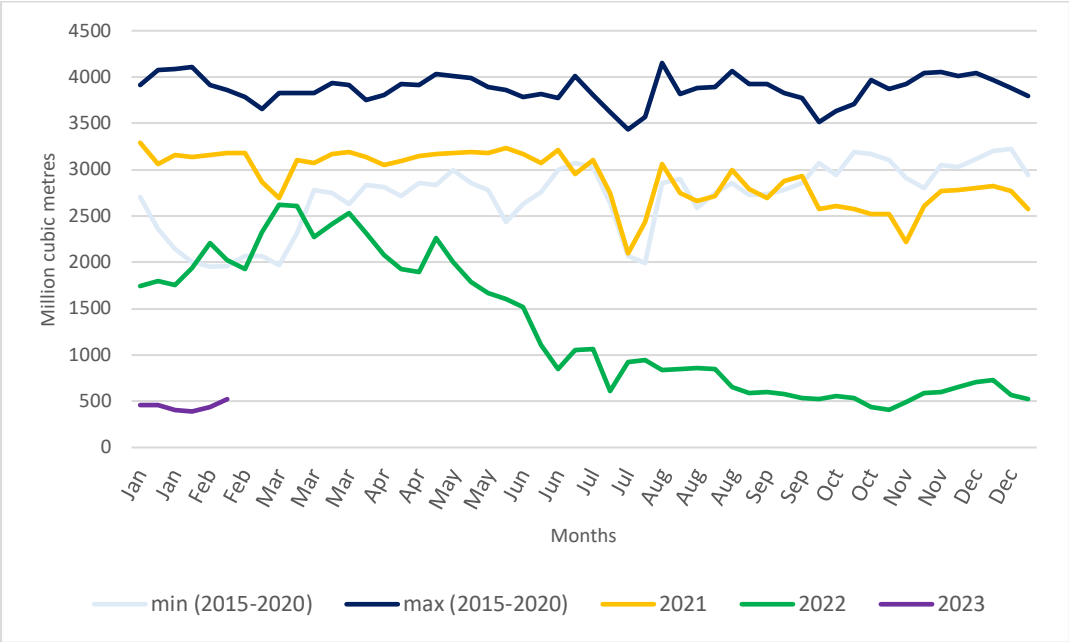
Source: Consortium elaboration on IEA data (2019)

Oil is instead a key source for transport in many European countries, sometimes being of key importance and exceeding a dependence rate of 50% as is the case in Finland (72%), Lithuania (73%), Poland (60%) and Slovakia (64%). Oil also plays a non-negligible role in manufacturing, accounting for 7% of German dependency, 8% in Lithuania and the Netherlands, and 10% in Slovakia. As for the service sector, dependency is higher in Finland (14%) and Poland (10%). Dependency on coal is generally much more limited, with peaks for manufacture in Slovakia (10%), the Netherlands (8%) and Lithuania (8%). Russian coal also plays a non-negligible role for electricity generation in the Netherlands (7%) and Germany (6%).

2.2.3. Recent development

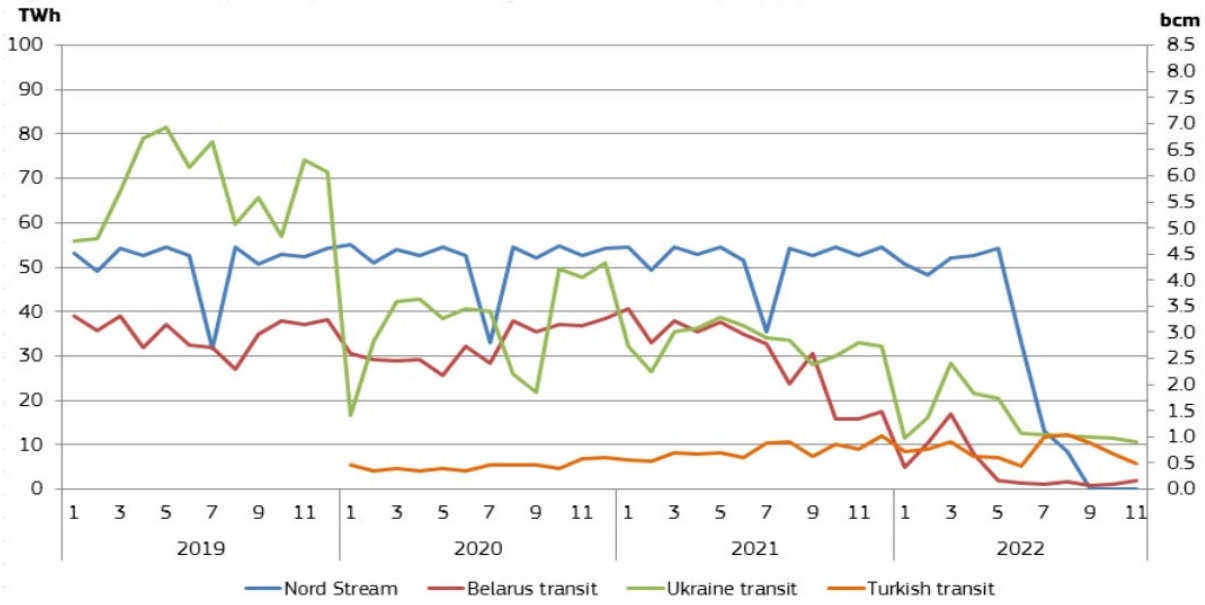
Following the war in the Ukraine, the EU adopted several sanctions, targeting the energy, transport, technology, and financial sectors, as well as imposing restrictive measures on individuals, and affecting EU exports towards Russia. Most recent data demonstrate the severity of disruption in the supply of natural gas from Russia. In 2021, the import of natural gas, in terms of million cubic metres, from Russia was already close to the minimum levels experienced since 2010 (McWilliams, Sgaravatti, & Zachmann , 2021). Nonetheless, imports remained significantly below the minimum after the sanctions against Russia were imposed at the end of February 2022 and, by September, the level of imports from Russia were down to one fifth of the quantity imported in the same period the year before. In absolute terms, covering all of 2022, Russia's pipeline supplies declined by almost 86 bcm. The decline of import levels remained almost constant over winter 2022-2023 and well below the maximum value imported in the period 2015-2020 (Figure 8). This major disruption of the supply of gas was due mainly to the interruption of transit from two of the four natural gas pipelines coming from Russia to the EU. Apart from the Turkstream, all exporting routes from Russia have been severely limited during the second half of 2022 (Figure 9).

Figure 8: Natural gas imports from Russia (weekly changes)



Source: Consortium adaptation from Bruegel Dataset

Figure 9: Monthly EU imports of natural gas from Russia by supply route

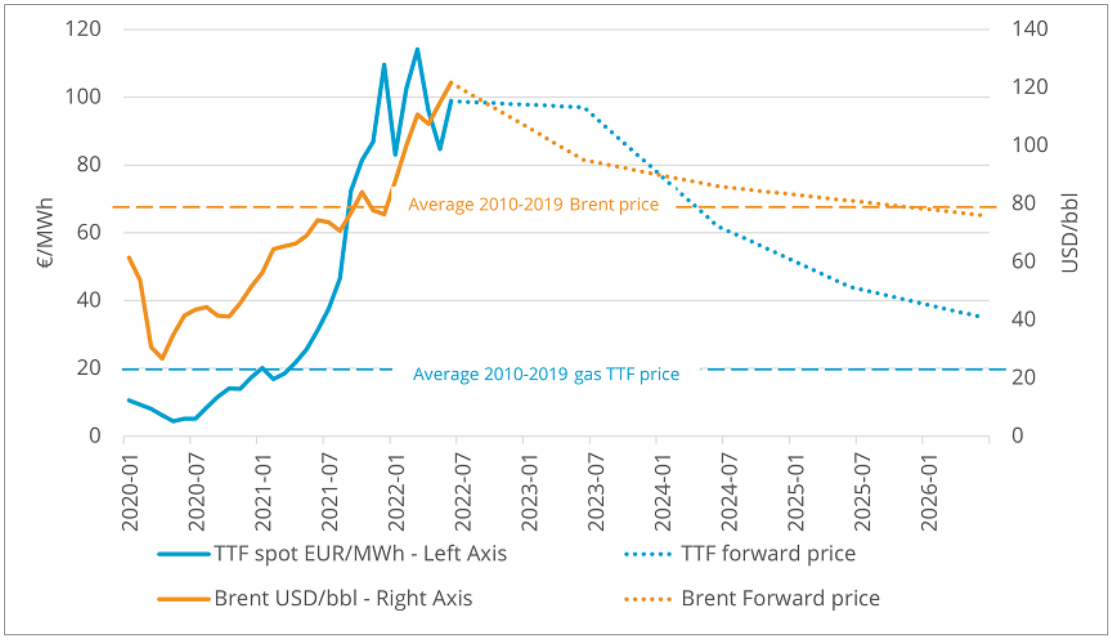


Source: reproduced from "Quarterly report on European gas markets" (EU Commission, 2023, p. 14)

Over the course of 2022, the Ukraine and Belarus transits decreased their capacity by more than 75% in a year-on-year comparison. After several reductions in the delivery through the Nord Stream I pipeline starting May 2022, as of the beginning of September Russia has halted all gas supply through this pipeline. Lastly, Russia has initially severely limited the supply of the Yamal pipeline, then completely interrupted it in May 2022. Other main pipelines reaching the EU come from the UK, Northern Africa, and Norway as well as in the form of liquified natural gas (LNG). LNG inflows to the EU and UK rose by 65% in the first 10 months of 2022, a historic high.

The disruption of the supply from Russia, and the increased reliance on LNG, has provoked a sharp increase in gas prices. However, the unprecedented gas price increase started in July of 2021, one year before the Russian invasion of Ukraine, mainly driven by the recovery of the global markets from the Covid-19 crisis. In 2022 gas prices reached around a fivefold increase with respect to the 2010-2019 period according to the TTF[12] trading (Figure 10). As further discussed below, expectations foresee a high price continuing over the coming years.

Figure 10: Gas price evolution in the EU



Source: Enerdata, based on Energymarketprice

The sharp increase in gas prices has had rapid and direct repercussions on the price of electricity, as historically the two are strictly connected in the EU market (Zakeri, et al., 2022). The connection between gas prices and electricity prices is particularly evident for those countries that rely more on gas to cover electricity demand, in particular Ireland, Italy, Portugal, and Spain (ACER, 2021).

Nonetheless, thanks in part to strategic decisions taken, the consequences of the energy crisis in the EU were less severe than initially expected. The increased non-Russia gas imports, including the recent commissioning of new gas infrastructure projects (EU Commission, 2023)(Baltic PIPE Project, 2022), and a lower demand than expected during winter months, enabled the EU to off-set Russian cuts and secure substantial gas storage levels. The mild weather in the last three months of 2022, and the beginning of 2023, decreased the demand for heating in both residential and commercial sectors around the EU. Member States were therefore able to respect the 80% target[13] for storage by reaching 95% fullness of EU storage sites by November 2022 (5% above the previous 5-year average). This pushed down the price of gas, with a sharp decrease of the TTF in October 2022. Moreover, the energy

[12] The Title Transfer Facility, trading point for natural gas in the Netherlands, is considered as Europe price gas benchmark

[13] Following Russia's invasion of Ukraine in the beginning of 2022, the Commission published on 23 March a proposal for amendment of Regulation (EU) 2017/1938 including measures to deal with the market imbalances for energy and to ensure well-filled gas storage in the EU. The proposal highlights how gas storage contributes to security of supply by absorbing supply shocks in case of strong demand or supply disruptions. On 27 June, the European Parliament and the Council adopted this proposal. The resulting Regulation on Gas Storage (EU) 2022/1032), amending Regulations (EU) 2017/1938 and (EC) 715/2009, provides that underground gas storage on EU countries' territory must be filled to at least 80% of their capacity before the winter of 2022/2023 and to 90% before the following winter periods. Overall, the EU will attempt collectively to fill at least 85% of the total underground gas storage capacity in the EU in 2022.

crisis caused by the invasion of the Ukraine did not provoke a surge in the use of coal (Jones, 2023). In fact, the last quarter of 2022 saw a 7% decrease in coal and gas generation (by 10%). Nonetheless, the fact that the EU was able to maintain its necessary storage levels in 2022 is mainly due to some favourable factors that will not be guaranteed in 2023 (IEA, 2022c):

- Russian gas deliveries remained close to average levels in the first months of 2022, until April. This resulted in an amount of gas provided by Russia that will likely not repeat itself in 2023, especially given the first data for January and February.
- Alternative pipelines to Russia, such as Azerbaijan, Norway, and Algeria, are close to nameplate capacity.
- The market for LNG will also likely change in 2023. First, an increase in demand from China is expected, with a return of imports to the pre-pandemic level. This could signify the absorption by the Chinese recovery of a significant amount of increase production of LNG (lower demand in Asia was responsible for almost 50% of the increase availability of LNG in the EU in 2022). Second, domestic gas production in the EU is set to decline in 2023.[14]

For these reasons, the International Energy Agency (IEA, 2022c) (IEA, 2022a) expects shortfalls in the gas supply by the time the EU Member States will need to refill their storage. These evolutions further explain the expectation of high gas and LNG prices in the coming years.[15] The increased uncertainties in gas imports and prices underline, in the medium term, the importance of a successful diversification of the gas supply chain and energy sources. In the short term, it is important to assess the level of dependency on gas of EU regions and therefore their level of risk to future shocks.

2.2.4. Regional risk assessment

A more in-depth analysis of EU exposure to the current, but also future, gas crisis is provided through a regional risk assessment, by considering the regional (NUTS2 level) industrial structure. The analysis considers whether a region (see annex A.1 for the detailed methodological approach):

- is specialised in an energy (gas and oil) dependent sector;
- is in a country dependent on gas import from Russia;
- presents a diversified economy.

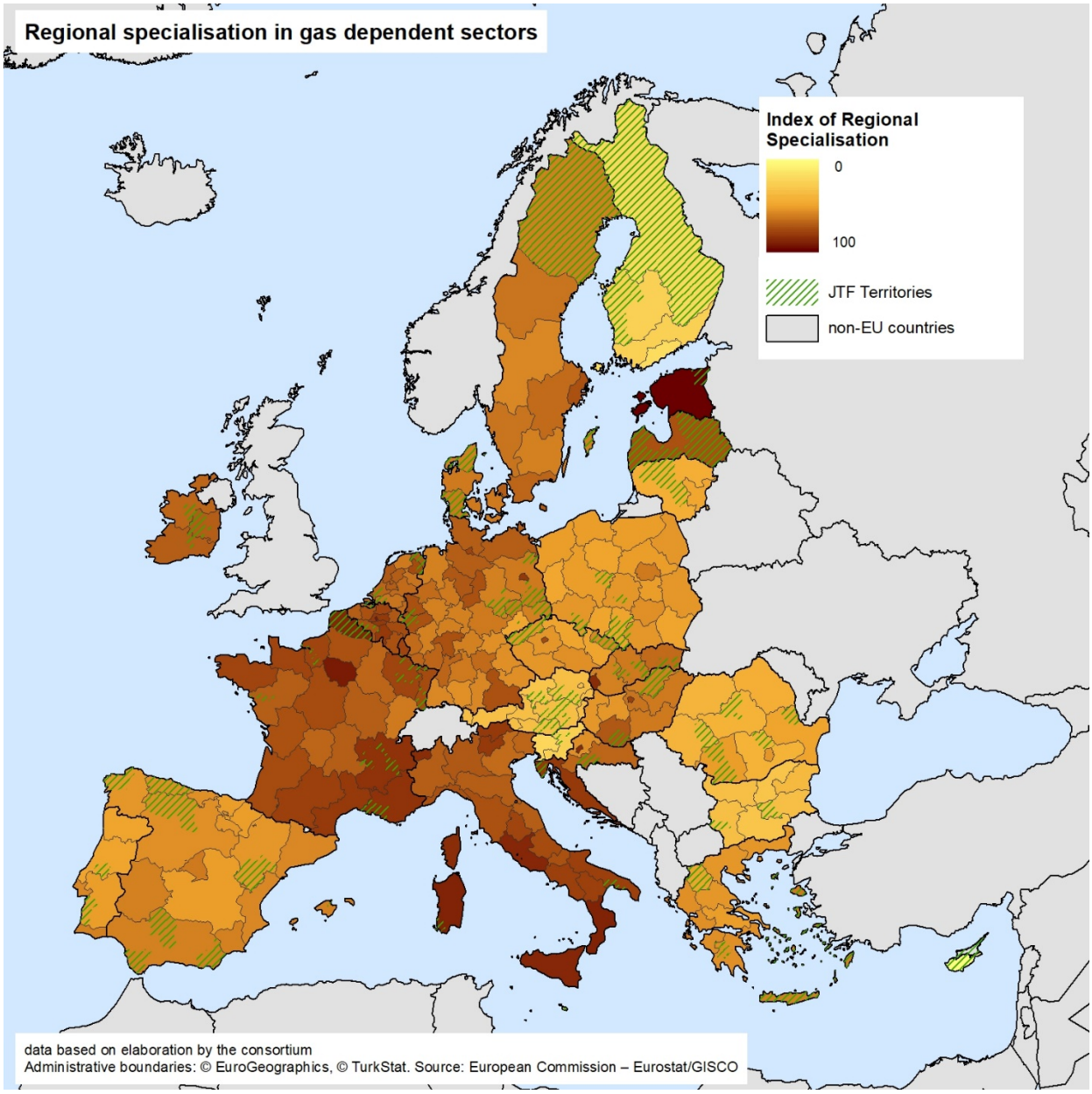
The regional specialisation structure considers employment figures based on the 2-digit NACE classification. Moreover, the analysis considers the level of diversification of regional economies. Potentially, having a less differentiated economy and a workforce employed on a limited number of sectors reduces the region's economic resilience to external shocks. The maximum risk, therefore, is present in regions that are highly specialised in gas dependent sectors, highly dependent on Russian gas import, and have limited opportunities to disinvest from sectors in crisis.

The first map illustrates the level of regional specialisation in sectors highly dependent on gas, indicating also the JTP territories. Most of the regions specialised in these sectors are located in Italy, France, Belgium, and Croatia. Some of these include also JTP territories. Less specialised regions are by comparison in eastern Member States, and in Spain, Portugal and Sweden.

