

# POLICY CHALLENGES AND POLICY ACTIONS FOR A JUST CLIMATE TRANSITION

## FIVE RECOVERY PLANS IN COMPARISON

*Linnea Nelli - Maria Enrica Virgillito - Andrea Roventini*



Policy Study published in December 2022 by

**FEPS**  
FOUNDATION FOR EUROPEAN  
PROGRESSIVE STUDIES



**THE FOUNDATION FOR EUROPEAN  
PROGRESSIVE STUDIES (FEPS)**

European Political Foundation - No 4 BE 896.230.213  
Avenue des Arts 46 1000 Brussels (Belgium)

[www.feps-europe.eu](http://www.feps-europe.eu)

@FEPS\_Europe



**FRIEDRICH EBERT STIFTUNG**

EU-Office Brussels- Rue du Taciturne 1000 Brussels (Belgium)

[www.brussels.fes.de](http://www.brussels.fes.de)

@FES\_Brussels



**INSTITUT EMILE VANDERVELDE (IEV)**

Boulevard de l'Empereur 13 1000 Brussels (Belgium)

[www.iev.be](http://www.iev.be)



This Policy Study was produced with the financial support of the European Parliament.  
It does not represent the views of the European Parliament.

This paper only represents the opinion of its authors and not necessarily the views of FEPS.  
Copyright © 2022 by Foundation for European Progressive Studies.

Knowledge Partner for this Policy Study:



**FORUM DISUGUAGLIANZE E DIVERSITÀ**

Via della Dogana Vecchia 5 00186 Roma (Italy)

[www.forumdisuguaglianzediversita.org](http://www.forumdisuguaglianzediversita.org)

@DD\_Forum

ISBN: 9782930769929

Editing: Helen Johnston

Layout and editing: Triptyque

Cover photo: Shutterstock.com

# RECOVERY WATCH

## WHAT IS THIS PROJECT ABOUT?

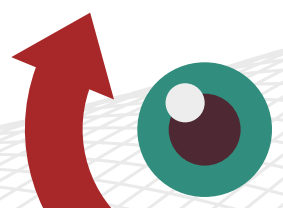
The National Recovery and Resilience Plans represent the new framework in which European member states identify their development strategies and allocate European and national resources – with the objective of relaunching socio-economic conditions following the coronavirus pandemic.

This process, initiated as part of the European response to the global health crisis, follows the construction of NextGenerationEU. It combines national and European efforts to relaunch and reshape the economy, steering the digital and climate transitions.

For European progressives, it is worth assessing the potential of these national plans for curbing inequalities and delivering wellbeing for all, as well as investigating how to create a European economic governance that supports social, regional, digital and climate justice.

The Foundation for European Progressive Studies (FEPS), the Friedrich Ebert Stiftung (FES) and the Institut Emile Vandervelde (IEV), in partnership with first-rate knowledge organisations, have built a structured network of experts to monitor the implementation of National Recovery and Resilience Plans and assess their impact on key social outcomes. Fact- and data-based evidence will sharpen the implementation of national plans and instruct progressive policymaking from the local to the European level.

The Recovery Watch will deliver over 15 policy studies dedicated to cross-country analysis of the National Recovery and Resilience Plans and NextGenerationEU. Monitoring the distributive effects of EU spending via NextGenerationEU, and the strategies and policies composing the national plans, the project will focus on four areas: climate action, digital investment, welfare measures and EU governance.



# KNOWLEDGE PARTNERS



# TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY</b>	<b>5</b>
Glossary	5
Main takaways	6
Policy Recommendations	7
<b>1. INTRODUCTION</b>	<b>8</b>
<b>2. METHODOLOGY</b>	<b>13</b>
2.1 Identified cases	14
2.2 Recovery Watch: climate transition in the NRRPs	17
<b>3. COMPARATIVE ANALYSIS</b>	<b>28</b>
<b>4. FINAL REMARKS AND CONCLUSIONS</b>	<b>34</b>
<b>END NOTES</b>	<b>37</b>
<b>REFERENCES</b>	<b>40</b>
<b>ABOUT THE AUTHORS</b>	<b>42</b>
<b>RAPPENDIX: SACRIFICE ZONE IDENTIFICATION AND DESCRIPTION</b>	<b>45</b>

# TABLE OF FIGURES AND TABLES

<b>Figure 1.</b> Global renewable energy employment by technology, 2012-2020	<b>9</b>
<b>Figure 2.</b> Structure of the analysis	<b>12</b>
<b>Figure A1.</b> CO2 and NOX emissions in Schleswig-Holstein, bordering sub-regions and other sub-regions in eastern Germany	<b>46</b>
<b>Figure A2.</b> CO2 and NOX emissions in the region of Sachsen-Anhalt, sub-regions	<b>46</b>
<b>Figure A3.</b> CO2 and NOX emissions in Slovakia	<b>47</b>
<b>Figure A4.</b> CO2 and NOX emissions in the Balearic Islands	<b>48</b>
<b>Figure A5.</b> CO2 and NOX emissions in the sub-regions of Noroeste, with Valencia and Barcelona in comparison	<b>49</b>
<b>Figure A6.</b> CO2 emissions in the previously mentioned sub-regions in Italy, sub-regions in Puglia, Umbria, bordering sub-region Viterbo, and Perugia and Torino	<b>50</b>
<b>Figure A7.</b> CO2 and NOX emissions in Norrbotten, bordering sub-regions and sub-regions under analysis	<b>51</b>
<b>Table 1.</b> Identified cases in the energy sector	<b>15</b>
<b>Table 2.</b> Identified cases in the automotive sector	<b>16</b>
<b>Table 4.</b> Strengths of the NRRPs, by country	<b>31</b>
<b>Table 5.</b> Comparative analysis of policies for the energy sector in sacrifice zones and the automotive sector, by country	<b>32</b>
<b>Table 6.</b> Comparative analysis of labour-market policy action for the climate transition: gender inequality measures and policies for reskilling workforce, by country.	<b>33</b>



# EXECUTIVE SUMMARY

This policy study addresses the extent to which the national recovery and resilience plans (NRRPs) adopted by five EU member states are able to combine environmental sustainability and employment stability, and therefore to pursue a just transition. We employ the lens of economic geography, with a specific territorial focus on left-behind places, and identify three main policy challenges: employment effects; environmental

inequalities; and gender inequalities. Given this theoretical framework, we investigate the presence of mitigation/adaptation policies for the labour markets and of industrial policies. Overall, the scope of this policy study is to evaluate whether the policy interventions are able to meet the policy challenges, and the effectiveness of these preventions – specifically in targeting left-behind places and the most vulnerable areas.

## GLOSSARY

### GOOD/DECENT JOBS

Jobs which guarantee fair income, social protection and integration, security in the workplace and equality of opportunity and treatment for all women and men. (See “[Decent work](#)” on the International Labor Organization website.)

### GREEN CASE

A virtuous case in terms of climate transition spurring employment creation, potentially born from the conversion of a sacrifice zone into a new sustainable one.

### GREEN JOBS

Decent jobs which produce green products and services and are in environment-friendly processes. They can be in traditional sectors, such as in manufacturing, or new green sectors, such as renewable energy. Green jobs help to improve energy and raw materials efficiency, limit greenhouse gas emissions, minimise waste and pollution, protect and restore ecosystems and support adaptation to the effects of climate change. (See “[What is a green job?](#)” on the International Labor Organization website.)

### INDUSTRIAL POLICY

Top-down, strategically defined investment policy directly affecting the productive dimension of the economic system, with the aim to spur new industrial activities or to push existing ones toward a new direction. In the frame of the impact of climate transition on employment, the creation of new jobs via investment-promoting plans.

### MITIGATION/ADAPTATION POLICY FOR LABOUR MARKETS

Mitigation: to avert future damage, reduce the cost of transitioning. Adaptation: to prevent degradation from causing damage, to cope with changing scenarios and reducing the mismatch, for example the reskilling of workers avoiding job losses in the automotive sector because of the shift to electric vehicle engines. (See “[World employment social outlook 2018: Greening with jobs](#)”.) [www.ilo.org/weso-greening/documents/WESO\\_Greening\\_EN\\_web2.pdf](http://www.ilo.org/weso-greening/documents/WESO_Greening_EN_web2.pdf)

### SACRIFICE ZONES

Areas, industrial plants and towns which have been characterised by a successful industrial history from a productive and employment point of view, that is, granting the community good jobs but in highly polluting activities. At present, such areas pose high risks to health and have been dismissed when it comes to productivity and investment plans. There is persistent unemployment, or low employment rates, while the community is faced with poor health and damage to the environment.