[14] In the Netherlands, production at the Groningen field was capped at 2.8 bcm for the 2022-23 Gas Year1, down from 4.5 bcm in the 2021-22 Gas Year. Production from small fields in the Netherlands also continues to decline. In Denmark, the restart of the Tyra field was postponed to the 2023-24 winter –meaning that it will not contribute to the refilling of gas storages during summer 2023. In the United Kingdom, gas production recovered strongly in 2022 and the potential for further short-term growth is limited. (IEA, 2022)

[15] Several institutions have forecasted high energy prices in the medium term. https://acer.europa.eu/news-and-events/news/gas-wholesale-market-monitoring-report-shows-market-expectations-high-gas-prices-until-2024

Map 3: Regional specialisation in gas dependent sectors

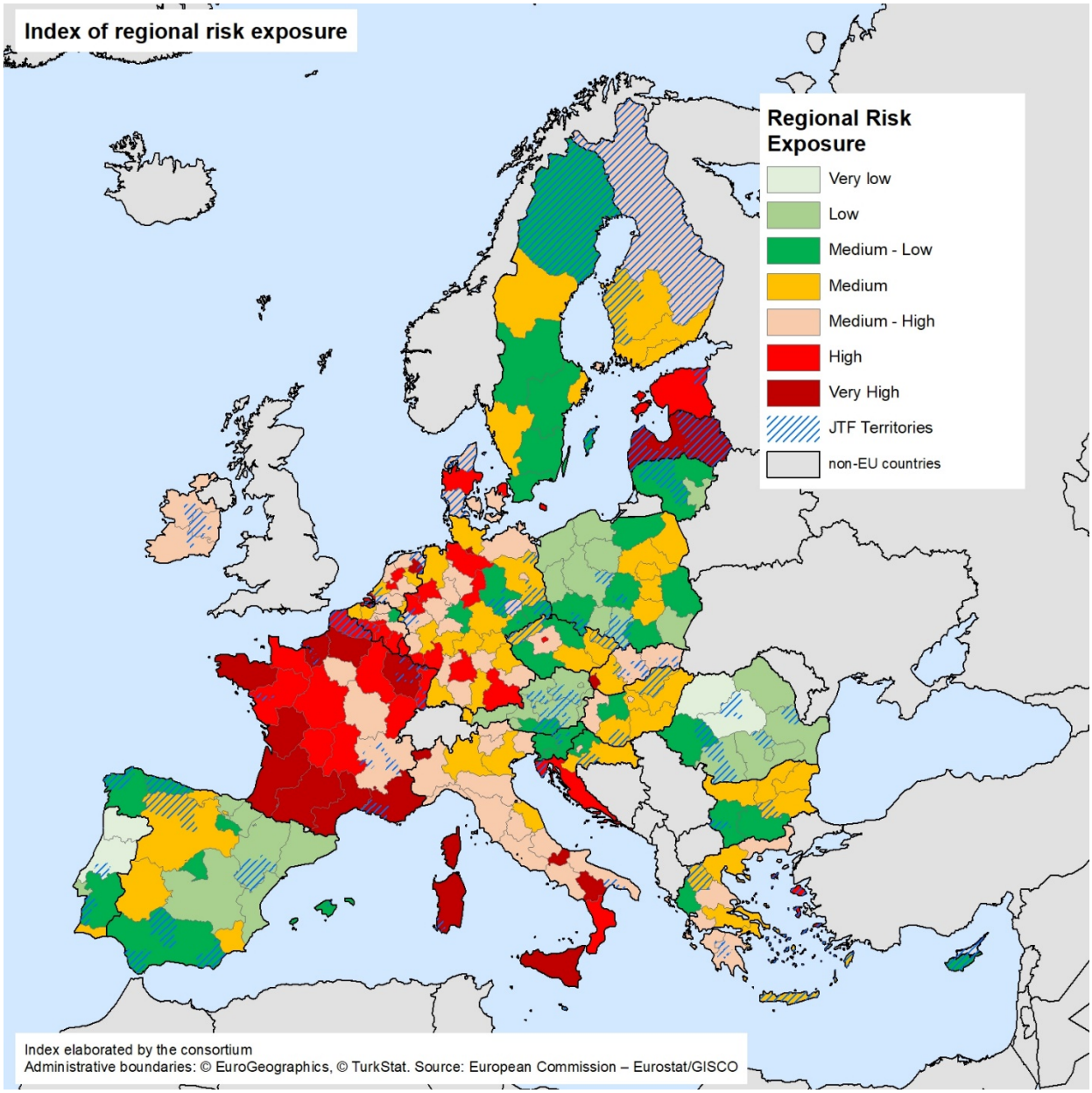


Source: data based on elaboration by the consortium, administrative boundaries based on Eurostat/GISCO

The second index, on regional risk exposure, is elaborated by adding other factors to the regional specialisation in gas dependent sectors, namely, the location of the regions in Russian import dependent country and the level of regional economy diversification. The resulting index, however, attaches more weight to the regional specialisation in gas dependent sectors in order to provide an assessment basis for potential future energy-related crises. As described in previous paragraphs, in fact, the dependency on Russian imports significantly decreased over the last year, however, the EU supply differentiation is still ongoing and the reliance on gas, in general, is still high (see Map 1 and Map 3). Moreover, the information from the level of diversification of the regional economy should be treated with caution, as a region can be highly specialised in few sectors (i.e. less differentiated) which are not necessary gas-dependent. Map 4 below illustrates the regional risk exposure to gas crises. The index intends to assess the potential risk exposure of the regional industrial structure, given the disruptions of natural gas supply chains from Russia. Comparing this index to the index illustrating regional

specialisation, some differences can be observed. In Germany and Italy, the high dependency on Russian imports is an additional risk factor, one that is coupled with a less diversified economy in some regions, such as in southern Italy. This can also be observed in Bulgaria, Slovakia and the Baltic States. Furthermore, the more differentiated industrial profiles of some regions in Italy, Germany, and the Netherlands determined a more diversified index of risk for these MS. In other cases, such as Spain, Bulgaria, Poland and Hungary, the opposite effect can be observed as they have a less differentiated industrial profile.

Map 4: Index of regional risk exposure



Source: Index elaborated by the consortium, administrative boundaries based on Eurostat/GISCO

3. TRANSFORMATION TO CLIMATE NEUTRALITY IN THE EU

KEY FINDINGS

- As of April 2023, there are 93 JTP territories in the EU. They are almost all agreed with the European Commission (apart from Bulgaria) and in the very early phase of the implementation.
- The main factors for the identification of the JTP territories are as follows: coal extraction and industry, CO_2 intensive industry in the region, peat extraction, other fossil fuel production. In addition, there are several regions with a focus on the cement or metal and steel production sectors.
- REPowerEU key measures include: improving energy infrastructure and facilities, energy efficiency, renewable energy deployment, biomethane and hydrogen development, energy transportation, distribution and storage, requalification of the workforce.
- The level of synergy between the JTPs and REPowerEU is different from region to region: while the requalification of the workforce is included in all JTPs anyway, improvement of energy infrastructure, energy efficiency and renewable energy deployment are also common measures in the JTPs, the investments in biomethane and hydrogen as well as energy transportation and storage are definitely less often included in the JTPs.

3.1. European Union's commitments for climate neutrality

Climate change is one of the biggest challenges of our time. The European Union intends to fight climate change through ambitious policies, strategies, and a targeted use of EU funds. Climate neutrality is accordingly needed to mitigate and counteract the noxious impacts of climate change. Climate neutrality is about transitioning toward a more sustainable form of development concretely by (inter alia) improving air quality, protecting biodiversity, creating local jobs, shifting towards cleaner energy sources and changing behaviours (IPCC, 2021). Climate neutrality is defined in line with the Paris Agreement, which asks for achieving "a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century" (*Regulation (EU) 2021/1119*, 2021, Art. 4 (1)). In June 2021, the EU specified in its Climate Law (Regulation (EU) 2021/1119, 2021) climate neutrality as a 2050 target. In Article 2, the EU states that the climate-neutrality objective means to balance EU-wide GHG emissions and removals reducing emissions to net zero. Thereafter, the EU aims to achieve net negative emissions.

Reaching climate neutrality requires changes to every aspect of life. Therefore, it demands realistic strategies and instruments supporting the process. Climate neutrality describes a state in which net GHG emissions arising from the EU territory have reached zero ("net zero"). The remaining GHG emissions are thus in the same order of magnitude as natural sinks such as soils, forests, or wetlands. Furthermore, technical GHG removal is aimed to take place through the capture and storage of emissions in chemicals and underground storage sites (Geden and Schenuit, 2020). Given that the elimination of the last percentage points of residual emissions is most challenging, net zero emission solutions require deep decarbonisation in each sector separately, as well as integrated measures reaching across sectors. Key sectors for reaching climate neutrality are: power generation, transport, buildings, industry (including circular economy approaches), agriculture, forestry and land use (Duwe *et al.*, 2021).

3.2. European Green Deal

The European Green Deal (EGD) (COM/2019/640 final, 2019) provides the blueprint for a transformational change of the current economic model, aiming to make Europe the first climate neutral continent in the world. Adopted in December 2019, the EGD represents the EU's long-term strategy for achieving economic growth to create a modern, resource-efficient, and competitive economy with zero net emissions of greenhouse gases by 2050. This means, that economic growth is decoupled from resource use. The EGD also aims in a just and inclusive way to protect the health and well-being of citizens and protect, conserve, and enhance the EU's natural capital. The EGD is an integral part of the Commission's strategy to implement the United Nation's 2030 Agenda and its 17 Sustainable Development Goals (SDGs).

Transformational change and new types of economic activity including creating opportunities for innovation, investment and jobs is crucial for reaching climate neutrality. Through the EGD a fair, competitive, and green transition with opportunities for European companies to create new jobs should be achieved. Therefore, the EGD policy framework touches on nearly every aspect of European society.

In July 2021, the European Commission (EC) adopted a set of proposals[16] to promote the reduction of net greenhouse gas emissions in EU climate, energy, transport, and taxation policies. In this context, key milestones to achieving carbon neutrality by 2050 were identified and include:

- Emissions: Greenhouse gas emissions reduced by at least 55% by 2030, compared to 1990 levels
- Energy: 40% renewable energy by 2030
- Transport: New cars emit zero CO_2 by 2035
- Buildings: 35 million buildings renovated for energy efficiency by 2030
- Farming: 25% of EU agricultural land under organic farming by 2030
- Circular economy: EU's circular material use rate doubled in one decade

By 2019, net greenhouse gas emissions were reduced by 25.9% compared with the 1990 base year[17]. This means that profound structural changes in every economic sector and the governing regulations are needed to achieve the 2030 and 2050 targets (Eurostat, 2022a). Different pathways are possible, as sketched out in the European Commission's 2018 communication "A clean planet for all" (COM/2018/773 final, 2018), but all scenarios require technological and institutional change on a scale and at a pace that has few parallels in human history.

The EGD's transformational agenda is implemented and supported by a number of other policy initiatives, including: the Fit for 55 package (COM/2021/550 final, 2021), Sustainable and Smart Mobility Strategy (COM/2020/789 final, 2020), a new Circular Economy Action Plan (COM/2020/98 final, 2020), the Farm to Fork Strategy (DOM/2020/381 final, 2020), EU Biodiversity strategy for 2030 (COM/2020/380 final, 2020), and Zero Pollution Action Plan (COM/2021/400 final, 2021).

3.3. Cohesion Policy

Moreover, the EU Cohesion policy legislative package 2021-2027 has been aligned with the European Green Deal objectives. The Cohesion Policy Funds'[18] main areas of focus include a green and digital

[16] See https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en#documents
[17] Net greenhouse gas emissions consider emission removals by carbon sinks in the land use, land use change and forestry (LULUCF) sector. The data also include international aviation and indirect CO_2.
[18] The European Regional Development Fund (ERDF); Cohesion Fund (CF); European Social Fund Plus (ESF+) and the Just Transition Fund (JTF)

transition, a more connected, inclusive, and social Europe, and a Europe that is closer to its citizens. The Cohesion Policy, due to its overall share of the EU budget, plays a vital role in delivering on EU climate objectives, in paving the way for the green transition, and in contributing to the reduction of the external energy dependency.

As such, the 2021-2027 Multiannual Financial Framework (MFF) foresees climate mainstreaming across all EU expenditure, dedicating 25% of EU expenditure to climate objectives. Climate mainstreaming is assessed via the weighting of the budget strands according to their relevance in supporting the climate change objective. In combination with elements of "green" financing in the European Regional Development Fund (ERDF) and INTERREG programmes through a high importance of the Policy Objective (PO) 2: "a greener Europe", the EC and in particular DG REGIO have ensured support for a transition toward a climate neutral Europe.

Within the ERDF, the majority of funding must be thematically concentrated on the Green Deal aligned PO2 and the innovation focused PO1. This accounts for 67% of the overall available ERDF budget, depending on the state of development of the region. The allocation method for Cohesion Policy funding has been expanded from GDP per capita to include broader socio-economic characteristics (e.g. additional funding per young and unemployed person) and climate change (additional funding per tonnage of CO_2 emissions). Operational programmes in Member States with a gross national income below the EU average will have to dedicate at least 30% of ERDF funding to PO2.

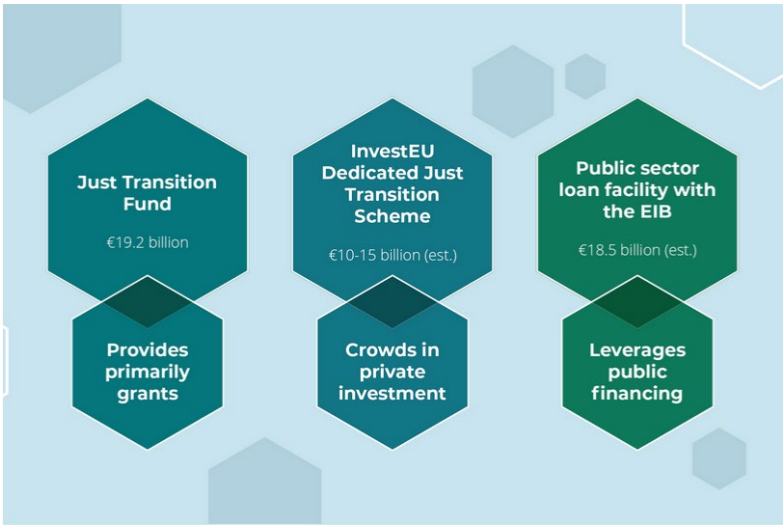
The Just Transition Fund (JTF) was designed to complement the ERDF and ESF+. However, two key differences to the devolved implementation of the other Cohesion funds are the existence of a dedicated technical assistance facility and the active incorporation of EIB funding. The JTF support is targeted at (circular) business and employment creation and support activities, digitalisation, R&D, and innovation transfer, as well as regeneration and decontamination.

3.4. Just Transition Mechanism

The Just Transition Mechanism (JTM) was designed to provide territories facing serious socio-economic challenges arising from the transition towards climate neutrality with tailored support. The Mechanism was announced in January 2020 in the EC plans for a Sustainable Europe and the EGD (COM/2020/21 final, 2020), to mobilise investments in the regions most exposed to transition challenges for restructuring their economies, supporting changes in business models, and addressing new skill requirements.

The JTM was also set up in order to strengthen, and make more effective, EU support to regions in transition. As outlined by European Court of Auditors (2022), EU support in 2014-2020 to coal regions had a limited focus and impact on job creation and energy transition, and, despite overall progress, coal still remains a significant source of greenhouse gas emissions in some Member States. Coal regions had used EU funds in different ways with the aim of addressing their own specific needs – even if most regions developed their transition strategies toward the end of the 2014-2020 period – this was done with a weak focus on socio-economic improvement and energy transition. The report by the European Court of Auditors underlines that the number of jobs created directly in these regions through investments under the ERDF was relatively low and, in most regions, the funded projects did not have a significant impact on energy savings or on the renewable energy production capacity.

Figure 11: The three pillars of the Just Transition Mechanism



Source: Just Transition Platform, 2022

The JTM is implemented under shared management, in the overall framework of Cohesion Policy, which is the main EU policy to reduce regional disparities and to address structural changes in the EU Member States. The JTM is built on three pillars, which include different grant and financing instruments to offer a full range of support options in line with the needs to mobilise investments benefiting the most impacted regions:

- the Just Transition Fund (JTF) (Regulation (EU) 2021/1056, 2021), mobilizing of EUR 19.2 billion (in current prices, or EUR 17.5 billion in 2018 prices) in the programming period 2021-2027 from the MMF 2021-2027 budget and the NextGenerationEU proceeds. The JTF, primarily providing grants, supports the economic diversification and reconversion of the territories concerned, by financing productive investments in SMEs, creation of new firms, research and innovation, environmental rehabilitation, clean energy, upskilling and reskilling of workers, job-search assistance and active inclusion of jobseekers programmes, as well as the transformation of existing carbon-intensive installations when these investments lead to substantial emission cuts and job protection.
- the InvestEU Just Transition scheme (Regulation (EU) 2021/523, 2021), providing a guarantee under the InvestEU Programme and expecting a leverage effect of around EUR 10-15 billion from the private sector to support investments, including in sustainable energy and transport that benefit those regions and help their economies find new sources of growth. Projects not located in the most affected territories can also benefit from the scheme provided that those projects contribute to meeting the development needs stemming from the transition of those territories as set out in the relevant Just Transition Plans.
- a Public Sector Loan Facility (Regulation (EU) 2021/1229, 2021), combining grants from EU budget allocations (EUR 1,525 billion in current prices) and loans from the EIB (EUR 10 billion) and aiming to mobilise around EUR 18.5 billion of public investments. The Loan Facility exclusively targets public entities, providing support to projects that do not generate a sufficient stream of own resources to be financed commercially. Projects are expected to include investments in all types of public infrastructure, such as in energy and transport, district heating networks, energy efficiency measures including renovation of buildings, as well as social infrastructure. Support to fossil fuel related investments is excluded.

Table 3: Just Transition Fund, allocations per Member State (EUR million, 2018 prices)

	Under NextGenerationEU	Under MFF 2021-2027	Total	Share
Belgium	95	71	**166**	**0.9%**
Bulgaria	673	505	**1,178**	**6.7%**
Czechia	853	640	**1,493**	**8.5%**
Denmark	46	35	**81**	**0.5%**
Germany	1,288	966	**2,254**	**12.9%**
Estonia	184	138	**322**	**1.8%**
Ireland	44	33	**77**	**0.4%**
Greece	431	324	**755**	**4.3%**
Spain	452	339	**790**	**4.5%**
France	535	402	**937**	**5.4%**
Croatia	97	72	**169**	**1.0%**
Italy	535	401	**937**	**5.4%**
Cyprus	53	39	**92**	**0.5%**
Latvia	100	75	**174**	**1.0%**
Lithuania	142	107	**249**	**1.4%**
Luxemburg	5	4	**8**	**0.0%**
Hungary	136	102	**237**	**1.4%**
Malta	12	9	**21**	**0.1%**
Netherlands	324	243	**567**	**3.2%**
Austria	71	53	**124**	**0.7%**
Poland	2,000	1,500	**3,500**	**20.0%**
Portugal	116	87	**204**	**1.2%**
Romania	1,112	834	**1,947**	**11.1%**
Slovenia	134	101	**235**	**1.3%**
Slovakia	239	179	**418**	**2.4%**
Finland	242	182	**424**	**2.4%**
Sweden	81	61	**142**	**0.8%**
EU 27	**10,000**	**7,500**	**17,500**	**100.0%**

Source: reproduced from European Commission (link)

To further accompany Member States and regions to achieve a just transition, the Just Transition Platform was established in 2020 to provide a single access point to support and transfer knowledge on Europe's transition to a sustainable, climate-neutral economy. The Platform ensures that all stakeholders have the guidance, information, and knowledge they need to contribute to Europe's just transition to a sustainable, climate-neutral economy. It builds on and expands the work of the existing Initiative for Coal Regions in Transition, which supports fossil fuel producing regions across the EU in achieving a just transition through tailored, needs-oriented assistance and capacity-building. Additional support is ensured by the InvestEU Advisory Hub, which acts as a central entry point for advisory support requests to any project under Pillars 2 and 3 of the JTM, as well as for some projects to be financed under the JTF.

The allocation of the funds from the JTF is regulated by Regulation 2021/1056, which establishes the potential beneficiaries from the funding (all Member States), the origin of the resources allocated

(Article 3 and 4), and the type of activities supported (Article 8). Annex I of the Regulation details the allocation by Member State, with Poland (20%), Germany (12.9%) and Romania (11.1%) displaying the highest allocated rates. Provisions are related to the requirement for specific territorial plans, and the indictors for the follow up of the plans (Annex III of the Regulation). Activities range from technological investments in SMEs and in the digital economy, support to renewable energy and to the circular economy, and job creation, including training and support for job searching. Moreover, article 9 specifies, inter alia, that investments related to the production, processing, transport, distribution, storage or combustion of fossil fuels shall be not supported by the JTF.

To unlock and use JTM resources, EU Member States must prepare strategic Territorial Just Transition Plans, as a part of their cohesion policy programmes. In the Plans, to be prepared in dialogue with relevant partners and the EC, they are required to identify the territories and sectors eligible for funding (i.e. those most negatively impacted by the transition) and indicate frameworks and a timeline for the transition process spanning until 2030 and 2050. Member States should further set out the social, economic, and environmental challenges stemming from the phasing out of fossil fuel-related activities or decarbonisation of greenhouse gas-intensive processes or products. Moreover, they should describe the types of operations to be funded by the JTF and outline the intended use of resources under Pillars 2 and 3 of the JTM. Finally, Plans must be consistent with the Smart Specialisation Strategies and the National Energy and Climate Plans.

The approval of the Plans by the EC, therefore, opens the door to dedicated financing not only from the JTF but also from the Pillar 2 and 3 of the JTM. The Plans are annexed to the Cohesion Policy programmes entailing support for the JTF, and are adopted by the EC. As indicated in article 11 of the Regulation, the focus should be on regions with major challenges in terms of transition to a low carbon economy: *"Those territories shall be those most negatively affected, based on the economic and social impacts resulting from the transition, in particular with regard to the expected adaptation of workers or job losses in fossil fuel production and use and the transformation needs of the production processes of industrial facilities with the highest greenhouse gas intensity"*. The allocation of funds to regions under transition is based on the approval of the Just Transition Plans. The Plans must define the regional development needs, the objectives to be met by 2030, the type of operations envisaged, and the governance mechanism adopted to achieve these objectives.

3.5. Overview of Just Transition Plans

As of March 2023, there are 93 JTP territories in the EU. They are almost all agreed (apart from Bulgaria) and in the early phase of the implementation. The JTPs address different challenges of the transition. While the majority of the Member States have elaborated a separate JTP for each territory (e.g. Poland, Germany, Italy), there are also examples of countries with a single JTP for all the territories (e.g. Austria, Finland). The eligibility of the territories differs in the underlying conditions. The main factors for the identification of the JTP territories are as follows:

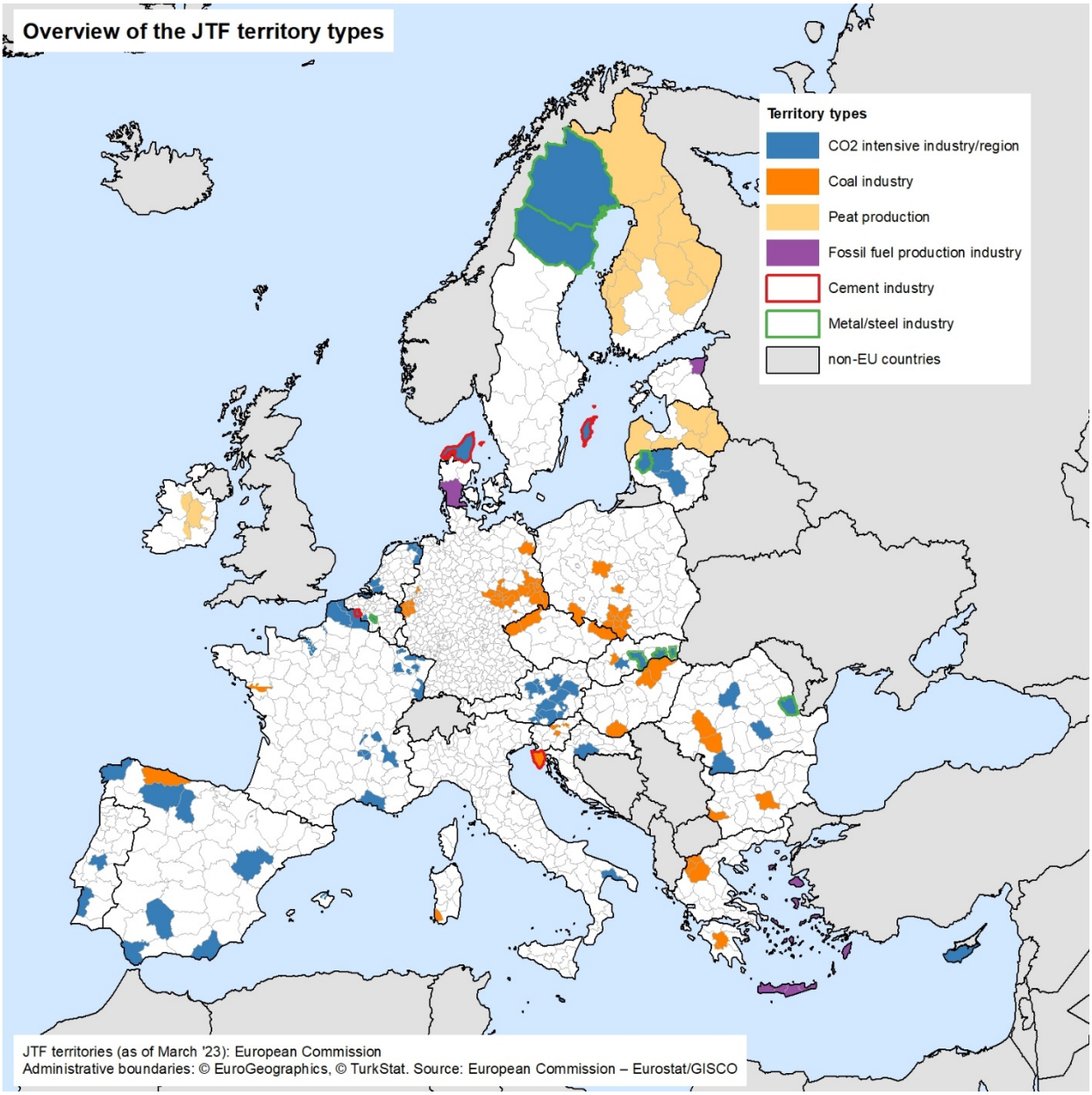
- Coal extraction and industry
- CO_2 intensive industry in the region
- Peat extraction
- Other fossil fuel production

In addition, there are several regions with a focus on the cement or metal and steel production sectors. These conditions were the basis for the typological analysis of the JTPs across the EU (see Map 5). Reasons for the delineation of the regions frequently overlap. Coal extraction regions in the most cases also have a CO_2 intensive industry, and fossil fuel production tends to be located in proximity of the

sites of extraction. In these cases, the territory type was assigned according to the dominant reason. Only cement and steel production are presented separately as an additional category on the map. A list of all JTP territories by type is provided in annex A.3.

Further criteria for the identification of the regions eligible for support under the JTF, apart from the general carbon intensity of the local economy, are related to employment in relevant sectors (i.e., the number of jobs in carbon intensive industries, fossil fuel extraction and the production industry), unemployment, existing and potential regional disparities as well as further environmental factors (such as reclamation and redevelopment of land).

Map 5: Overview of the JTF territory types



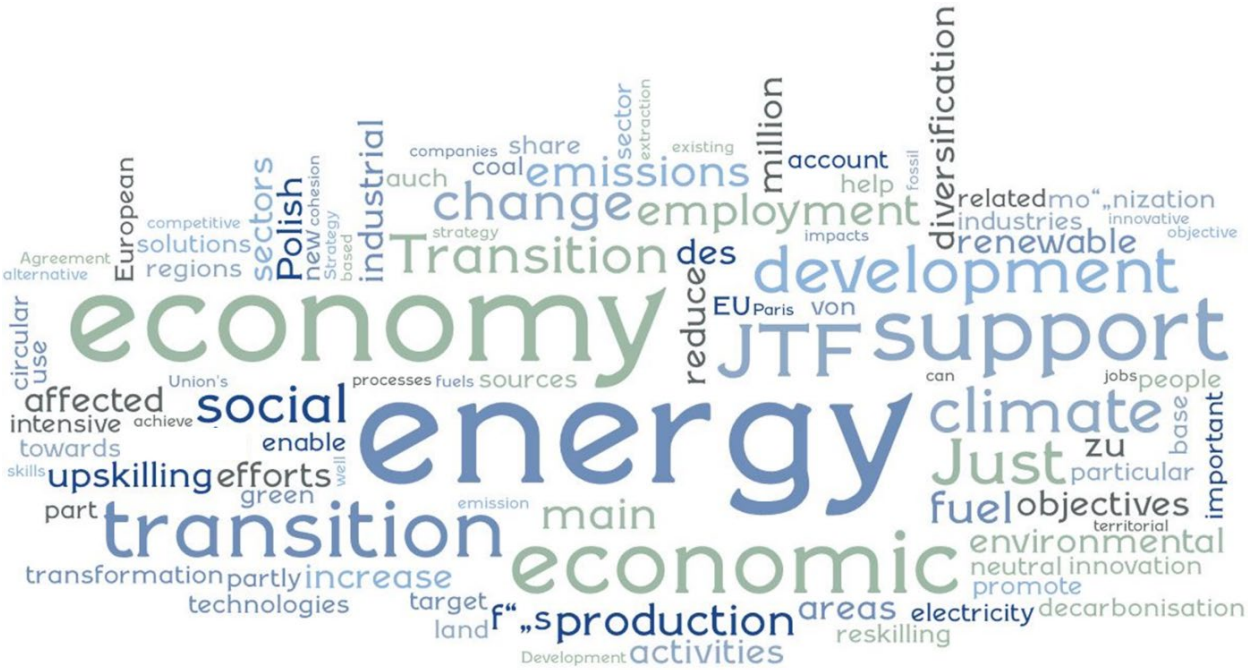
Source: Own elaboration, 2023.

Apart from the identification of the most negatively affected areas and the assessment of challenges, the JTPs include the overview of the transformation process. This includes specific opportunities and strategies for achieving the goal of climate neutrality. The development strategies have similarities in

their general characteristics. They foresee coal phaseout, closure of peat extraction sites, reduction of the emissions through a switch to renewable energy sources, development, introduction and promotion of new technologies, the encouragement of innovation at different dimensions of development, an enabling of social capital by upskilling and reskilling, and an increased development of circular economies. Figure 12 presents a word cloud based on the descriptions of the development strategies for the JTP-territories throughout EU.

The JTPs outline the specific actions and measures that will be taken to achieve objectives and targets. The § 8 of the JTF Regulation (Regulation (EU) 2021/1056, 2021) specifies which types of actions can be supported by the JTF. The word cloud in Figure 13 illustrates the main actions and measures described in the JTPs. It is dominated by new technologies, research, strengthening of economy, development and implementation of innovative projects, measures to improve employment chances, diversification and creation of new business opportunities, recycling of waste and other materials, biobased solution for production, circular economy, research development and providing the society with new qualifications fitting the new labour market, measures for improvement of the environmental quality in the region.

Figure 12: Key words based on the JTP development strategies



Source: Own elaboration, 2023.

Figure 13: Key words based on the actions and measures to be supported by JTF

Source: Own elaboration, 2023.

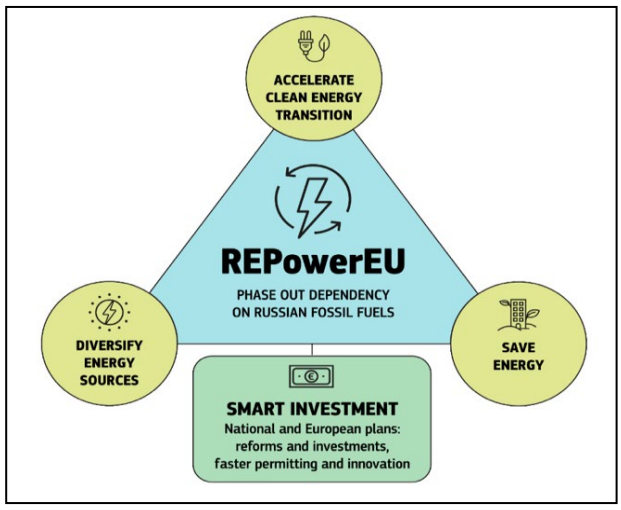
More detailed information on the JTPs is provided in the regional case study analysis in section 4.1 of this report.

3.6. RePowerEU

The RePowerEU Plan was presented by the EC on 18th May 2022 (COM/2022/230 final, 2022)[19]. The RePowerEU initiative, by combining investments and reforms, aims at ending EU dependence on fossil fuels and gas imports from Russia with a target of reducing it by two thirds by the end of 2022 through promoting energy savings, diversifying supply and fostering the deployment of renewable resources. End 2022, the Russian gas accounted for only 10% of the total gas imported in the EU (against 50% before the Ukraine invasion).

The RePowerEU Plan builds on the full implementation of the Fit-for-55 proposals as a part of the European Green Deal with the ambition of achieving at least a 55% reduction of net GHG emissions by 2030, compared to 1990, and accomplishing climate neutrality by 2050. This package of legislative proposals, adopted in July

Figure 14: RePowerEU main pillars



Source: reproduced from European Commission, COM/2022/230 final, 2022

[19] Communication from the Commission to the European Parliament, the European Council, The Council, The European Economic and Social Committee and the Committee of the Regions. COM/2022/230 final.

2021 (COM/2021/550 final, 2021), aims to modernise existing legislation in line with the EU's 2030 climate targets and introduce new measures for a faster transition of the EU economy, society and industry, to achieve climate neutrality. The proposed regulatory framework addresses, inter alia, the transition challenges in a large range of activities including the energy sector, district heating and cogeneration, land use and forestry, the road transport sector, as well as energy taxation.

The RePowerEU Plan is centred around three main elements:

Firstly, improving energy efficiency by encouraging consumers (both households and companies) to become more energy conscious. With the EU Save Energy Communication, accompanying the RePowerEU (COM/2022/240 final, 2022), the EC intends to adopt a two-pronged approach, achieving immediate energy savings through voluntary choices and accelerating and strengthening structural, mid-term to long-term energy efficiency measures. To implement this approach the EC:

- Intends to increase the binding targets from 9% to 13% compared to the 2020 reference scenario (revision of the Energy Efficiency Directive (European Commission, 2022c).
- Will revise the Energy Performance of Buildings Directive (COM/2021/802 final, 2021) and support the Commission proposal for a Regulation on Ecodesign for Sustainable Products (COM/2022/140 final, 2022).
- Has launched the "Playing my part" nine-point plan (European Commission, 2022b), an easy-to-use guide explaining simple steps citizens can take to save energy now. The RP Plan is based on actions drawn from the IEA's 10-Point Plan to Reduce the European Union's Reliance on Russian Natural Gas and the 10-Point Plan to Cut Oil Use.
- Invites Member States to make full use of supporting measures, such as reduced VAT rates for high efficiency heating systems and for insulation in buildings. It further encourages MS to implement and update the National Energy and Climate Plans (NECPs).

Secondly by diversifying energy imports. To address this element, an EU Energy Platform for the voluntary common purchase of gas, liquefied natural gas (LNG) and hydrogen has been set-up in April 2022 (European Commission, 2022a). The aim of this platform is to aggregate and structure gas demand, optimise and make transparent use of the import, storage and transmission gas infrastructure, and stimulate international cooperation. The Platform operates through Regional Task Forces supported by an Industry Advisory Group. With the RePowerEU Plan, the EC will also present a voluntary joint purchasing mechanism to negotiate and contract gas for consumers in participating EU countries.

Thirdly by substituting fossil fuels and accelerating Europe's clean energy transition. The RePowerEU aims at expanding the use of renewable energy and accelerating changes in the legislation to expedite permits on such infrastructure. The EU phasing-out of Russian fossil fuels requires a large acceleration and scale-up of renewables in power generation, industry, buildings, and transport, by:

- Boosting renewable energy. Under the Plan, the EC proposes to increase the target in the Renewable Energy Directive to 45% by 2030, up from 40% in the Green Deal initial proposal. Concerning solar energy, the EC has set the REPowerEU target of over 320 GW of solar photovoltaics newly installed by 2025, over twice today's level. The target further aims for almost 600 GW by 2030. Moreover, the EC adopted an EU solar energy strategy in May 2022 (COM/2022/240 final, 2022) and has established the European Solar Rooftop Initiative, introducing obligations for certain categories of buildings. The EU is also called for growing its wind sector and doubling the current deployment of individual heat pumps. Overall, to strengthen the EU supply chains for solar, wind and heat pump technologies and increase the sustainability of these technologies, the EC will enhance the regulatory framework and

establish the Important Projects of Common European Interest (IPCEI) to channel MS public contributions towards the plan objectives.

- Accelerating hydrogen. The RP Plan sets a target of 10 million tonnes of domestic renewable hydrogen production and 10 million tonnes of renewable hydrogen imports by 2030. To achieve these goals, EU institutions will align the sub-targets for renewable fuels of non-biological origin under the Renewable Energy Directive for industry and transport and plan to rapidly conclude the revision of the Hydrogen and Gas Market package. It will also top-up Horizon Europe investments on the Hydrogen Joint Undertaking (EUR 200 million) to double the number of Hydrogen Valleys. Accelerated efforts are also needed to deploy hydrogen infrastructure for producing, importing, and transporting 20 million tonnes of hydrogen by 2030. The basis for planning and the development of the cross-border hydrogen infrastructure has already been established through its inclusion in the revised trans-European networks for energy. To facilitate the import of up to 10 million tonnes of renewable hydrogen, the EC will also support the development of three major hydrogen import corridors via the Mediterranean, the North Sea area and, as soon as conditions allow, with Ukraine. Furthermore, Green Hydrogen Partnerships will facilitate the imports of green hydrogen while supporting decarbonisation in partner countries.
- Scaling up biomethane. The EU needs to boost sustainable biomethane production to 35 bcm by 2030 to achieve its ambition to reduce imports of natural gas from Russia by two-third (SWD/2022/230 final, 2022). To increase the capacity of biogas production in the EU and promote its conversion into biomethane, the estimated investment needs amount to EUR 37 billon by 2030. The focus should be on sustainable production to avoid impacts on land use and food security, giving priority to production from organic waste, forest and agricultural residues.
- Reducing fossil consumption in hard-to-abate industrial and transport sectors. To support hydrogen uptake and electrification in industrial sectors, the EC will roll out carbon contracts for difference and dedicated REPowerEU windows[20] under the Innovation Fund to support a full switch of the existing hydrogen production in industrial processes from natural gas to renewables and the transition to hydrogen-based production processes in new industrial sectors, such as steel production. Moreover, in cooperation with the EIB, it will develop a technical advisory facility under the InvestEU Advisory Hub to support power purchase agreements (PPAs) financed renewable energy projects. To unlock industrial investment, the Commission will double the funding available for the 2022 Large Scale Call of the Innovation Fund to around EUR 3 billion.
- Delivering REPowerEU with skilled people, raw materials and a complete regulatory framework. To enhance the industry's contribution to REPowerEU and reinforce its competitiveness, the EC will set up an EU Solar Industry Alliance, it will work with industry to scale up electrolyser manufacturing capacities, and it will intensify work on the supply of critical raw materials and prepare a legislative proposal. Moreover, to address the skills shortages, the EC encourages stakeholders in renewable energy production, and permitting authorities, to establish a large-scale skills partnership under the Pact for Skills. It will also support skills through ERASMUS + and the Joint Undertaking on Clean Hydrogen, with the launch of a large project to develop skills for the hydrogen economy.
- Speeding up permitting and innovation. To help Member States exploit all possibilities for acceleration that exist within the legislative framework, the EC has presented a recommendation to speed up permit-granting procedures for renewable energy projects and

[20] A specific REPowerEU window will support innovative electrification and hydrogen applications in industry, innovative clean tech manufacturing (such as electrolysers and fuel cells, innovative renewable equipment, energy storage or heat pumps for industrial uses), and mid-sized pilot projects for validating, testing, and optimising highly innovative solutions.

facilitate PPAs (C/2022/3219, 2022) in which Member States are invited to adopt participatory approaches involving local and regional authorities, and providing authorities, with the necessary resources to facilitate the timely realisation of locally adapted investments. Further acceleration in permitting procedures is foreseen in the EC amendments in its proposal on the Renewable Energy Directive.