## MAIN TAKEAWAYS

The employment effects of the climate transition are differentiated across countries, sectors and territories. Indeed, the climate transition might enhance environmental, income and gender inequalities if not addressed by means of equitable policy paths. In this policy study we compare the national recovery and resilience plans (NRRPs) of Germany, Slovakia, Spain, Italy and Sweden, focusing on the just transition. We adopt a sectoral and place-based geographical perspective to evaluate the plans.

In terms of sectoral heterogeneity, while the energy sector is expected to be labour-creating, the automotive sector will quite probably be labour-expelling, because of value-chain disruptions deriving from the shift of the production to electric engines. Despite battery-manufacturing production being expected to absorb part of the unemployed workforce in the automotive industry, the reallocation ratio of workers is not one to one and differs across countries because of differences in industrial strategies and productive capabilities.

In terms of country heterogeneity, investment in electric vehicles and battery production are currently located in core productive countries. Periphery productive countries will import batteries, pre-empting new employment opportunities for dismissed workers.

In terms of territorial asymmetries, “sacrifice zones”, where polluting industries are located and an employment–health trade-off used to be accepted by local communities, risk being left behind if not converted. Depopulation, unemployment and income inequality co-exist with environmental and health damage.

Finally, in terms of gender asymmetries, women are ex ante excluded from employment opportunities in sectors which will benefit from the climate transition because of occupational segregation in service-based activities and female under-representation in the fields of science, technology, engineering and mathematics (STEM).

Given such policy challenges, we find heterogeneous results across the five countries under analysis in terms of policy actions put in place to achieve a just transition. The main strengths of the plans by country are:

- Germany intervenes in the crisis in the automotive industry;
- Spain invests to overcome the risk of depopulation and of rising unemployment, income and gender inequality in sacrifice zones;
- Italy invests in the conversion of some dismissed industrial plants, in particular for the production and supply of green hydrogen;
- Sweden identifies sacrifice zones willing to cooperate with the Just Transition Fund, entailing reforms to tackle gender inequality in the climate transition; and
- Slovakia directly addresses the need to convert specific sacrifice zones, phasing out coal-mining activities.

Overall, the most effective NRRPs are developed in those countries which have already implemented pre-existing industrial and mitigation/adaptation policies out of the recovery framework.



## POLICY RECOMMENDATIONS

We recommend a common European policy framework able to provide support to the European industrial capacity. This is in terms of innovative investments, R&D (research and development) and workforce training, in those sectors expected to grow. In particular: (1) the supply chain of battery manufacturing including not only production but also recycling and waste management; (2) sustainable public mobility; and (3) energy infrastructure and provision.

The Green Deal is a policy framework already moving in such directions and including initiatives such as the European Battery Alliance and the Circular Economy Action Plan.<sup>1</sup> However, a dedicated Public European Agency for Industrial Policy able to coordinate the policy initiatives of the European Industrial Strategy is recommended,<sup>2</sup> beyond stakeholder involvement. The Public European Agency for Industrial Policy should be responsible for transforming guidelines into actions at the member-state level, reinforce the effectiveness and the cohesiveness of the policies and be guided by the principles of a just transition.

We recommend the following:

- Policies ought to be place specific to tackle environmental inequalities in sacrifice zones.
- Labour-market policies, such as the reskilling and upskilling of workforces that may be expelled, must be envisaged, guaranteeing occupational and income stability.
- Green industrial policies creating decent jobs must remove gender barriers for women, to overturn occupational gender segregation and remove under-representation in STEM subjects.

“

The Public European Agency for Industrial Policy should be responsible for transforming guidelines into actions at the member-state level, reinforce the effectiveness and the cohesiveness of the policies and be guided by the principles of a just transition.

”

# 1. INTRODUCTION

The transition toward a more sustainable socio-economic system, able to cope with the causes and consequences of climate change, is all but an easy task. There are potential differences and asymmetries in the capacity of the economy to sustainably address such transition, in particular across countries and sectors. Additionally, a just transition has to be undertaken. Challenges, such as the rise in unemployment and the enhancement of environmental, income and gender inequalities, are expected. Therefore, in line with the words of Frans Timmermans, the EU Commission's vice president, responsible for the European Green Deal, the climate transition "will be just, or will just not be".