To implement the RP Plan and achieve targets, the EC has estimated (SWD/2022/230 final, 2022) that implementing the full potential to reduce the dependence to zero (310 bcm) would require EUR 300 billion in investments until 2030 (beyond the Fit-for-55 proposals), of which EUR 210 billion is required by 2027. Some more specific figures include:

- Implementation of the Fit for 55 framework and the REPowerEU plan is expected to save EUR 80 billion in gas import expenditures, EUR 12 billion in oil import expenditures and EUR 1.7 billion in coal import expenditures per year by 2030.
- Investments up to EUR 10 billion will be required to import sufficient LNG and pipeline gas from other suppliers. . The total investment needs to ensure the security of oil supply is instead expected to amount to up to EUR 1.5-2 billion.
- An additional EUR 29 billion in investments is needed in the power grid to make it fit for increased use and production of electricity.
- Total investment needs for key hydrogen infrastructure categories are estimated to be in the range of EUR 28-38 billion for EU-internal pipelines and EUR 6-11 billion for storage.
- An amount of EUR 37 billon over the period is required to scale-up biomethane.

Moreover, even if most targets and objectives require a strong coordination at European level, implementation of many of the measures remain with Member States which are called to adopt targeted reforms and investments. The EC invites Member States to add to their existing Recovery and Resilience Plans (RRPs) a dedicated chapter with new actions to deliver on the REPowerEU objectives of diversifying energy supplies and reducing dependence on fossil fuels. The RRPs should also ensure complementarity with actions supported via other national or EU funds, including synergies with measures included in the Just Transition Plans. The RRPs are expected to mobilise additional finance for covering the REPowerEU investment needs, through RRFs loans (to be granted until the end of 2023). Additional funding will be available from the auctioning of allowances of the Emissions Trading System ("ETS"), under Directive 2003/87/EC and or through transfer from the Brexit Adjustment Reserve (under Regulation 2021/1755). Moreover, Member States will have the possibility to transfer up to 5% of their initial allocation under the Funds covered by the Common Provision Regulation (Reg EU 2021/1060), except the JTF. Additional transfers of 7.5% are also allowed to the national RRPs from the European Regional Development Fund, the Cohesion Fund and the European Rural Development Fund.

However, despite the large amount potentially available for the REPowerEU objectives, there are some limitations in financing the overall RP plan. The court of auditors identified potential issues related to the implementation of RePower. In its opinion published July 2022[21], the Court underlined that most of the sources are outside the Commission's control and depend on Member States' willingness to invest. Moreover, there is a risk that the financial resources identified in RePower might not be sufficient to guarantee the gas saving objectives as initially planned, while incentives to use the loan component may be limited for some MS. Other issues are related to the cross-border initiatives, the exemption from

[21] Opinion 04/2022 (pursuant to Article 287(4) and Article 322(1)(a), TFEU) concerning the proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2021/241as regards REPowerEU chapters in recovery and resilience plans and amending Regulation (EU) 2021/1060, Regulation (EU) 2021/2115, Directive 2003/87/EC and Decision (EU) 2015/1814 [2022/0164 (COD)].

the application of the DNSH principles, the timing for RRPs assessment and the signature of operational arrangements.

Table 4: RePowerEU at a glance

Measures	EU and MS Actions
Savings	
Citizens: behavioural change	EU Save Energy Communication Play my part campaign
Residential sector: energy efficiency and heat pumps	EU Save Energy Communication Higher 13% Energy Efficiency Directive (EED) target Ecodesign and energy labelling requirements for solar PVs heat pumps Potential important projects of Common European Interest (IPCEI)
Industry: energy efficiency and electrification	Higher 13% Energy Efficiency Directive (EED) target Higher 45% Renewable Energy Directive target Innovation fund RRF chapter
Curtailment	EU coordinated demand reduction plan
Fuel diversification	
LNG and pipeline gas	Diversification obligation Joint Gas and Hydrogen Purchasing EU IT tool for demand aggregation and infrastructure transparency MoUs with partner countries Adoption of the storage proposal RRF chapter
Biomethane	Biomethane action plan RRF chapter
Renewable Hydrogen	RFNBO sub-targets in line with higher RED targets Hydrogen Valleys Regulatory framework: Delegated acts on definition and standards Imports: Joint Gas and Hydrogen Purchasing Vehicle and International Hydrogen Partnerships Industrial Capacity: Electrolyser Declaration Innovation fund RRF chapter
Renewable Electricity	
Solar & Wind	Higher 45% RES target by amended RED PPA guidance Solar strategy Solar roof top initiative by amended RED

Measures	EU and MS Actions
	RRF chapter Solar alliance Potential Important Projects of Common European Interest (IPCEI) focused on breakthrough technologies and innovation
Permitting	Legislative proposal on permitting amending RED EC recommendation
Smart investments and reforms	
Infrastructure	Integrated EU-wide infrastructure gaps and needs assessment for gas, electricity and hydrogen
RRF	Revised RRF proposal close to EUR 300 billion (225 bn loans+up to 72 bn grants) RRP guidance
Innovation Fund	Revised Innovation Fund proposal rolling out carbon contracts for difference Dedicated RePowerEU call in Autumn 2023 Dedicated RepowerEU funding windows
CEF	Dedicated RePowerEU calls, starting May 2022
Reform	European semester Country-specific recommendations Permitting PPA guidance RRF chapters

Source: based on RePower Plan Communication, COM (2022) 230 final – Annexes 1, 18 maggio 2022.

As of February 2023, MSs were still negotiating with the EC regarding the amendments to their NRRPs, with the objective to design the RePower RRPs' chapters and to access the additional financial resources made available. Considering the actual contribution of RePowerEU to implement the JTF, no change in the JTP strategies is foreseen in the short term, while some MS are likely to use additional funding to improve energy security and investments in energy infrastructure at the national level (e.g. Romania). Generally speaking, RePowerEU measures implemented in the RRPs are expected to complement and scale up the impacts of JTP interventions (see table below). Moreover, at this stage, an estimation of the additional funding allocated to the territories already benefiting from the Joint Transition Mechanisms is premature. In general, there are some doubts about the concrete synergies and complementarities between the different instruments implemented to address the gas supply crisis at territorial level. The risk of overlaps between RRPs measures and the actions in the JTP is not excluded, with consequences in terms of over-financing the interventions in some specific territorial contexts.

Table 5: Synergies between the JTPs in the selected case study regions and RePowerEU key measures

	Sardinia (Italy)	Galati (Romania)	JTP territories in Austria	Uckermark (Germany)	Lapland (Finland)	Silesia (Poland)
Improving energy infrastructure and facilities						
Energy efficiency						
Renewable energy deployment						
Biomethane and Hydrogen development						
Energy transportation, distribution and stockage						
Requalification of the workforce						

4. IMPACT OF GAS CRISIS ON IMPLEMENTATION OF JUST TRANSITION PLANS AND COHESION POLICY

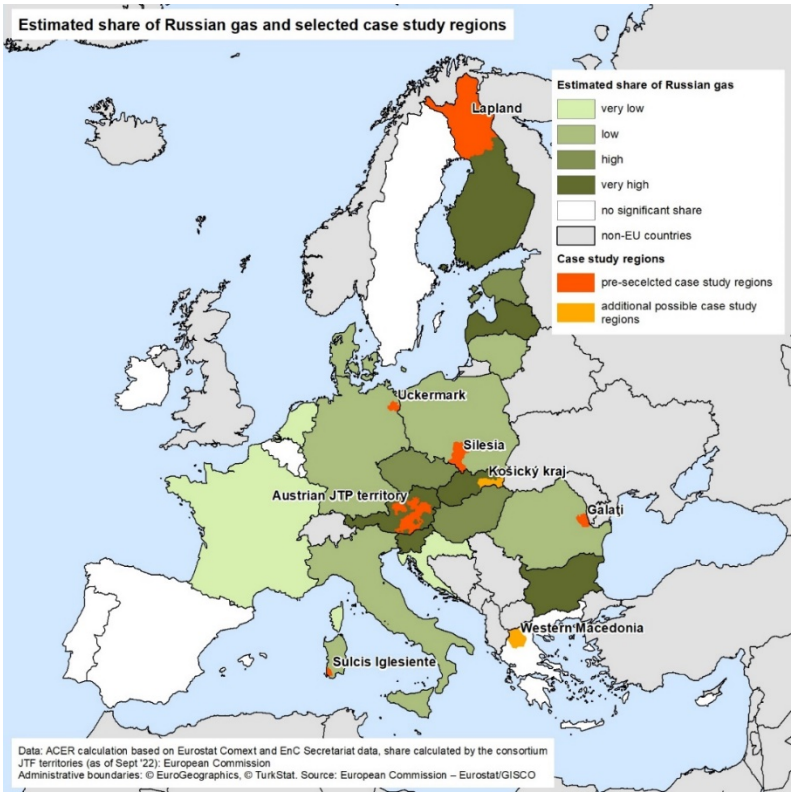
KEY FINDINGS

- The case study analysis reveals a wide range of implementation approaches for the Just Transition Fund. Some Just Transition Plans (JTP) are very tailor-made, while others are more general and less adapted to the existing regional characteristics. The more a JTP reflects the regional characteristics, the fewer are the concerns for its successful implementation, especially in the light of the existing crisis.
- All JTPs analysed are at the very early stage of implementation. Therefore, a direct impact of the gas crisis on the JTPs cannot be observed yet.
- The future scenarios reveal that various new drivers affect the development of regions. Existing implications stimulating negative development paths are rather short-term. If no appropriate, regionally specific measures are taken to tackle them, they may influence the future in a long term. The main new positive implication is the existing awareness of the importance and acceptance for the transition process can be seen in positive indication that the regions can cope with the challenging situation.
- There is no direct need to adapt the JTPs themselves. Potential improvements concern the delivery system and the exchange between the regions and the EC.

4.1. Introduction of the case study regions

The detailed investigation of impact of the gas supply crisis on the Just Transition Plans and generally cohesion policy was done for the six case study regions. In drawing the evidence from the representative combination of JTP-regions, the selection of the case studies was based on dependency on Russian gas, gas share in gross available energy mix, and representation of different types of JTP-territories (as presented in section 3.5). In addition, the regions cover different parts of Europe, territorial characteristics, and vary in overall social and environmental performance.

Map 6: Case Study regions



Source: Project team, 2023.

The regional profiles of the case studies are presented in Table 6 and in the following info-boxes on each case study region.

Table 6: General characteristics of the case studies

Location		Case study characteristics				Economic Profile		Gas dependency	
Region	Country	JTF type	Size [km²]	Population [habitants]	Population density [inhabitants per km²]	GDP: EUR per capita (2020)	GDP growth since 2010	Share of Russian gas[22]	Gas share in gross available energy mix[23]
Lapland	FI	Peat production	100,367	176,494 (2021)	2	39,058	+36%	92%	7%
Ucker-mark	DE	Coal industry	3,077	117,336 (2021)	38	30,237	+29%	49%	26%
Galați	RO	CO_2 intensive industry, Metal/ steel production	4,466	500,213	123	9,100	+90%	26%	30%
JTP territory	AT	CO_2 intensive industry	24,147	1,669,917 (2022)	69	42,540	+20%	92%	23%
Silesia	PL	Coal industry	12,333	4,492,300 (2022)	364	13,800	+53%	50%	17%
Sulcis Iglesiente, Sardinia	IT	Coal industry	1,500	119,086 (2021)	79	20,200	+2%	38%	41%

Case study: Lapland

Lapland is a predominantly rural region with long distances and a very low population density. There are some larger regional towns (Rovaniemi, Kemi, Tornio) and 60% of the population lives in the urban areas. The population of Lapland decreased from the 1990s until the COVID-19 pandemic, after which there has been a slightly positive population trend due to in-country immigration. Lapland has strong industry and tourism, as well as abundant natural resources.

Economic profile

The main sectors of the regional economy are industry (10% of employment and 54% added value), trade (9% of employment and 6% of added value) and construction (5% employment and 7% of added value) (2020).

Industry is by far the largest sector with a EUR 6.4 billion turnover and 7,214 employees (10%) in 2020. The second largest sector was trade with a EUR 2.5 billion turnover and 5,977 employees (9%) in 2020. In terms of turnover, the next largest sectors are construction (0,85 billion turnover, 4,846 employees), mining (0,69 billion turnover, 3,266 employees), and transport (0,49 billion turnover, 2,081 employees). The value of exports from Lapland was EUR 3.8 billion in 2019, which is approximately 6% of the Finnish exports of goods. There are around 12,500 companies in Lapland. Most of the companies are micro enterprises or SMES, but there are some large mining and metallurgy companies as well.

[22] Values refer to the respective country. The share of Russian gas includes also the apportionment of the Russian share from liquid hubs in other countries. Based on the dataset "Diversity of gas supply" of the Agency for the Cooperation of Energy Regulators (ACER) (ACER, 2021).

[23] Values refer to the respective country. Information based on the Eurostat dataset "Simplified energy balances". The share of natural gas is calculated by dividing the gross available natural gas by the total gross available energy. The calculated share of natural gas in the 14, respectively 19 Member States named above ranges between 6.5 and 40.5%. Finland has the lowest share, while as Italy has the highest one (Eurostat, 2022b)

Case study: Lapland

Energy supply in the region

In 2021, the gross electricity consumption in Finland was 87,076 GWh, decreasing to 81,680 GWh in 2022. The share of industry was approximately 44% of the total electricity consumption. The share of domestic electricity production was 72% in 2021, rising to 76% in 2022. The natural gas import decreased by 48% between 2021 and 2022. In contrast, the imports of coal, cox, raw oil, propane and some other oil-based products increased in 2022. The domestic electricity production in 2022 was based on nuclear power (35%), converted thermal power (28%), hydro power (19%), wind power (17%), and solar power (1%).

District heating amounted to 45% of the heating sources in residential and service buildings in Finland in 2020. Other significant heat sources were electricity (19%), wood (12%), heat pumps (10%), and oil (7%).

The use of energy by industry in Finland was 143,144 GWh in 2021, out of which 10.6% (15,160 GWh) was used in Lapland. Even though the energy use by industry in the entire country has reduced by 9.6% since 2010, the industry in Lapland uses 4.2% more energy in 2020 than in 2010.

Finland has been reducing its dependence on natural gas. In 2020, the natural gas consumption was at 25,4 TWh (higher heat value). The consumption has halved since 2010 due to increases in the taxation of natural gas and the reduced use of natural gas in energy production. Finland has no domestic production of natural gas. Whereas in 2015, Finland imported 2,566 million tonnes of natural gas, entirely from Russia, in 2021 the natural gas imports totalled 2,230 million tonnes. Out of this, 75% was imported from Russia and 25% from Estonia.

Case study: Uckermark

The district of Uckermark is located in the extreme north-east of Brandenburg, in the German-Polish border region. The largest towns in the otherwise very rural district are Schwedt/Oder (pop. 30,000) and the district administrative centre Prenzlau (pop. 18,000) (cf. Statistik Berlin Brandenburg, 2022, p.34). The region is assigned to the "wider metropolitan area" of Berlin. The proximity to the Polish city of Szczecin, whose centre is only 15 km away from the eastern Uckermark, is also significant in terms of cross-border integration (cf. Deutsch-Polnisches Raumordnungsportal, 2022). Since the fall of communism, the population of the Uckermark has been in constant decline, from 160,000 in 1995 to 117,000 in 2021 (cf. Statista, 2023).

The large number of lakes in the Uckermark district, totalling over 400, are of great landscape importance. In addition, the Lower Oder Valley National Park is partly located in the region. Agriculture is the predominant land use, accounting for two thirds of the area (cf. LAG Uckermark, 2014, p.2).

In addition to its importance as a major food producer, the region plays a role in the processing of crude oil into fuel products (especially for the Berlin metropolitan area) with the refinery in Schwedt/Oder (PCK Raffinerie).

Economic profile

The gross value added in the Uckermark amounts to 2.9% from the primary economic sector (Ø Brandenburg (BB) 1.3%), 33.2% from the manufacturing industry (Ø BB 27.6%) and 63.9% from the service sector (Ø BB 71.0%) (cf. et.al, pp. 50-51). The above-average focus on the manufacturing sector can be explained above all by the PCK refinery in Schwedt/Oder, one of the largest employers in Brandenburg (1,180 employees). In addition, there are several supplier companies for the refinery as well as strong structures in paper production and waste and recycling management. The dependence of the region on the lead company PCK is described in the TJTP as stronger than in other areas defined as refinery regions. The mono-centrist economic structure is problematic in that, on the one hand, PCK primarily produces fossil fuels for cars, but there are national and international objectives to convert car and truck traffic to electric motors in the medium term. On the other hand, the refinery processed only Russian crude oil until the beginning of 2022 (cf. Land Brandenburg, 2022A, p.7). Currently (as of January 2023), the refinery is running at about 50% capacity and is supplied via the port in Rostock. There are also plans to enable deliveries via the port of Gdansk (cf. Spiegel, 2023).

In terms of labour force, 5.7% of those employed in the Uckermark are in agriculture or forestry, 23.2% in manufacturing, 23.4% in trade, transport, hotels and restaurants, information and communication, 12.4% in financial, insurance and business services; real estate and housing and 35.3% in public and other services, education, health. The region has a negative commuter balance of -3,902 (10,027 out; 6,125 in). Most employees commute to Berlin and the neighbouring district of Barnim. (cf. WFBB, 2019, p.15 & 17).

Case study: Uckermark

Energy supply in the region

The production of thermal energy emitted 347,000 tonnes of greenhouse gases in the Uckermark in 2020. Only 4.8% of the gigawatt hours consumed are produced by renewable energy sources. By far the largest share of energy sources used are natural gas (73.3%) and heating oil (17.6%). The Uckermark requires an average of 275 GWh of electricity annually. In contrast to heat production, renewable energy plays a significantly larger role in electricity production, as a total of approximately 2,400 GWh is produced by renewable sources (82% of which is wind energy). The region is thus a strong net exporter of electricity (cf. Kreisverwaltung Uckermark, 2021, p.48-51).

Case study: Galați

The South-East region is one of the "development regions" in Romania, a division of territory created to better manage the process of accession to the EU. These territories do not have an administrative status within the country, but they are now in charge of managing EU cohesion policy funds. The South-East region is composed of six counties and, while it has a relatively low population density, it has also several metropolitan areas, such as Constanta, Galați and Braila.

The Galați county accounts for around 2.5% of the Romanian population and 1.8% of the national GDP. Strategic to the South-East region is its access to the maritime transport route, both to the Danube River and to the Black Sea. The Port of Galați, the largest port in on the Danube River and the second largest port in Romania, is crucial for the steel industry of the county, as the largest steel company in Romania, Mittal Steel Galați, uses the port for import and export activities.

In the last five years, the Galati County experienced high levels of unemployment, especially among young people (23% for the 15-24 years old). The South-East region is also characterised by a low level of education attainment in 2021 it had the highest share of early leavers from education within all EU regions (23%) and the lowest level of tertiary education attainment (16%).

Economic profile

Galați is the fourth largest industrial centre in the country and, high-energy intensive industries, and in particular the manufacturing of basic metal, employs a high percentage of workers, especially in respect to the national average. The steel industry generates around 80% of exports of the county and is responsible for around 30% of its GDP. Moreover, the steel industry and its production of raw material is essential for the value chain of several other sectors, in particular the automotive and shipbuilding sectors (Consiliul Judentul Galati, 2021). The shipbuilding industry has developed an active economic cluster in the region by taking advantage of the shipyards in Braila, Galati, Mangalia, Tulcea and Constanta.

Main manufacturing sectors of the South-East region include manufacturing of food products (16% of manufacturing employment), manufacturing of wearing apparel (16% of manufacturing employment) and manufacturing of transport equipment other than vehicles (9% of manufacturing employment) (2020).

Despite its dimension, both in terms of sales and employees, the company Liberty Galati has already experienced several restructuring processes, also due to its privatisation. By the start of the 2000s, the company went from almost 30,000 employees to 11,049 in 2009. At the moment, it directly employs only 5,300 workers. (Romania, 2022)

Energy supply in the region

In 2020, most of the energy generated in the county of Galați originates from hydrocarbons and, in particular, from the Galați Power Station, the thermal power plant located in the municipality of Galați that is responsible for more than 60% of the electricity generated in the County (375 MW). The second source of energy is wind, with an installed capacity of around 160 MW (from several wind farms). The County also relies on hydro-electric power and, to a lesser extent, power from photovoltaic installations (4MW). In the last decade, the County has made important investments in renewable energy generation but has also increased substantially the use of natural gas (especially for heating) (Consiliul Judentul Galati, 2021). However, as the industrial structure of Galați counts on several energy-intensive industries, its domestic energy production is not sufficient to satisfy domestic demand. Thus, the County relies on imports of natural gas, and before the war in Ukraine, this was predominantly from Russia.

Case study: Austrian JTP-territory
The JTP territory consists of parts of four Austrian federal states and there is one single JTP for all those regions. Since urban regions like Linz and Graz were excluded from the JTP territory, the JTP is mostly composed of rural to intermediate regions (except e.g. Wels-Stadt which is an urban region). The regions are characterised by their economic focus on industry and are neither the poorest nor the richest regions of Austria. Sectors and industries of the regional economy: Metal production and processing, Paper and print, Chemical and pharmaceutical production, Processing of mineral raw materials (ÖROK, 2022)
Economic profile
The main sectors in the JTP territory include metal production and processing (19% of employment in the secondary sector), paper and print (4% of employment in the secondary sector) and processing of mineral raw materials (4% of employment in the secondary sector) (2020) (ÖROK, 2022)
Energy supply in the region
About one third of the primary energy sources comes from domestic production. The most important energy sources in domestic production are biogenic fuels and hydropower. Austria imports the majority of its fossil energy. Currently, Austria imports about four times as much energy as it exports. Austria is dependent on imports due to its low reserves of fossil fuels. In 2021, Austria's degree of energy self-sufficiency was 36.9%. Prior to the war in the Ukraine, Austria obtained about 80% of all natural gas imports from Russia (BMK, 2022).

Case study: Silesia
The Just Transition Territory in Śląsk is part of the Silesian Voivodship and includes the most industrialised area in Poland, the Upper Silesian Industrial Region. The regional economy is based mainly on mining, metallurgical, transport, energy, machine-building, coking and chemical industry and services.
Economic profile
The main sectors and industries of the regional economy: Industry (31% of added value), Retail (28%) and Services (24%) (2020)
Energy supply in the region
The administrative region on the NUTS2 has the largest energy demand in the country and ranks the second largest in terms of energy production (14% of national energy production). Consequently, regional energy production covers only 91% of its own energy demand. The current (2020) energy mix in the region is based on coal sources (84%), gas (9%), and renewables (6,7%). On the national level, Poland's dependency on Russian hydrocarbons was 33,1% in 2020. At that time 51% of gas supplies were imported from Russia (ACER, 2021).

Case study: Sulcis Iglesiente
The territory of *Sulcis Iglesiente* identified by the JTP, is part of the province of Sud Sardegna (NUTS3), located in the Italian island region Sardinia (NUTS2) and it is composed of 23 municipalities.[1] Sardinia (which accounts for around 2.7% of the Italian population), is characterised by a rural territory, with a population density among the lowest in Italy. A significant phenomenon impacting the territory of Sulcis Iglesiente and the entire region is demographic decline, as the province has been losing on average 0.7% of its inhabitants per year since 2010[1]. Moreover, the province population is progressively getting older, the share of the population over 65 is continuously increasing.[1] Sud Sardegna is characterised by job market difficulties. The unemployment rate in the province in 2019, was 16% against a national average of 10%. Moreover, the population in the region has a lower level of education than the rest of the country (Sardinia Region, 2021).
Economic profile
Main industrial sectors (excluding mining) of the Sardinia region are manufacturing of food products (24% of all manufacturing employment), manufacture of fabricated metal products (14%) and repair and installation of machinery and equipment (13%) (2019)

Case study: Sulcis Iglesiente
The Sardinia region relies heavily on the service sector that employs around 80% of the workforce, especially in commerce and tourism, as well as public administration. Industry, and notably manufacturing, accounts for a relatively low share of the workforce if compared to the national average. In the province of Sud Sardegna, industry (including mining and construction) accounts for around 16% of the total economic value added, the territory depends on agriculture as well, which accounts for around 9% of the value added.[1]
Energy supply in the region
Mostly due to its insular nature, Sardinia is the region with the highest cost of energy in Italy. This has substantial implications for the competitiveness and sustainability of high-energy intensive industries, such as the metallurgic industry, and the manufacturing sector in general. While natural gas is not used, hydrocarbons still account for a substantial amount of energy generation in the region. According to the territorial energy balance in 2019, Sardinia had a final energy consumption of 2,458 ktep. Around 58% of this energy comes from oil and petroleum products, 25% from electricity and 15% from renewables (ENEA, 2021). The region also produces more electricity than it consumes, and in 2021 the total net production of electricity was 11,590 GWh. Traditional thermoelectric energy still accounts for around 70% of the production, while renewables account for smaller shares; 15% from wind, and 10% from solar. The province of Sud Sardinia is responsible for around 21% of the final consumption of electric energy, and more than half of this is destined for the industrial sector (52%).[1] Despite the current production being dominated by fossil fuels, the region presents a great potential for renewable energy generation, and the power installed in the region (2,641.5 MW in 2020) accounts for 4.7% of the national total. This potential generation is mostly due to the almost 600 wind installations and almost 40.000 solar installations in the region (Terna-Snam, 2022).

4.2. Development of JTPs in the case study regions

4.2.1. Lapland, Finland

Starting point of the transformation

There are around 4,000 hectares of peat production areas in Lapland, mainly around Rovaniemi, Tervola, Kolari, Simo, Ranua, and Tornio. The peat production companies employed around 50 persons and their turnover was around EUR 8 million in 2020. The indirect economic effects of peat production in Lapland was estimated at EUR 11 million in 2020. However, the effects are concentrated on small rural municipalities with high outmigration, which exacerbates socio-economic challenges. Namely, it is difficult to replace lost jobs and create new economic activity in sparsely populated rural areas. The loss of jobs also reduces demand for services, which in turn influences the supply of public and private services.

The economic structure of Lapland's municipalities is narrow, and the business base is dominated by microenterprises and SMEs. Municipalities are losing their population due to aging and migration of the working-age population. Low R&D activity narrows the possibilities of business renewal. The lack of jobs and training increases negative socio-economic effects and increases social problems. Locally, the adverse effects are also aimed at transport and logistics activities, machine maintenance and service business, machine trade, and other local-level service activities.

The municipalities and companies using district heat in the area will be affected by the transformation as peat has traditionally been used by the district heating plants in Lapland (12 out of 15 plants used peat in 2019). The share of peat as an energy source in district heating in Lapland was 43% in 2019, reducing to about 20% in 2021. However, the reduction of wood pellet imports from Russia has raised the demand for peat in 2022, and some district heating plants (Napapiirin Energia ja Vesi Oy and Kemin energia) estimated in July 2022 that peat would account to around 20% of the energy production in 2022.

Current GHG emissions in Lapland amount to 8.4 tonnes per capita (2020), or 1493 $ktCO_2e$ (2020). The main sources of emissions were transport (356 $ktCO_2e$), agriculture (323 $ktCO_2e$), heavy machinery (229 $ktCO_2e$) and district heating (206 $ktCO_2e$). The GHG emissions have been decreasing since 2010, when they were 2232 $ktCO_2e$. The GHG emissions have decreased especially for transport, district heating, and electricity.

Strategies and measures for climate neutrality included in JTP

The starting point for the Finnish JTF was the government's goal of Finland reaching carbon neutrality by 2035 by hastening the reduction of emissions and strengthening carbon sinks. The government has also stated a goal of halving the use of peat as an energy source by 2035. Further, the Finnish energy and climate strategy 2030 aims at increasing the share of renewable energy to at least 51% of total energy usage, and 30% of energy used by road transport. The national climate law 2022 goals include the reduction of greenhouse gases due to human action by 60% by 2030, 80% by 2040, and 90-95% by 2050. The regional plans do not include quantitative goals for emissions reductions.

The development strategies are based on diversification of economic structure and the adaptation of the peat industry's workforce to a carbon-neutral transition. The measures that diversify the economic structure take into account the regional smart specialisation strategies, especially jobs in the green economy and new solutions of green technology. The measures focusing on workforce retraining and employment are primarily aimed at those who have become unemployed from the peat sector and those at risk of unemployment in the sector, with young people as a special target group. The know-how and capabilities of peat entrepreneurs are developed, for example, in the areas of wood harvesting and peat restoration to enable new business. Areas leaving peat production are renovated, restored and the purpose of use is changed in order to reduce environmental and emission effects and to diversify the economic structure.

The governance of the Just Transition Plan

The Finnish JFT programme includes seven regional plans, out of which one covers Lapland. The programme was developed as an interactive exercise with both top-down and bottom-up processes. The regional plans were entrusted to the regional councils, who designed their plans in co-operation with regional stakeholders, coordinating with the national level and other Finnish JTF regions.

The JTF implementation follows the ERDF and ESF+ structures. The Managing Authority (MA) is the Ministry of Economic Affairs and Employment. The MA is responsible for programme development and modifications, as well as for the programme level monitoring. The authorities responsible for the implementation of the JTF programme in Lapland are the Regional Council of Lapland[24] and the Centre for Economic Development, Transport, and the Environment[25].

Needs and use of funds: key activities and projects supported by JTF

The total EU funding for the JFT in Finland is EUR 465.7 million. With national co-financing, the total budget amounts to approximately EUR 665 million. The JTF funding is divided between seven regions in Northern and Eastern Finland. The share of Lapland is EUR 62 million (EU funding). Each JTF region in Finland will utilise all possible measures that the Finnish JTF supports. However, the regional plans

[24] Lapin Liitto at https://www.lapinliitto.fi/en/

[25] The 15 Centres for Economic Development, Transport and the Environment (ELY Centres) are responsible for the regional implementation and development tasks of the central government. They have three areas of responsibility: 1) Business and industry, labour force, competence and cultural activities; 2) Transport and infrastructure; and 3) Environment and natural resources. Source: https://www.ely-keskus.fi/web/ely-en

do not contain targets or budget at measure level, only the totals at regional level. Each region has specified output and result indicator targets.

Implementation status

The implementation of the Finnish JTF will start in the spring of 2023. The first information sessions on JTF funding were held by the regional councils in January 2023.

4.2.2. Uckermark, Germany

Starting point of the transformation

In addition to the monostructural economy, the JTP highlights, in particular, the fact that there are fewer SMEs than average in the fields of research, development, and innovation. The low level of local innovation makes it difficult to transform the economic structure internally, which is why more help is now being offered from the "outside" through various funding channels (cf. Land Brandenburg, 2022A, p.7).

In 2017, the Uckermark emitted 755,800 tonnes of greenhouse gases. The largest source of these emissions is private households (52%), followed by transport (35%) and commercial emissions (12%) (cf. Kreisverwaltung Uckermark, 2021, p.57).

Strategies and measures for climate neutrality included in JTP

The core goal of the JTP is to transform Schwedt/Oder to a centre for bioeconomy, circular economy and non-ETS-activities to support the transition for other regions. To this end the following aspects are supported:

- Diversification of the economy towards renewable energy, bioeconomy, and circular economy based on the existing industrial infrastructure
- Education, reskilling, and upskilling of the industrial workforce, including investments in infrastructure
- Increasing digital competences in the workforce, including investment in infrastructure
- Upgrading of the heating system, replacing the refinery-based system currently in place

Ultimately these actions by 2029 should lead to:

- the reduction of CO_2 equivalent emissions of 240,000t by 2029
- an increase in the number of innovative SMEs by 15
- additional operational capacity for renewable energies of 60MWh
- An increase in the yearly users of new education infrastructure by 660

The governance of the Just Transition Plan

The development and implementation of the JTF, and both TJTPs, in the federal state is carried out by the Brandenburg Ministry of Economic Affairs, Labour and Energy. In the drafting process, regional actors were involved through participatory events (physical and virtual), informed about the basic goals and intervention logics in events, and were given the opportunity to submit proposals for suitable projects. The submitted projects have been taken into account when drafting the plan. The following actors were involved in the information process: regional and local authorities, social partners, partners of the environmental sector, NGOs, organisations for the promotion of social inclusion, representatives of the Commission Services.

Central management of the JTF is done at the state level. The region itself has no political-administrative decision-making power and thus does not have the capacity to manage the implementation. To ensure that local and regional actors are also adequately taken into account in the implementation, they are represented in the monitoring committee with voting rights during the implementation period (cf. Land Brandenburg, 2022A, p.19).

Needs and use of funds: key activities and projects supported by JTF

The aim of the supported projects is to build an innovative business and research network in the region. One focus is on digitalisation, including with regard to the skills of the local workforce. The central building block for achieving all three goals is the establishment of an innovation campus in Schwedt, which also includes structural measures. The campus function is to train specialists for a modern processing industry, with a thematic focus on the circular economy and bioeconomy. The promotion of a research cluster is a declared goal of the measures.

In addition to investments in educational infrastructure, projects for a more environmentally friendly heat supply are also to be promoted, as the PCK refinery currently also supplies households with heat. The focus of the programme is on solar thermal energy and heat pumps (cf. Land Brandenburg, 2022B, p.98-99).

In addition to funds from the JTF, the federal government is also increasingly committed to modernising the Schwedt/Uckermark industrial site after a lack of Russian oil supplies endangered the regional economy around the refinery. In drawing up the plan "Territorial Transition Plan for the Schwedt/Oder Refinery Region in the Uckermark", federal funding programmes were explicitly taken into account in order to avoid double funding. Thus, the TJTP is explicitly intended to minimise the negative effects of the downturn of the mineral oil industry, but not to remedy general economic structural weaknesses (cf. Land Brandenburg, 2022A, p.13 & p.15).

Economic structural weaknesses in Germany are mainly addressed by the "GRW" ("Gemeinschaftsaufgabe Verbesserung der regionalen Wirtschaftsstruktur" – "joint actions for improvement of regional economy") programmes. These are a bundle of programmes with several funding sources addressing, among other priorities, different key aspects (such as improvement of regional infrastructure, upskilling of workers etc.) of the transition.

Further relevant funding programmes include the ESF+ and the ERDF, both of which address key aspects of the transition in the region. Nevertheless, both are also implemented in a broader manner from a geographical as well as a content perspective.

Implementation status

At the stage of the case study research, no project with JTF as the sole funding source is yet ongoing. Yet, developments related to the innovation campus (financed from other sources) are already ongoing.

4.2.3. Galați, Romania

Starting point of the transformation

In 2020, only six Romanian counties were responsible for around 61% of total CO_2 ETS emissions of the Country (31,89 CO_2 million tons). The steel industry is responsible for a large part of this emission (Romania, 2022). Industries in Galați are responsible for a substantial share of emission in Romania, which have however decreased since 2014, when the total emissions in the county was more than 4 million tons. At county level, there are 13 other installations that are being monitored in accordance to

the Industrial Emissions Directive[26] including industries in the sectors of faming, chemical, metal production and processing, hazardous waste treatment, and incineration.

The county of Galați is expected to suffer a considerable amount of job loss following the transition (around 5,500), that will only be partially offset by the plan for industrial diversification (Frankfurt School, 2021). This is mostly because the economic regional specialisation relies on steel, including several companies along the value chains of this sector (manufacturing, machinery, transport services, metal trading etc). Most of the affected workers are within the categories requested in the skill forecast for 2030, but will still need support in job transition and re-training. The employment generation planned following the energy transition is mostly focused on the service and administrative sectors to the detriment of skilled workers, operators and assemblers.[27] Furthermore, jobs within the steel sectors are paid more than the national average in other sectors, and most of the workers belong to a one-income household.

Part of the repercussion in terms of job loss of the plant transition to the use of hydrogen is unknown as key technologies (for example the large-scale use of hydrogen) are not mature enough to assess their implementation. Other uncertainties include: the complexity and cost of integrating new technologies and equipment in all existing production infrastructures, currently unknown market conditions for green steel, or the availability of raw materials, especially secondary ones such as it is scrap metal (Romania, 2022, p. 172).

Moreover, the county is acutely affected by energy poverty that affects around 55% of the population in winter (Romania, 2022). For this reason, part of the JTP is dedicated to the development of alternative sources of energy that should be more cost-efficient for the final consumer, such as small-scale photovoltaic production.

Strategies and measures for climate neutrality included in JTP

According to the objectives of the National Integrated Plan in the field of Energy and Climate Change (PNIESC) and the acceleration to renewable energy projects envisioned by the National Recovery and Resilient Plan (NRRP) Romania will substantially transform the electricity production mix of the country (Ministry of Energy, 2020). The share of coal within the energy mix should decrease in 2030 to less than a quarter from what it was in 2020 (17% to 3.4%), the share of solar production should increase to over 20% and wind production should reach 22%. The country should also rely less on electricity production from natural gas (reduction from 18% to 12.8%). (Romania, 2022, p. 168)

The JTP, that covers six counties within Romania, includes actions for both accelerating the energy transition envisioned for Romania, and mitigating its consequences at local level. The JTP allocation for Galati[28] intends to prioritise: enterprise and entrepreneurship development (42% of the allocation), investments directed to large enterprises (28%), development of green energy and non-polluting mobility (18%), support for the workforce transition (10%), and support for the greening and conversion of buildings affected by economic activities in decline or in transformation (2%). The JTP aims mostly to reduce the intensity of emissions from the industrial complex of the county (Romania, 2022).

[26] Directive 2010/75/EU of the European Parliament and the Council on industrial emissions is the main EU instrument regulating pollutant emissions from industrial installations. More information is available at: ec.europa.eu/environment/industry/stationary/ied/legislation.htm (last accessed 03/02/2023)

[27] Ibid., Table 11

[28] Allocations for the national JTF: the support to the development of SMEs and large enterprises for the diversification of the economy (over 58% of the allocation), increase the energy resilience of essential public services (over 21%), sustain the workforce transition (11%) and decontamination and reconversion of contaminated sites (4%)

The governance of the Just Transition Plan

The managing authority for the JTF programme in Romania is the national Ministry of European Investments and Projects. The elaboration of the JTP included the consultation of public authorities involved in implementation, the main type of beneficiaries envisioned by the programme, and civil society representatives. At the territorial level, local authorities (municipalities and the County Council), local public institutions (County Agencies), education and training entities, business representatives and local groups from civil society were consulted for the elaboration of the programme. The implementation of the JTP is coordinated and monitored at local level through County Groups, established for the coordination of the transition to climate neutrality.

The Galați County Council (CJ Galati) launched the process of setting up the Galați County Climate Neutrality Transition Coordination Group. CJ Galați carries out a transparent and non-discriminatory procedure for selecting economic and social partners and bodies representing civil society at the level of Galați County in order to ensure an optimal level of representation of different stakehokders.[29] The County Climate Neutrality Transition Coordination Group will be part of the JTP Monitoring Committee, a national partnership structure that has a strategic decision-making role in the implementation process of the JTP.

Coordination with the South-East Regional Programme (South-East ERDF), and national programmes including the NRRP, will be carried out at the level of the monitoring committee and project selection, with specific guidelines establishing diversification criteria of the investments.

Needs and use of funds: key activities and projects supported by JTF

Under the JTF, a total of EUR 2.14 billion has been allocated to Romania, of which nearly EUR 330 million are exclusively allocated for Galați County. The actions included in the plan are focused on technological innovation and infrastructure for affordable clean energy, greenhouse gas emission reduction, upskilling and reskilling of workers, and development and diversification of both SMEs and large enterprises. The actions, in greater detail, are:

- Enterprise and entrepreneurship development,
- Economic diversification including: engineering and shipping, the clothing industry, the agro-food industry, aquaculture and fisheries, tourism, and information technology,
- Support for the workforce transition, including reskilling of workers affected by the energy transition, vocational training in the areas of smart specialisation, and environmental economy incentives for employers,
- Affordable green energy and clean mobility,
- Investments to reduce emissions from steel production (an allocation of EUR 70 million) for the plant of Liberty Galați,
- Support for large enterprises: NAVROM S.A. productive investment to ensure a green river transport and ship handling service on the Danube in the port of Galați and investment of Damen Galați Shipyard S.A. in new productive lines for the construction of ships with electric propulsion or other ecological fuels (expected to generate around 100 new jobs).