## EMPLOYMENT EFFECTS

The energy and the automotive sectors are potentially among the most exposed to the green transition and as such represent two archetypal case studies.<sup>3,4,5</sup> The new targets to contain greenhouse gas (GHG) emissions and the green stimuli of European policies (for example, the hydrogen, methane and energy system integration strategies, or even the European Green Deal more broadly)<sup>6</sup> are expected to foster innovation, development and the production of green technologies, specifically renewable-energy production. As a consequence, the energy sector is among the most targeted in terms of expected employment effects due to climate-change technologies and low-carbon scenarios.<sup>7</sup> New jobs are expected to be created in the development of energy crops, construction and maintenance jobs, and technicians specialising in hydrogen fuel cells.<sup>8</sup>

## EMPLOYMENT EFFECTS IN THE ENERGY SECTOR

The International Renewable Energy Agency (IRENA) shows the number of jobs in the renewable-energy sector by technology at global level from 2012 to 2020. As we can see from Figure 1, employment in this sector has increased in the reporting period, from 7.3 million jobs in 2012 to 12 million in 2020. The technologies employing the most workers are solar photovoltaic (PV) and bioenergy. The main factors driving employment trends in renewable-energy sectors are the manufacturing, installation and exploitation of technology equipment. For instance, costs for wind and solar technologies have continued to decrease while investments have been

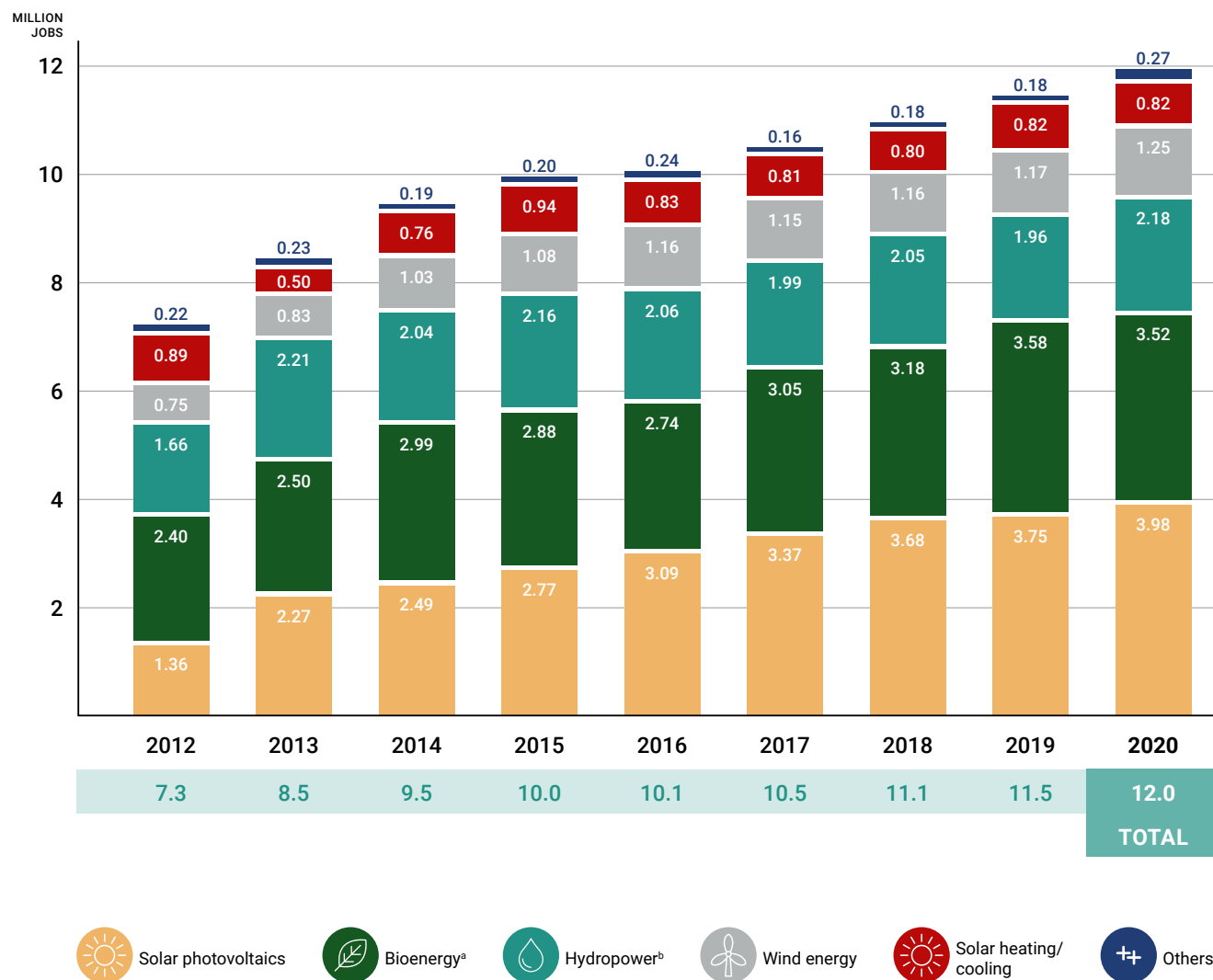
continually favouring an increase in the deployment of these two technologies. Consequently, improved investment, policy guidance and financial support (such as feed-in tariffs, subsidies and permitting procedures) would favour the deployment of renewable energy, fostering employment and productivity growth.<sup>9</sup> IRENA has estimated the additional employment effects of a shift from a more conservative "planned energy scenario" (based on the actual energy plans developed by governments in relation to the Paris Agreement) to the more progressive "1.5° scenario" (a pathway aimed to cut emissions by 37 gigatonnes per year by 2050 by increasing the generation and use of renewable sources, hydrogen and derivatives in particular).<sup>10</sup> Under the planned energy scenario, the number of jobs in the energy sector would be 106 million, with 17.4 million in renewables and 45.8 million in other climate-transition-related sectors by 2030. Under the 1.5° scenario, the number of jobs would be 139 million, 38.2 million and 74.2 million respectively at the global level.