[29] In this regard, the Galati County Council issued Resolution no. 38 of 03.02.2023 on the approval of the Guidelines for the identification and selection of relevant partners and the Regulation for the organization and functioning of the County Group.

Implementation status

At the time of drafting of the case study, the implementation of the Galați JTP has not yet started, as authorities at the County level are delineating the partnership structure for the implementation and monitoring of the Plan.

4.2.4. JTP Territory, Austria

Starting point of the transformation

JTP aims at a transition from energy-intensive industries. Each of the four most CO_2 intensive sectors is responsible for 13% to 15% of GHG emissions in industry and commerce. In total, 57% of the GHG emissions in the secondary and tertiary sector are produced by these four sectors. Additionally, more than 71,000 employees (31%) in industry and commerce in the region work in one of these four sectors.

Current GHG emissions are 0,64 tonnes CO_2-eq. per capita (2019) and 10,533,700 tonnes CO_2-eq. (2019; without emissions of the primary sector) (ÖROK, 2022; Statistik Austria, 2023). The main sources of emissions in Austria are energy and industry (44%), transport (30%), construction (10%). There has been a decreasing trend of the total CO_2-eq. emissions since 2010 (BMK, 2022).

Expected socio-economic challenges during the transition: More than 71,000 people are currently employed in the sectors affected by the transition. Due to transition, job losses are possible (ÖROK, 2022).

Strategies and measures for climate neutrality included in JTP

No targets were set in the JTP with regard to renewable energy, since according to the managing authority these concern Austria as a whole, and not only the JTP regions. Furthermore, the JTP does not include targets for CO_2 emissions (and other) reduction, phasing out of coal or peat mining and extraction, use of coal and other fossil fuels in energy productions.

The measures include two areas of the transition:

- "transformation", which comprises the promotion of operational transformation in GHG-intensive sectors.
- "diversification and employment", which includes the development of new, sustainable business fields, the creation of innovation-oriented framework conditions and the accompanying design of the labour market. The JTP in general focusses on employment strategies including competence building and qualification as well as on the support of R&D, pilot, and innovation projects.

The governance of the Just Transition Plan

The JTP territory is not a geographical unit and cannot autonomously implement the JTP. The Plan was elaborated on the national level. The MA for the JTP is the Austrian Conference on Spatial Planning (ÖROK). As the JTP territory consists of different regions which are located in four different federal states, all four federal states were involved into the development and decisions of the JTP. The programming of JTF was coordinated by the ERDF (ÖROK) and ERDF (Ministry of Labour) MAs and incorporated in the respective programme. The implementation is done by regional (federal state) level and also follows the ERDF and ESF+ structures.

Needs and use of funds: key activities and projects supported by JTF

In total, Austria receives EUR 135.8 million from EU funds, of which approximately EUR 76 million is allocated for the IBW ERDF/JTF programme, and approximately EUR 59.7 million for the ESF+ Employment programme (ÖROK, no date).

Implementation status

The implementation has just begun. The more detailed actions plans are being developed (e.g. Just Transition – Action Plan for Education and Training). First measures are being launched.

4.2.5. Silesia, Poland

Starting point of the transformation

The exploitation of the Upper Silesia Region, the most industrialised area in Poland and the biggest coal region in the EU, has resulted in complex and severe environmental problems. The industrial pollution, water pollution, air quality, and degraded and devastated land all need to be improved and brought back into use. The first transition attempt started already in the 1990s. Since then, coal mining has been reduced. The measures included only direct financial compensation for the redundant mine employees. Therefore, in addition to the new challenges, there are still long-term unsolved consequences of the previous selective transition. The current transition strategy comprises the social, economic, and environmental goals for the region.

Strategies and measures for climate neutrality included in JTP

The strategy for the just transition includes measures for people who will be left unemployed and without adequate skills for the new job market. In line with the main objective of the JTF, mitigating the impact of the transition and leaving no one behind, the Plan includes development of new job opportunities, competences and reskilling measures. In addition, investments in the RES, innovative industry, green economy, and education system corresponding to the future labour market are foreseen. A very important role of the plan is the reclamation and redevelopment of land to reduce the environmental hazard of blowing off heavy metals from the polluted surface, etc. and become suitable for new functions. A further element of the transformation plan is to address the problem of declining budget revenues due to decommissioning of the mining industry.

The current GHG emissions from the coal-based electric energy production of a total of 13.8 bln tons in 2019 is planned to be reduced by 50% by 2030. The reduction in hard coal mining will contribute to an 8% reduction in atmospheric methane emissions in 2030 compared to 2021.

Furthermore, the land reclamation process is very complex and still little is known about the feasible potential future development of the areas. Currently, no extra time is foreseen for the investigations and studies exploring this topic. The knowledge-based exploration of the opportunities and their implementation must happen practically at the same time to fit the time constraints of the JTF.

The governance of the Just Transition Plan

The JTP was elaborated by the province administration (Department of Regional Development and Transformation of the Marshall's Office) in a two-year negotiation and participation process. A regional steering group consisting of coal mining municipalities, government and administration, society, ecological institutions, and additional stakeholders acted to support the process of the delineation of goals, development strategies and measures included in the Plan.

However, the energy sector is managed at the national level, and therefore the provinces have very limited opportunities to interfere in energy management.

Needs and use of funds: key activities and projects supported by JTF

Following the release of European Commission Implementing Decision approving the programme "European funds for Silesia 2021-2027" (C(2022) 9041 final, 2022), the board of the Silesian Voivodeship adopted the resolution "European Funds for Silesia 2021-2027". According to the resolution, the following framework of financial support is foreseen for Silesia:

- Total: EUR 5,139 billion; divided between: ESF+: 829, ERDF: 2,092 and JTF: 2,216

It is streamlined by complementary programming to enforce a modern economy, and new jobs to replace those that are extinguishing due to transition. Reskilling and development of competences on different levels also play a very significant role in the Plan. Reclamation and environmental objectives for the areas devastated by coal mining (also covered by ERDF) will additionally be supported through Pillars II and III.

Furthermore, advantages of synergies with other EU Programmes are envisaged (Interreg, Horizon Europe) for cooperation and the broadening of the scope and opportunities of the transition.

Implementation status

No specific measures have yet been started. The programmes are just about to begin. The regional authorities expect a high interest among beneficiaries.

4.2.6. Sulcis Iglesiente, Sardinia

Starting point of the transformation

The main sources of emissions are the coal plant "Grazia Deledda" and Portovesme Srl that account for around 85% of all emissions in the territory of Sulcis Iglesiente, despite the reduction from 1,554,327 tCO_2eq (2015) to 1,482,854 tCO_2eq (2020).[30]

The Current GHG emissions in Sardinia Region reach 9.26 tonnes per capita (2015), and 9.47 tonnes (2010).

The region presents a decreasing trend in carbon emission since 2010 and, in 2019, Sardinia was in line with its goal to reduce emissions by 50% with respect to the 1990 baseline. This reduction has been mainly due to a reduction of consumption in the heating sector and energy transformation sector. The transport sector is experiencing the opposite trend, with an increase of emissions in the last decade of around 2% per year.

The industrial fabric of the province of Sulcis Iglesiente has always been concentrated in the mining and steel sectors. The crisis of this sector has resulted in a diminishing number of jobs in the manufacturing sector (-25% from 2012 to 2018) and therefore produced several socio-economic challenges for the region. These challenges could be further exacerbated by the new plans for the energy transition, without a detailed strategy for job replacement and re-orientation.

Moreover, the province of Sud Sardegna presents several critical factors for economic development, such as a low rate of entrepreneurship and a concentration of activities in sectors characterised by low innovation potential, a high rate of unemployment coupled with a high rate of inactivity especially

[30] Data from the Rapporto Ambientale PN JTF (pg127) based on ETS Transaction Log

among young people, and lastly an insufficient family support system that hinders women from entering the job market. In addition to these factors, the insular nature of the region further exacerbates development issues, implying higher production costs due to the higher cost of inputs, including energy, for logistics and transport. All these factors influenced the decision to include the province in the Italian JTF.

Strategies and measures for climate neutrality included in JTP

In accordance with EU strategies of "Fit for 55" and the Green Deal, Italy has pledged to reduce carbon emission by 55% in 2030 (from the 1990 baseline). The National Plan on Energy and Climate (PNIEC) envisages a phase out of coal by 2025. In 2020, solid fossil fuels, including coal, accounted for only 4.4% of the energy mix in Italy but were responsible for a much higher percentage of CO_2 emissions in the country.[31] Italy plans to achieve a share of production from renewable energy in the final energy consumption equal to 30% and 21.6% for the transport sector. The Italian objective is also to reduce greenhouse gasses by 33% with respect to the 2005 baseline in all sectors outside the ETS.

The actions for Sulcis Iglesiente and the JTP will work in complementarity with these objectives. The Italian JTF programme, approved by the Commission on 16/12/2022, is focused on three main areas of intervention:

- Valorise the regional potential for renewable energy generation and diversified the regional economy to promote the phase-out of carbon. These include the promotion of innovation processes to maintain competitiveness of the regional industrial system.
- Mitigation measures to reduce the negative socio-economic consequences of the transition, including upskilling and reskilling activities for workers, family support measures.
- Activities to reclaim land polluted by mining activities.

The governance of the Just Transition Plan

The JTP is a national plan, of which the managing authority is the National Agency for Territorial Cohesion (Agenzia per la Coesione Territoriale). The Sardinia Region, and in particular the "Centro Regionale di Programmazione" (Regional centre for planning), acts as an intermediate body for the implementation of the JTP, in close connection with the managing authority for the ERDF 2021-2027, and with the coordination office for the implementation of the NRRP in Sardinia.

The planning phase of the JTP, in 2021, included extensive consultations with local actors in order to identify the needs of the territory. At this stage, they have not been contacted again, but the regional authorities plan to answer the request of local actors to be more involved in the implementation of the JTP and to be kept informed on the opportunities given by the JTF.

Needs and use of funds: key activities and projects supported by JTF

In total, including the national co-financing (25%), Italy will receive EUR 1.21 billion through the JTF, of which 367,2 million is exclusively destined to the territory of Sulcis Iglesiente. The financial resources are distributed according to the aim of the transition and are around 30% for energy and environment, 38% to promote economic diversification, and 32% to the mitigation instrument for the negative economic consequences of the energy transition. The programme does not foresee the use of any other funds. In particular, the programme envisions eight actions under priority one (Support to the transition of Sulcis Iglesiente):

- Action 1.1 – promotion of renewable energy production

[31] Eurostat dataset 'Simplified energy balances' (NRG_BAL_S)

- Action 1.2 – energy efficiency performance of SME
- Action 1.3 – systems for the intelligent distribution of energy
- Action 1.4 – reclamation of land polluted by mining activities
- Action 1.5 – energy transition and diversification of the local economy
- Action 1.6 – promotion of innovation process
- Action 1.7 – Support for up-skilling and re-skilling pathways for unemployed, unemployable and workers at risk due to transition
- Action 1.8 – family support system

Implementation status

In February 2023, no specific measures of the Sardinia JTP have been implemented yet. Nonetheless, some initiatives are ongoing as they will build on previous funding opportunities, and some are already planned as operation of strategic importance (i.e. "Power-to-Green Fuels").

4.3. Impact of the gas crisis on regional economy and Just Transition Plans

4.3.1. Current impact of the energy crisis on the transition

Finland, Lapland

The share of peat as an energy source in district heating in Lapland was 43% in 2019, reducing to about 20% in 2021. However, the reduction of wood pellet imports from Russia has raised the demand for peat in 2022, and some district heating plants estimated in July 2022 that peat would account for around 20% of the energy production in 2022.

Direct influence on the JTP cannot be determined as the implementation has not yet started.

Germany, Uckermark

The key effect of the crisis in the Uckermark region is not linked primarily to gas but rather to the oil supply to the region. As the industrial company central to the region, namely the PCK refinery in Schwedt/Oder, was almost exclusively using oil originating from Russia as a basis for their refinement process, the embargo enforced had an immediate devastating impact on the regional economy. The rearranged supply chains (making use of the Danzig and Rostock harbours) can only provide enough oil for a 50% utilization rate of the industries capacity.

General negative effects in relation to increased energy costs and rising inflation rates are impacting the region simultaneously, however not to a significantly higher degree than in other (non-transition) regions. In particular the good status of renewable wind energy in the region relieves pressure on the energy suppliers in the region.

On a short-term, the crisis however accelerated the transition needs, as instead of a slower phase-out, a rather rapid cut of fossil fuel availability, and thus operation of the refinery, took place.

The war and connected energy crisis have been unfolding throughout the middle and later stages of JTP drafting. The events and developments that could be taken into consideration include the embargo on Russian fossil fuels. The JTP thus explicitly addresses these issues, in particular the double negative dependency on fossil fuels (in the light of the climate crisis) and Russian sources (in the light of the Ukraine war) and outlines the necessary responses in detail.

JTP faces no additional challenges in implementation. Increased awareness of the issue can even be expected to support in the uptake of the measures.

Romania, Galați

The energy crisis is eroding household purchasing power and affecting energy consumption in Romania. The economic outlook remains exceptionally uncertain and the potential for further economic disruption is far from being eliminated.

The biggest threat before winter was posed by negative developments in the gas market and the risk of shortages. In June 2022, the Romanian government has approved an emergency ordinance on the decarbonisation of the energy sector that includes the possibility for a postponement of the closure of coal-fired power capacities and mining operation in case of a crisis. At the EU level, diversification of supply sources and a sharp drop in consumption have left gas storage levels above the seasonal average of past years, and, as of February 2023, wholesale gas prices have fallen well below pre-war levels. Thus, the programme for decarbonisation of the energy sector and the region's development strategy may undergo changes in the future, however, they are not envisioned at the moment. Nonetheless, the energy crisis had an impact on the economy as a whole, pushing new level of inflation. The region was also affected by a humanitarian crisis due to its direct border with Ukraine.

The investments envisioned by the JTP and, in particular, the transition to green steel production at the Liberty Galati Steel Complex increase their strategic importance.

Austria, JTP-territory

The increased and more volatile prices have led to greater and new uncertainties. The only certainty is that there is no way back to the state as of before the outbreak of the war.

The crisis has led to a greater awareness in business that energy has its price. Before the crisis, companies thought that energy was cheap and that it would stay that way. The crisis accelerates the shift towards diversification of energy sources and climate neutrality.

Direct influence on the JTP cannot be determined as the implementation has not started yet.

Poland, Silesia

The current situation is very uncertain. The war has been going on for a year, while the funds are just about to start. There is certainly a short-term deterioration of the situation in the region. However, in the next few months, the region shall move smoothly to the development of RES, and new technologies.

The crisis, and the potential economic decline, are considered to be temporary and are not anticipated to pose a risk for the achievement of the goals set for 2030. The current transition, in contrary, to the one started in 1990s, is much more than just the reduction of coal mining. Therefore, all other actions can get started, and be implemented, getting the economy, environment, and society ready for a "green" future.

Italy, Sardinia

In 2020, Italy had an energy import dependency rate higher than 70%, which was among the highest in the EU. Around 20% of the gross available energy in the country in 2020 was imported from Russia. As a consequence of strategic decisions, electricity demand was reduced by 9.4% (2021-2022). It was possibly thanks to energy efficiency measures and reduction of the demand due to prices.

Sardinia has been experiencing a further increase of high costs of energy in the region. The Bank of Italy estimates that Sardinian enterprises have seen an increased incidence of energy costs at around 40% following the Russian war in Ukraine.

Despite the deteriorating economic outlook of the region, the energy transition plan should not be directly affected by the crisis. On the contrary, since the region had already foreseen renewable energy as an alternative for the phasing out of coal in electricity generation, the crisis could have the positive effect of accelerating this transition.

The strategic view of the JTP is not changed by the gas crisis. The energy transition is not directly affected by energy price fluctuations.

4.3.2. Implications for negative development from the case study regions

The possible future development paths discussed and derived from the case study analysis led to identification of the following drivers of the negative future development of the JTP-regions:

- Decreased revenues of local municipalities due to coal phase-out and increased energy prices, as well as high inflation rates (PL).
- Due to the crisis, there is pressure on industry, which will possibly lead to a reduction of the primary industry sector (AT).
- Peat is typically used in the district heating plants in peat producing regions. As the goal of the government policy is to halve the use of peat as a heating source, the district heating plants have started to replace peat with wood pellets. In the district heating plants of Northern and Eastern Finland, a large part of the wood pellets was imported from Russia. There is a fear that when the pellet imports from Russia stopped, the district heating plants will revert to using peat (FI).
- Low capacity of innovation, difficulties in diversification of economy, low uptake of grants for smart specialisation, digitalisation, research, development and innovation in past programming periods (RO).
- Capacity to absorb the amount of funds allocated to a very small region and slow implementation of other plans. The region has a small entrepreneurial ecosystem and it remains therefore difficult for this system to absorb a large amount of funds, with the risk of insufficient implementation of measures. This can also be seen by previous initiatives that attempted to aid the local economy (IT).
- At the moment, there is a risk of displacement of funds destined to the energy transition between the NRRP and the Cohesion Policy funds, including the JTF. The measures envisioned by both instruments are mostly overlapping and the implementation of the PNRR started before the approval of the JTF, increasing the risk of displacement (IT).
- The region is experiencing a long period of economic decline that has created a fragile entrepreneurial ecosystem, characterised also by a low propensity for innovation. This is coupled with insufficient investments in energy, digital, and transport infrastructure, that have left the region in a place of disadvantage with respect to Italy and the rest of the EU (IT).
- Reduced opportunity in the job market, population decline, and inadequate vocational training pose difficulties for companies to acquire the adequate workforce to drive the innovation process necessary for the energy transition (IT).
- The demographic phenomena of ageing and emigration, with an impact on the specialised labour force in the region, will have the risk of deepening the socio-economic gaps between the development regions and the counties of the South-East Region, exacerbating further the negative consequences of the transition (RO).

- The region has a low capacity to innovate according to the European Regional Competitiveness Index and may find difficulties in taking advantages of the diversification potential in the economy. This is also reflected in the low uptake of grants for smart specialisation, digitalisation, research, development, and innovation of past programming periods (RO).
- The JTF requires substantial regional communication and activation, without receiving enough technical assistance by the regions it is not possible to develop the potential of the JTF (FI).
- Absorption of JTF funds in the given schedule as the development projects under JTF have a lower support percentage (70%) than those under the ERDF (80%), so it will be harder to market funding to the applicants (FI).
- The implementation of the JTP is constricted by a lower attractiveness compared to, for example, the ERDF and ESF, with the JTF funding carrying additional administrative requirements. A structural issue with German national funding related to the GRW can furthermore pose challenges as the way maximum funding available for a region is calculated can lead to a reduction in overall available money. These issues combined could lead to a low effectiveness of the transition funding available for the region and thus to fail to support the recovery of the region post crisis (DE).
- Romania has already had several difficulties in the past with respecting deadlines in the implementation of big projects (RO).
- External conditions are difficult and hinder the process of moving away from fossil fuels. Potentially, they may even delay fund implementation and investment development (PL).
- Legislative barriers (such as the windmill law in Poland) and unclear or unknown frameworks make investment decisions difficult (PL).
- The technical implementation structure of the JTF, and especially the speed of expenditure (2 billion must be verified by 2026) present an additional problem and distraction from the transition process itself (PL).
- Negative consequences of the transformation started already in the 1990s and must be compensated for now (PL).
- Parallel structures between JTP and ERDF. Enterprises might not be clear which funding to apply for, and respectively which focus to put on their projects in order to fulfil the specific funds requirements. This is especially relevant for funding which does not correspond to the already planned out measures (e.g. Innovation Campus), but rather to measures linked to upskilling (DE).
- Without the implementation of strong (financial) support, devastating effects on the regional economy as a whole are possible. The peripheral status and the low innovativeness of the regional economy is unlikely to recover on its own. Thus, the positive long-term development scenario cannot be taken as a given for the region (DE).