“

The energy sector is among the most targeted in terms of expected employment effects due to climate-change technologies and low-carbon scenarios.

”

**FIGURE 1. Global renewable energy employment by technology, 2012-2020.**



<sup>a</sup> Includes liquid biofuels, solid biomass and biogas.

<sup>b</sup> Direct jobs only.

<sup>c</sup> "Others" includes geothermal energy, concentrated solar power, heat pumps (ground based), municipal and industrial waste, and ocean energy.

<sup>1</sup> Data are principally for 2019-20, with dates varying by country and technology, including some instances where only earlier information is available. The data for hydropower include direct employment only; the data for other technologies include both direct and indirect employment wherever possible.

<sup>2</sup> The jobs numbers shown in Figure 1 reflect what was reported in each earlier edition of this series. IRENA does not revise estimates from previous years in light of information that may become available after publication of a particular edition.

Source: "Renewable energy and jobs: Annual review 2021", IRENA.

# 1. INTRODUCTION

## EMPLOYMENT EFFECTS IN THE AUTOMOTIVE SECTOR

The 55% reduction in GHG emissions by 2030 might threaten employment stability in sectors affected by the climate transition.<sup>11</sup> In particular, as a consequence of CO<sub>2</sub> emission targets for cars and vans established by the European Commission, the automotive sector is shifting production to electric vehicles (EVs). The effects of the transition of the automotive sector are expected to be felt along the entire value chain in the manufacturing of engine components, given that the production of an electric engine counts only 20 moving parts, while an internal combustion engine involves 200.<sup>12</sup> Therefore, value-chain disruptions and employment effects are expected, although the net impact is not straightforward.

“

Policy interventions are crucial to address the transition of the automotive industry in the right direction. In the short run, investments must create employment opportunities.