4.3.3. Implications for positive development from the case study regions

The possible future development paths discussed and derived from the case study analysis led to the identification of the following drivers of positive future developments of the JTP-regions:

- The region had already elaborated a plan for the energy transition so that it does not rely on hydrocarbons for electricity generation but instead focuses on increasing the capacity for energy storage and update of the electric grid infrastructure to potentiate the output of renewable energy capacity. The regions are at risk, but have already elaborated the energy transition plan in the form of the JTPs (IT, all CS).
- Finland (and also other countries) have managed to reduce their dependence from Russian gas and electricity very swiftly which is promising for further necessary changes (FI).

- Already completed identification of opportunities for diversification of the regional development Strategy 2021-2028. Moreover, the regional Smart Specialisation Strategy (ADRSE, 2020) includes some key sectors such as shipbuilding and energy as central to the potential for research, development and innovation of the region (RO).
- Some of the former peat production areas will be reconstructed to natural protection areas or woodlands, or converted to renewable energy areas (wind and solar energy parks) as they are typically far away from habitation, and they cannot be used for other purposes (such as agriculture) (FI).
- The common character of transition goals helps and leads to the realisation of the transition (PL).
- The most significant driver of the transition: involvement of residents, entrepreneurs, research institutions, universities, etc. (PL).
- Even if something is delayed in the initial phase due to the reaction to the crisis, it will be made up for (all CS).
- Additional awareness that the transformation is a preparation for the future, so that the present crisis situation will not be repeated (PL).
- The current multitude and diversity of funds and support possibilities is seen as a positive factor. Projects can be supported as they are, without the need to match a specific fund, as there are more options to choose (PL).
- On the short-term, the crisis accelerated the transition needs. Instead of a slower phase-out, a rather rapid cut of fossil fuel availability and thus operation of the refinery took place (DE).
- The strong position of renewable energies in the current market can provide regional income and jobs, however it is volatile to future changes. It can provide a stable basis for expansion if the region manages to attract further industry players (DE).
- Some people will lose their jobs. However, society has a lot of innovative power and will manage the transition and improve the economic system. The labour market needs to be reformed, and in particular women need to be more integrated (Austrian rural areas) (AT).
- Without war, transformation would happen more slowly. The crisis made it clear to the companies and society that action towards transition must be taken (AT).

4.3.4. General impact and possible scenarios for the JTP-regions

The possible future development paths for each analysed region and the identified development drivers, complemented by the results of literature and documentary analysis, as well as the regional risk assessment based on the regional industrial specialisation, were further elaborated to more general scenarios. The scenarios have the form of hypotheses and are the basis for the recommendations.

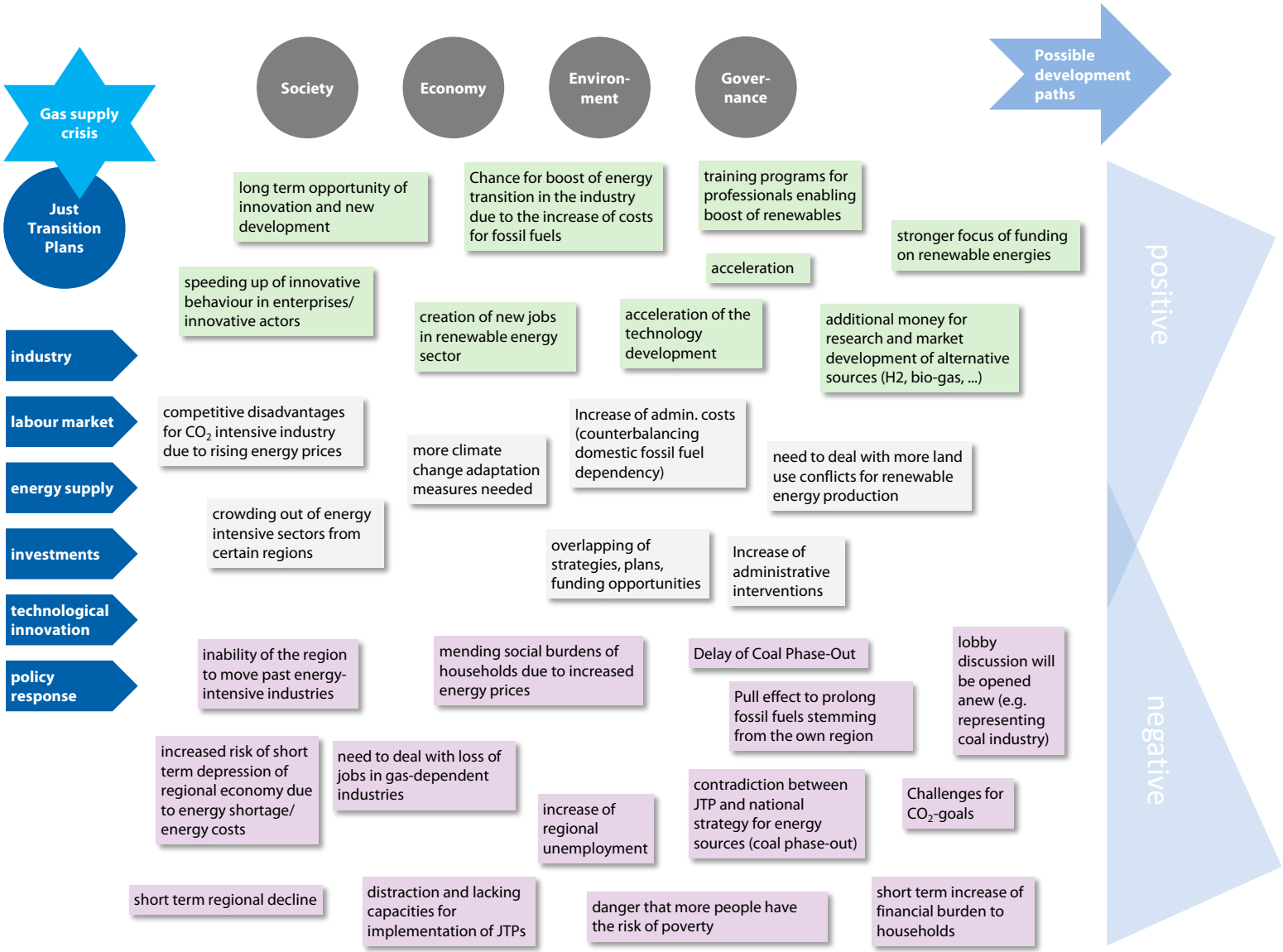
Negative development scenario: short-term regional decline, disadvantages due to rising energy prices, challenges for achievement of CO_2 reduction goals; delay of coal phase-out; job losses in gas-dependent industries; increase of unemployment; financial and social burdens of households due to increased energy prices; potentially more people at risk of poverty; distraction of public administration and programme management and lack of capacities for implementation of JTP, insufficient attractiveness of JTF-funding in comparison to other support opportunities, unreadiness of the region to absorb all the available means and measures, broader regulative framework is insecure and in the same time not stable enough for long-term investments, volatility of renewable energy sources.

Positive development scenario: long-term innovation opportunities; acceleration of the technology development, speeding up innovation and investments in enterprises; creation of new jobs in renewable energy sector; stronger focus of funding for renewable energies; additional funding for research and market development of alternative energy sources (hydrogen, bio-gas); more training

programs for professionals enabling boost of renewables; further increase of consent for the transition; multitude and diversity of funds and support opportunities allows the implementation of different projects without the need of adaptation to fit the specifications of one funding scheme; acceleration of transition needs and awareness – the current state cannot be continued and back to the previous situation is not reasonable nor desirable.

Further challenges for the development: contradiction between JTP and national strategy for energy sources (e.g. coal phase-out, import of other energy sources); crowding out energy intensive sectors from the region; need to deal with more land use conflicts for renewable energy production; increase of administrative interventions; overlapping of strategies, plans, funding opportunities.

Figure 15: Potential impact of the gas crisis on the implementation of the JTPs



Source: Own elaboration, 2023.

4.4. Feasibility of JTM and regional adaptations to crisis conditions

Finland

There are already measures foreseen by different programmes for transition (ERDF, CAP Strategic Plan, national funding) such as energy efficiency, innovative energy projects, etc. These funding sources were not developed as a reaction to the energy crisis. They are long-term plans to promote energy efficiency and a transition to greener energy sources.

Germany

Several actions have been implemented at federal, regional, and local level in Brandenburg to react to the crisis in general. As the implementation of the JTP is not directly impacted by the crisis in its current form, no immediate actions for restructuring or reprogramming of the JTP had to be taken. The transition actions, as outlined in the plan, had to be implemented in the same manner even if no energy crisis was evolving.

Romania

Romania intends to use the measures envisioned in the RePowerEU plan. The two instruments do not significantly overlap both in terms of geographic dimension and thematic dimension. REPowerEU is planned to be used mainly for big infrastructure projects (natural gas and hydrogen investments).

Austria

The strategies addressing the current crisis are national strategies. RePowerEU funds are used at the national level, but not at the regional level. This may lead to a situation where the JTP funds may become redundant, as funding is now provided at national and EU level.
The current adaptation strategies focus on the increased use of renewable energies, increased energy efficiency, and diversification of energy sources. Since the energy supply is limited, it can only be controlled via the demand side. In the long term, the process of energy supply should be changed, so that it is sustainable. In general, it will not be possible to completely phase out gas in the foreseeable future. For this reason, import routes for renewable gases should be secured.

Poland

There are no specific measures yet. The programmes are just about to start. The regional authorities expect high interest among beneficiaries. The funds from RePowerEU, or other especially dedicated funds, are not available, as the NRRP for Poland has not yet been finally accepted. However, the region is looking forward to the opportunity of RRF funding as, for example, the very attractive 100% financing will be possible.
The national energy strategy is being updated. In is not clear, whether there are any significant changes with regard to the transition to climate neutrality in Silesia.

Italy

Italian government implemented a series of measures in the immediate aftermath of the Russian invasion on Ukraine: ensure an increase in storage of natural gas for winter 2022-23 and a rapid diversification of natural gas supply chains, to increase imports from Algeria, Egypt, Qatar and other potential countries. The region intends to revise its Regional Energy Plan on the basis of the new outlook on energy prices and energy demand. This new update of needs, in terms of energy for the region, will clarify whether the outlook of the energy demand in the region has changed. There is no regional intention to make use of the additional resources available under RePowerEU.

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1. Synthesis of research results

Natural gas represents a crucial component of the EU energy mix. The dependency on natural gas has been increasing in the recent years, also caused by the shift from other more CO_2 intensive fossil fuels to gas. The EU imports more than half of its total energy demand of oil and petroleum products and coal. The external dependency on gas imports had been relying predominantly on one supplier: Russia. Despite the significant decrease in gas imports from Russia in the last year, the EU overall gas supply is still not diversified.

The EU had very close and strong trade linkages with Russia. The analysis of comparative advantages based on imports and exports revealed that not only sectors with import dependencies with Russia may potentially be negatively affected by the crisis. The changes in trade relations may also influence sectors with current advantages because of exports to Russia.

The EU-wide regional risk assessment to the gas supply crisis revealed that there are significant differences in the exposure to the current and future disruptions in gas supply. The presence of highly gas dependant sectors combined with little differentiation of the regional economy was observed predominantly in Italy, France and Germany. Higher diversification of the regional economy can counterbalance the risk level based on the country's significant dependence on Russian gas imports (e.g. as in the case of many regions in Austria). If the region has a less differentiated economy, but in sectors which are less gas dependant, it may not be at the highest risk due to the current Russian gas supply crisis. Still, it is potentially highly exposed to the occurrence of other possible crisis situations directed at the specific sectors of economic specialisation in these regions. According to the analysis, the JTP-territories individuated are part of regions that are considered to have varying levels of potential risk since the index is based on different parameters, especially the dependence on gas imports from Russia.

Based on these findings of the general analysis, and in the context of EU development strategies and policies, six regions with JTPs and different characteristics were examined more in detail. The case study regions are as follows:

- Silesia, Poland, a large well-developed and prospering industrial region;
- Sulcis Iglesiente, Italy, a very small area on an island;
- Lapland, Finland, a remote and scarcely populated region covering a large area and with long distances even within the region;
- JTP-territory in Austria, a combination of geographically disconnected regions facing similar challenges;
- Uckermark, Germany, a specific, partly peripheral region with well-defined ideas for new development paths;
- Galați, Romania, an EU external border region with complex challenges, including the recent humanitarian crisis caused by the large number of people fleeing the war in Ukraine.

The analysis revealed a wide range of implementation approaches for JTF. The approaches for developing the JTPs and their content vary as much as regional characteristics. The commitment and preparedness for the implementation of the JTPs also differs. However, all regions have a deep common understanding that the measures for transition must be implemented independently from the crisis. The crisis situation serves to emphasise the necessity of transition and to push the preparation for an uncertain future and the building of regional, or at least European, energy self-sufficiency.

It is clear that the complex transition process is multi-dimensional and very demanding. Based on identification of the risks and uncertainties through the regional specialisation analysis, and the analysis of the case study regions, recommendations for better supporting EU regions on their way to implementing the European Green Deal and, in particular, regions realising their JTPs were developed.

The findings of the study can be used by those regions that are likely to be particularly affected by the transition to climate neutrality. Since the regions setting up JTPs have already elaborated tailor-made strategies for the transformation, they are actually the pioneers of the transformation. Therefore, aspects of the recommendations derived from the study apply to all EU regions.

5.2. Findings and policy recommendations

The policy recommendations developed aim at providing relevant, feasible and appropriate recommendations at EU level, in particular to EU policy makers. The evidence used to inform the recommendations is based on the previous working steps. Suggestions for policy recommendations were collected in the context of the case studies and discussed with the interviewees. They were analysed in the cross-case synthesis and further discussed, then refined and validated through an expert workshop.

One main result is that in principle the analysed regions with the JTPs are capable of setting up activities to react to the gas supply crisis. There is no need to change the JTPs themselves in response to the current crisis situation on the European energy market.

However, the level of detail of the development strategies and measures provided in the JTPs varies considerably across the EU. Regardless the crisis, the less regionally specific JTPs would benefit from further elaboration in order to better address regional needs, and understand and take into account regional development opportunities, such as more detailed strategies for diversification of energy sources.

The recommendations below are arranged along the level of executive power: EU, national and regional/local, and to be applied at all levels.

Findings and policy recommendations at the EU level

Diversification of the energy mix and energy supply chains

- In the medium term, the EU will need to diversify its energy mix and suppliers, even if this could imply high costs in terms of infrastructure and trade relations.
- Diversification is particularly needed to limit the exposure of EU regions to future crisis risks, especially for those that are highly specialised in gas-dependent sectors and with low differentiation in their industrial specialisation structure.
  The following box includes the first suggestion for a simplified assessment tool for the potential energy infrastructure investments. Through the assessment, the contribution of different plans and projects to the climate neutrality objectives and energy resilience becomes clear.

  Suggestion: Matrix or decision tree for comprehensive decision framework for energy infrastructure investments, including i.e.:

  1. Green impact level of the technology (Is the technology causing less pollution?)
  2. Cost to switch to the greener energy
  3. Reliance of energy suppliers
  4. Diversification of energy suppliers
  5. …

- To withstand possible future crises of any kind, and continue the application of the European Green Deal, diversification is crucial at different levels and domains including resources, trade linkages and their directions.

Coordination between different EU programs supporting transition to lift more synergies

- Good coordination between single EU-programs is necessary for their effective and timely implementation.
- Clear and efficient rules are needed. The different funding rates between, for example, the ERDF and JTF should be avoided. Still, the uptake can be controlled by higher funding rates for specific actions accelerating the transition.

Intensification of the knowledge-exchange to enable mutual learning

- Communication and permanent contact between EC and the regions are extremely important for the implementation process of the JTP. During the programming phase there had been a lot of exchange, negotiations, and feedback from the EC toward the regions. The continuation of this active support could help the JTP-regions stay on the right track throughout implementation.
- Supported and coordinated direct exchange with other regions (like through the Coal Regions Platform) helps regions to learn from one another. A further exchange platform promoting the continuation of the learning process and knowledge exchange would support the implementation of JTM.

Adoption of implementation of the JTPs to exploit its opportunities as well as possible

- There is no direct need to update the JTPs themselves. Though, a solution for the delivery framework with more flexibility is needed to ease the goal-oriented absorption of "a lot of money" from different sources in a very short period of time. This flexibility should also consider the deadlines for contracting the money.
- A longer time period for the assignment of money will help buffer issues attributed to the programming delay in relation to the original dates, the envisaged projects being very complex, and the legal land use framework that cannot be changed at the pace of currently scheduled funding, among other aspects.
- Further evaluation and monitoring combined with the stepwise development or revision of the intervention logic starting with more general, then more detailed formulations, would support regions in their process of adaptation to the changing situation and progress of the transition.

Improvement of the knowledge base to broaden regional knowledge and the mechanism of implementation

- Research and analyses on regional level, particularly comparative research focused on the problems and best practices, help regions base their strategies on findings and compare experiences and lessons learnt.
- There is still a gap between the objectives and the state of knowledge on land reclamation solutions. Studies, legal analyses, and elaboration of solutions are necessary but also need time to accomplish results.
- Providing the link for the existing gap between the goals at European level and regional implementation, for example, in the form of a development plan for the entire EU, will help to achieve the objectives.

Findings and policy recommendations at national and regional level

Improving support structures for the regions to implement the JTP

- Local administration should receive assistance in the implementation of the programs from regional/national authorities, in particular when multiple funds are planned to finance complementary and overlapping measures.
- Further streamlining of the process of transition, despite all the difficulties, is a form of solution and answer to the crisis.
- Regional "Transition Coordination Groups" or dedicated organisations as points of reference and communication should be established or continued.
- Establishment of "Centres" for observation, dedicated monitoring to help actively shape the process of JTP-implementation and manage further ongoing participation in the region.

Improvement of the communication between national and regional authorities

- The improvement of communication between different levels of governance to exchange the information on national strategies and regional needs helps to facilitate the targeted and coordinated deployment of all funding opportunities.
- The RePowerEU Plan represents a possible way that authorities could use to differentiate the supply and commence the necessary reconversion. However, the coordination and synergies should be explored and implemented.

Findings and policy recommendations relevant for all levels

Raising awareness and preparedness to reduce the vulnerability

- Dependencies and risks should be made clear. Awareness raising for better understanding and support of the political and investment decisions.
- Further intensive work on the change of the energy supply towards a reduction of the dependency on fossil fuels (energy sources, origin and dependencies) at all levels from single households, municipalities, regions and Member States will help to lower the regional risk levels and increase resilience.
- Improvement of general preparedness for a crisis situation. The supply chains and external dependencies should be diversified to avoid shocks if one of the elements in the supply system fails. To lower the risk exposure, the import and export of materials, goods and services should be well balanced on regional, national and EU-level. Furthermore, strong efforts should be placed on achieving a higher level of self-sufficiency in energy supply and on strengthening a functional system of cooperation within the EU.

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ANNEX

A.1 Methodology for Regional mapping

The index elaborated to map regional risk exposure is based on three main factors:

- the level of imports dependency from Russia of the Member State the region belongs to;
- the industrial specialisation of the region, with particular emphasis on those sectors that are more dependent on gas;
- the level of industrial specialisation/differentiation of the region as presented by the HHI;

First, the level of import dependency is calculated by the triangulation of several different sources of data, whose main source are the estimations conducted by Eurostat to determine the reliance on natural gas imports from Russia. Gas imports dependency by Eurostat is calculated as imports on gross available energy and it is adjusted to account for transited energy. Eurostat also uses assumptions for some countries that did not identified imports from Russia (Denmark, Estonia, Croatia, Austria, Romania, Slovenia, Finland). Moreover, where possible, this data has been cross-checked with other sources (see box below).

Data sources

Given the complexity of the topic of the study, and in particular the difficulties in obtaining accurate data on trade of natural gas, the study has used of several data sources to ensure a comprehensive analysis. In particular, the main data sources are Eurostat, CEPII-BACI, ACER and ENERDATA:

- Eurostat presents a comprehensive energy database[32] (Eurostat, 2023) that compiles datasets regarding energy mix by Member State, national energy dependency, energy balance, supply, and transformation of energy sources as well as energy consumption by sectors and sources with national-specific data.
- The BACI database24, compiled by the CEPII Centre, provides data on bilateral trade flows of products classified according to the Harmonised System (HS) nomenclature and includes data on 200 countries (CEPII, 2023).
- Other sources have been employed to cross-check the adequacy of the data. The European Union Agency for the Cooperation of Energy Regulators (ACER) published several datasets that estimate gas supply sources, tariffs, and gas prices. Most of these estimations are based on data from the ENTSOG25, National Regulatory Authorities, the International Energy Agency, and other public available data such as the ALSI tool developed by Gas Infrastructure Europe (GIE), giving the consortium the possibility to evaluate the data collection process and elaboration. Data directly from the International Energy Agency have also been employed to estimate gas import dependency.

The sources citied are necessary to minimise the possible inaccuracy of datasets presented. In fact, the consortium is aware of possible shortcomings in the collection of data, especially regarding trade value of natural gas. According to the CEPII, trade values data of hydro-carbons (especially natural gas traded in gaseous form) are often underreported or missing important information, such as the country of origin. These issues can be seen across datasets, including Eurostat, COMTRADE, COMEXT and BACI. A simple comparison performed by CEPII of these datasets on figure from the main EU importing countries (France, Germany, Italy, Netherlands, and Spain) provides an idea of the discrepancy between gas imports quantities and trade value.[33] This is the reason why the LFI analysis is limited to data at 2-digit HS, therefore including both natural gas and oil as a proxy of the weight of EU dependency on Russia. Moreover, where possible, to limit inconsistencies of the data relating to main trade actors, national or regional (for the case studies) dataset will be used.

[32] Eurostat, Energy database: https://ec.europa.eu/eurostat/web/energy/data/database (last accessed 01/03/2023)
[33] CEPII, 'Trade datasets are not the right starting point to discuss trade in natural gas': http://www.cepii.fr/BLOG/en/post.asp?IDcommunique=929

Second, the regional (NUTS2 level) industrial structure analysis is based on data from Eurostat that presents a breakdown of employment figures at regional level based on the 2-digits NACE classification. Starting from these data, the heterogeneity of regional energy dependency based on the different composition of local manufacturing systems is assessed. This includes the crossmatch of data regarding national level estimations of the most energy-intensive sectors by energy sources with the analysis of the regional industrial structure. In particular, the Eurostat dataset on "Simplified energy balances" allows to elaborate a country and sector specific index. This is based on the share of natural gas used by an industry in a country and the share of employed people in that industry at regional level. This value (that indexed from 0 to 1000) classifies the regions in terms of their reliance on natural gas for key sectors.

Lastly, the consortium will employ the Herfindahl Hirschman Index (HHI) to evaluate the level of specialisation of the industrial fabric of each region. The HHI is calculated as:

$$HHI = \sum_{i=1}^{N} s_i^2$$

Where s_i represents the share of employees in sector *i* out of the total labour force figures of the region, and *N* is the number of sectors considered in the analysis (all manufacturing sectors at NACE 2-digits level). Higher values of the HHI imply more specialisation (i.e. less differentiation) of the regional economic structure, this is assessed in relation to the values of HHI for the entire EU. This could denote additional risks for those regions that especially depends on Russian import and exports or that are strongly affected by a change in energy prices, as they have limited possibility to disinvest from sectors in crisis. Having a less differentiated industrial fabric and a workforce employed on a limited number of sectors reduce these region's economic resilience to external shocks.

These three factors allow for the creation of an index of "regional risk" that is classified from "very low" to "very high". The index represents the potential exposure and vulnerability of the regional economy to future disruptions of the natural gas supply chains.

In future studies, the index could be complemented by data on the regional energy balance, considering both civil and industrial sectors.

A.2 Lafay index tables

Table A.1: Bottom sectors in terms of comparative advantage, EU-Russia trade

HS CODES and LABELS / MEMBER STATES	27 MINERAL FUELS, MINERAL OILS AND BITUMINOUS SUBSTANCES	72 IRON AND STEEL	71 PEARLS, PRECIOUS STONES, PRECIOUS METALS	99 Other products	44 WOOD AND ARTICLES OF WOOD	75 NICKEL AND ARTICLES THEREOF	76 ALUMINIUM AND ARTICLES THEREOF	31 FERTILISERS	26 ORES, SLAG AND ASH	74 COPPER AND ARTICLES THEREOF
EU	-32.59	-2.05	-1.37	-1.17	-0.88	-0.66	-0.55	-0.54	-0.54	-0.39
AT	-19.93	-0.16	0.03	0.00	-2.02	0.00	-0.54	0.00	-5.44	-0.04
BE	-17.73	-7.81	-10.56	0.72	-1.02	0.00	-0.22	-0.68	-0.19	0.02
BG	-18.65	0.14	0.00	0.02	-0.06	0.00	-0.80	-0.38	-0.30	-0.53
CY	-6.90	-1.61	-0.02	-0.02	-2.08	-0.03	-0.02	-0.07	0.00	-0.45
CZ	-32.32	-2.98	0.00	0.00	-1.00	0.00	-0.28	0.00	-1.96	0.02
DE	-32.43	-0.95	-3.50	-0.08	-1.24	-0.65	-1.22	-0.13	-1.02	-1.45
DK	-18.53	-14.28	0.00	-0.22	-2.05	0.00	0.02	-1.16	0.00	0.08
EE	-21.06	-1.30	-0.04	0.00	-6.15	-0.04	-0.38	-2.02	0.03	0.07
ES	-33.27	-1.58	0.21	0.06	-0.07	-0.02	-0.27	-0.39	1.82	0.04
FI	-22.14	-0.22	0.00	0.00	-3.10	-6.96	0.11	-0.44	-1.22	4.86
FR	-39.67	-0.50	0.19	0.00	-0.60	0.05	-0.50	-0.54	-1.48	-0.11
GR	-7.22	-0.01	0.00	0.29	-0.03	0.00	-0.15	-0.06	0.75	0.52
HR	-29.59	0.00	0.00	0.00	-0.60	0.00	-6.36	-0.77	0.00	-2.20
HU	-35.45	0.16	0.00	0.15	-0.13	0.00	-0.05	-0.49	-0.24	0.03
IE	-31.43	-0.73	0.77	0.00	-1.34	0.00	-0.03	-11.17	0.00	0.02
IT	-31.78	-2.72	-2.52	0.00	-0.18	0.01	-0.35	-0.11	-0.01	-0.26
LT	-33.79	-2.59	-0.46	0.00	-1.55	0.02	0.19	-1.39	0.00	0.11
LU	0.00	0.19	0.00	-0.13	0.00	0.00	-12.98	0.00	0.00	0.00
LV	-19.89	-11.40	-0.02	0.01	-3.97	-0.04	0.05	-3.47	0.00	0.09
MT	-3.28	-0.02	-0.01	0.00	-2.43	0.00	-0.02	-0.03	0.00	0.00

HS CODES and LABELS / MEMBER STATES	27 MINERAL FUELS, MINERAL OILS AND BITUMINOUS SUBSTANCES	72 IRON AND STEEL	71 PEARLS, PRECIOUS STONES, PRECIOUS METALS	99 Other products	44 WOOD AND ARTICLES OF WOOD	75 NICKEL AND ARTICLES THEREOF	76 ALUMINIUM AND ARTICLES THEREOF	31 FERTILISERS	26 ORES, SLAG AND ASH	74 COPPER AND ARTICLES THEREOF
NL	-30.05	-0.83	0.00	0.01	-0.38	-1.01	-0.23	-0.13	-0.17	-1.52
PL	-23.12	-2.33	0.00	-9.95	-0.17	0.01	-0.69	-0.72	-0.10	0.04
PT	-16.71	-2.48	0.00	0.00	-0.56	0.00	0.02	-0.18	0.00	0.00
RO	-27.09	-1.17	0.00	0.00	-0.56	0.00	-0.05	-1.06	-0.75	0.01
SE	-30.85	-0.59	0.00	-0.01	-1.48	-0.04	-0.62	-1.16	-0.04	-0.01
SI	-29.59	-1.27	0.00	0.00	-2.03	0.00	-0.04	-3.01	0.00	0.02
SK	-30.56	0.07	0.00	0.00	-0.12	0.00	-0.02	-0.01	-3.22	-0.07

Table A.2: Top sectors in terms of comparative advantage, EU-Russia trade

HS CODES and LABELS / MEMBER STATES	84 BOILERS, MACHINERY AND MECHANICAL APPLIANCES	87 VEHICLES OTHER THAN RAILWAY	30 PHARMACEUTICAL PRODUCTS	85 ELECTRICAL MACHINERY AND EQUIPMENT	90 OPTICAL, PHOTOGRAPHIC, MEDICAL INSTRUMENTS	39 PLASTIC AND ARTICLES THEREOF	88 AIRCRAFT, SPACECRAFT, AND PARTS THEREOF	33 ESSENTIAL OILS AND RESINOIDS	38 MISCELLANEOUS CHEMICAL PRODUCTS	22 BEVERAGES, SPIRITS AND VINEGAR
EU	10.01	4.68	4.26	3.88	2.01	1.91	1.34	1.08	1.05	0.77
AT	6.97	0.64	8.71	1.85	0.94	1.02	0.09	-0.02	1.28	0.43
BE	3.72	2.05	13.66	1.52	1.71	3.38	0.00	1.43	1.43	0.71
BG	4.75	0.19	6.24	1.93	0.99	0.25	-0.08	0.70	0.38	0.04
CY	-0.13	-0.06	4.11	0.17	-0.10	0.12	-1.92	0.03	-0.42	-0.37
CZ	11.14	9.04	1.00	7.46	1.14	1.38	0.79	0.45	0.14	0.49
DE	11.54	7.21	4.54	3.77	2.82	2.28	1.63	0.80	1.10	0.23
DK	12.46	1.03	1.04	4.52	3.14	0.38	0.33	-0.15	1.90	0.17
EE	11.98	1.29	0.23	5.09	2.68	1.51	0.05	0.78	0.27	0.45
ES	5.35	3.27	1.01	1.31	0.29	1.54	0.02	1.54	0.99	0.48

HS CODES and LABELS / MEMBER STATES	84 BOILERS, MACHINERY AND MECHANICAL APPLIANCES	87 VEHICLES OTHER THAN RAILWAY	30 PHARMACEUTICAL PRODUCTS	85 ELECTRICAL MACHINERY AND EQUIPMENT	90 OPTICAL, PHOTOGRAPHIC, MEDICAL INSTRUMENTS	39 PLASTIC AND ARTICLES THEREOF	88 AIRCRAFT, SPACECRAFT, AND PARTS THEREOF	33 ESSENTIAL OILS AND RESINOIDS	38 MISCELLANEOUS CHEMICAL PRODUCTS	22 BEVERAGES, SPIRITS AND VINEGAR
FI	9.99	3.09	0.62	2.58	1.09	2.61	0.00	0.12	0.33	0.04
FR	6.83	2.35	2.70	2.63	2.08	1.36	10.33	3.03	2.77	0.42
GR	0.56	0.02	0.09	0.59	0.11	0.42	0.00	0.12	0.41	0.07
HR	3.57	0.13	13.78	0.62	0.23	0.81	-0.10	2.62	0.05	0.01
HU	7.52	3.99	6.04	5.56	0.72	1.59	-0.03	0.26	0.76	0.03
IE	3.89	0.02	6.80	0.82	7.10	0.12	0.33	3.93	1.67	0.66
IT	12.07	1.65	1.03	2.27	0.97	1.23	0.38	0.60	0.83	1.13
LT	11.71	2.17	0.46	4.81	3.27	0.84	0.03	2.76	0.91	3.28
LU	1.41	0.23	0.00	0.49	0.10	3.18	3.38	0.09	-0.13	0.00
LV	7.63	0.72	3.01	4.05	1.54	2.12	0.05	1.03	0.09	13.07
MT	0.00	-0.12	-0.23	0.36	-8.74	0.54	0.02	-0.10	-0.17	0.00
NL	5.93	2.42	7.05	5.03	2.42	1.86	0.14	0.27	1.09	0.13
PL	10.87	3.80	1.66	3.72	0.77	1.59	0.13	1.75	0.46	0.33
PT	2.56	0.53	0.29	0.63	0.06	0.27	0.00	0.02	0.11	1.54
RO	7.91	9.49	2.17	4.22	0.81	1.09	0.00	1.98	0.04	0.00
SE	14.06	8.01	3.62	5.74	0.87	2.25	0.06	0.04	0.38	-1.00
SI	4.78	0.04	16.63	5.05	0.51	0.67	0.00	0.44	1.28	0.17
SK	5.44	18.70	0.24	2.64	0.79	0.45	0.11	0.42	0.05	0.03

A.3 Types of JTP Regions in the EU

Country	Country code	Zone name	Type
Austria	AT	Austria	CO_2 intensive industry/region
Belgium	BE	Arr. Tournai	CO_2 intensive industry/region
Belgium	BE	Arr. Mons	CO_2 intensive industry/region
Belgium	BE	Arr. Charleroi	CO_2 intensive industry/region
Bulgaria	BG	Kyustendilska	Coal industry
Bulgaria	BG	Stara Zagora	Coal industry
Croatia	HR	Istria	Coal industry
Croatia	HR	Sisak-Moslavina	CO_2 intensive industry/region
Cyprus	CY	Cyprus	CO_2 intensive industry/region
Czechia	CZ	Karlovy-Vary region	Coal industry
Czechia	CZ	Moravian Silesian region	Coal industry
Czechia	CZ	Ústí region	Coal industry
Denmark	DK	Nordjylland	CO_2 intensive industry/region
Denmark	DK	Sydjylland	Fossil fuel production industry
Estonia	EE	Ida-Virumaa	Fossil fuel production industry
Finland	FI	Etelä-Savo	Peat production
Finland	FI	Pohjois-Savo	Peat production
Finland	FI	Pohjois-Karjala	Peat production
Finland	FI	Keski-Pohjanmaa	Peat production
Finland	FI	Lappi	Peat production
Finland	FI	Kainuu	Peat production
Finland	FI	Pohjois-Pohjanmaa	Peat production
Finland	FI	Etelä-Pohjanmaa	Peat production
Finland	FI	Pohjanmaa	Peat production
Finland	FI	Satakunta	Peat production
France	FR	Bouches-du-Rhône	CO_2 intensive industry/region
France	FR	Loire-Atlantique	Coal industry
France	FR	Moselle – Meurthe-et-Moselle – Haut-Rhin	CO_2 intensive industry/region
France	FR	Nord-Pas-de-Calais	CO_2 intensive industry/region
France	FR	Rhône – Isère	CO_2 intensive industry/region
France	FR	Vallées de la Seine et de la Bresle	CO_2 intensive industry/region
Germany	DE	Uckermark	Coal industry
Germany	DE	Nordliches Ruhrgebiet	Coal industry
Germany	DE	Lausitz Brandenburg	Coal industry
Germany	DE	Rheinisches Revier	Coal industry

Country	Country code	Zone name	Type
Germany	DE	Lausitz Sachsen	Coal industry
Germany	DE	Chemnitz	Coal industry
Germany	DE	Mitteldeutsches Revier Sachsen	Coal industry
Germany	DE	Mitteldeutsches Revier – Sachsen-Anhalt	Coal industry
Greece	EL	Megalopoli	Coal industry
Greece	EL	North and South Aegean Islands and Crete	Fossil fuel production industry
Greece	EL	Western Macedonia	Coal industry
Hungary	HU	Heves	Coal industry
Hungary	HU	Baranya	Coal industry
Hungary	HU	Borsod-Abaúj-Zemplén	Coal industry
Ireland	IE	Midlands	Peat production
Italy	IT	Carbonia-Iglesias	Coal industry
Italy	IT	Taranto	CO_2 intensive industry/region
Latvia	LV	Kurzeme	Peat production
Latvia	LV	Latgale	Peat production
Latvia	LV	Vidzeme	Peat production
Latvia	LV	Zemgale	Peat production
Lithuania	LT	Kauno apskritis	CO_2 intensive industry/region
Lithuania	LT	Šiaulių apskritis	CO_2 intensive industry/region
Lithuania	LT	Telšių apskritis	CO_2 intensive industry/region
Luxemburg	LU	Luxemburg	CO_2 intensive industry/region
Malta	MT	Malta	CO_2 intensive industry/region
Netherlands	NL	Groningen-Emmen	CO_2 intensive industry/region
Netherlands	NL	Groot-Rijnmond	CO_2 intensive industry/region
Netherlands	NL	Ijmond	CO_2 intensive industry/region
Netherlands	NL	West-Noord-Brabant	CO_2 intensive industry/region
Netherlands	NL	Zeeuws-Vlaanderen	CO_2 intensive industry/region
Netherlands	NL	Zuid-Limburg	CO_2 intensive industry/region
Poland	PL	Eastern Wielkopolska	Coal industry
Poland	PL	Lódz	Coal industry
Poland	PL	Silesia	Coal industry
Poland	PL	Walbrzych	Coal industry
Portugal	PT	Alentejo Litoral	CO_2 intensive industry/region
Portugal	PT	Médio Tejo	CO_2 intensive industry/region
Portugal	PT	Matosinhos	Fossil fuel production industry
Romania	RO	Mureş	CO_2 intensive industry/region

Country	Country code	Zone name	Type
Romania	RO	Galați	CO_2 intensive industry/region
Romania	RO	Prahova	CO_2 intensive industry/region
Romania	RO	Hunedoara	Coal industry
Romania	RO	Gorj	Coal industry
Romania	RO	Dolj	CO_2 intensive industry/region
Slovakia	SK	Banská Bystrica	Coal industry
Slovakia	SK	Košice	Coal industry
Slovakia	SK	Trencín	Coal industry
Slovenia	SI	Savinjsko-Šaleška	Coal industry
Slovenia	SI	Zasavska	Coal industry
Spain	ES	A Coruña	CO_2 intensive industry/region
Spain	ES	Asturias	Coal industry
Spain	ES	León	CO_2 intensive industry/region
Spain	ES	Palencia	CO_2 intensive industry/region
Spain	ES	Teruel	CO_2 intensive industry/region
Spain	ES	Almería	CO_2 intensive industry/region
Spain	ES	Córdoba	CO_2 intensive industry/region
Spain	ES	Cádiz	CO_2 intensive industry/region
Spain	ES	Alcudia	CO_2 intensive industry/region
Sweden	SE	Norrbotten	CO_2 intensive industry/region
Sweden	SE	Väterbotten	CO_2 intensive industry/region
Sweden	SE	Gotland	CO_2 intensive industry/region

The project provides information on the current and potential impact of the gas supply crisis on the Just Transition Plans (JTPs). The evidence is based on the analysis of EU gas and energy supply dependencies, trade linkages with Russia, the general EU's policy framework, Just Transition Mechanism (JTM), REPowerEU plan and the investigation of six case studies. It concludes with specified policy recommendations reflecting the implementation of the JTM, the JTPs in the light of risks of the energy crisis.

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