”

As reported by the Institute for Employment Market Research (IAB), the Institute for Economic Research (IFO) estimates job losses of 600,000 direct and indirect jobs because of the electrification of powertrains in Germany. The IAB estimates that technology-driven job losses in Germany, where the automotive industry is a leading sector of the economy, could be as high as 114,000. Because of the electrification of powertrains by 2035, most job losses will occur in vehicle construction. Fortunately, the manufacturing of lithium-ion batteries (used in EVs) is expected to absorb part of the job losses in the automotive industry. In addition, investments in reskilling workers and in powertrain production capacities are expected to take place.<sup>13</sup> However, this compensation effect will not be observed equally across countries. In particular, the impact on employment would depend on whether the original

equipment manufacturers (OEMs) decide and manage to shift to EVs and hybrid vehicle production domestically, ensuring investments in reskilling the workforce to be employed in the new production processes. In particular, the possibility of creating new job opportunities within battery manufacturing would dwindle if lithium-ion batteries were to be imported. Consequently, policy interventions are crucial to address the transition of the automotive industry in the right direction. In the short run, investments must create employment opportunities. The European battery-manufacturing supply chain, which is expected to be the target sector for new job opportunities, should be properly supported. In the long run, competitiveness has to be coupled with investments in infrastructure, R&D and workforce training.

## ENVIRONMENTAL INEQUALITY EFFECTS

Other than employment creation or destruction, another challenge posed by the climate transition is that it can reinforce environmental inequalities. In fact, in many instances, industrial pollution damages a territory in such a way that the area becomes a “left-behind” place. Particularly in “sacrifice zones”, an apparent employment–health trade-off emerges whereby such “bad jobs” are the only possible source of income for many residents, with noxious industrialisation creating economic dependence (see the Glossary).<sup>14</sup> Such unfavourable preconditions pave the way for a potentially unjust climate transition, given that: (1) environmental and health damages deriving from polluting industrial activities are unevenly distributed;<sup>15</sup> (2) sacrifice zones are usually inhabited by low-skilled and low-income communities;<sup>16</sup> and (3) low-skilled workers are also at the tail end of income distribution. As such, policies that address sacrifice zones and place-based are particularly relevant from a just-transition perspective.

“

Industrial pollution damages a territory in such a way that the area becomes a “left-behind” place.

”



The climate transition is expected to involve low- to medium-skilled jobs in manufacturing (for example, technicians and green-collar workers), or highly skilled occupations related to STEM subjects (for example, software and environmental engineers), which are characterised by low female representation.



## GENDER-INEQUALITY EFFECTS

In addition, there are assumptions that the climate transition will exacerbate gender imbalances.<sup>17</sup> On the one hand, because of gender occupational segregation,<sup>18</sup> women are under-represented in those sectors we expect to be losing jobs through the low-carbon transition of the production process (manufacturing, construction). However, by the same token, we do not expect women to benefit from new job opportunities spurred by the climate transition. The climate transition is expected to involve low- to medium-skilled jobs in manufacturing (for example, technicians and green-collar workers), or highly skilled occupations related to STEM subjects (for example, software and environmental engineers), which are characterised by low female representation.<sup>19</sup> As a result, while the overall gender-specific impacts of the climate transition are hard to quantify in advance, it is nevertheless important to check whether policies targeting the employment aspects of the climate transition integrate gender-equality concerns. This is of special interest as climate policies such as the European Green Deal, and even the concept of a just transition, have been found to be gender blind.<sup>20</sup>

## POLICY CHALLENGES: RECOVERY WATCH

To summarise, the main challenge for policymakers is to design the climate transition in such a way that it complies with the principles of the just transition, by addressing precariousness, gender differences and income disparities – particularly in the light of the pandemic, which exacerbated inequalities. Therefore, it becomes more and more urgent to combine decarbonisation with pro-workers policies meant to both ameliorate income distribution and maintain employment stability. At the same time, new opportunities of the green transition should be grasped by appropriate green industrial policies which might increase employment growth in new activities, potentially upgrading working conditions and worker rights.

This policy study examines if and how the NRRPs of Germany, Slovakia, Spain, Italy and Sweden include the following:

- Green industrial policies converting dismissed industrial plants located in sacrifice zones into sustainable production activities. They are characterised by a labour-augmenting effect in the energy sector, such as the development, deployment and maintenance of renewable energy sources and green technologies, therefore creating new job opportunities for the local community.
- Policies designed to maintain employment stability, limiting unemployment and income inequalities, such as reskilling and upskilling policies to allocate workers from brown to green sectors. For example, blue-collar workers who used to work in the supply value chain of the automotive sector being reskilled to be re-employed in the battery-manufacturing sector.
- Policies tackling gender inequality of the climate transition, overcoming gender barriers to women grasping employment opportunities.

# 1. INTRODUCTION

## POLICY INSTRUMENTS AT PRESENT: THE NRRPs

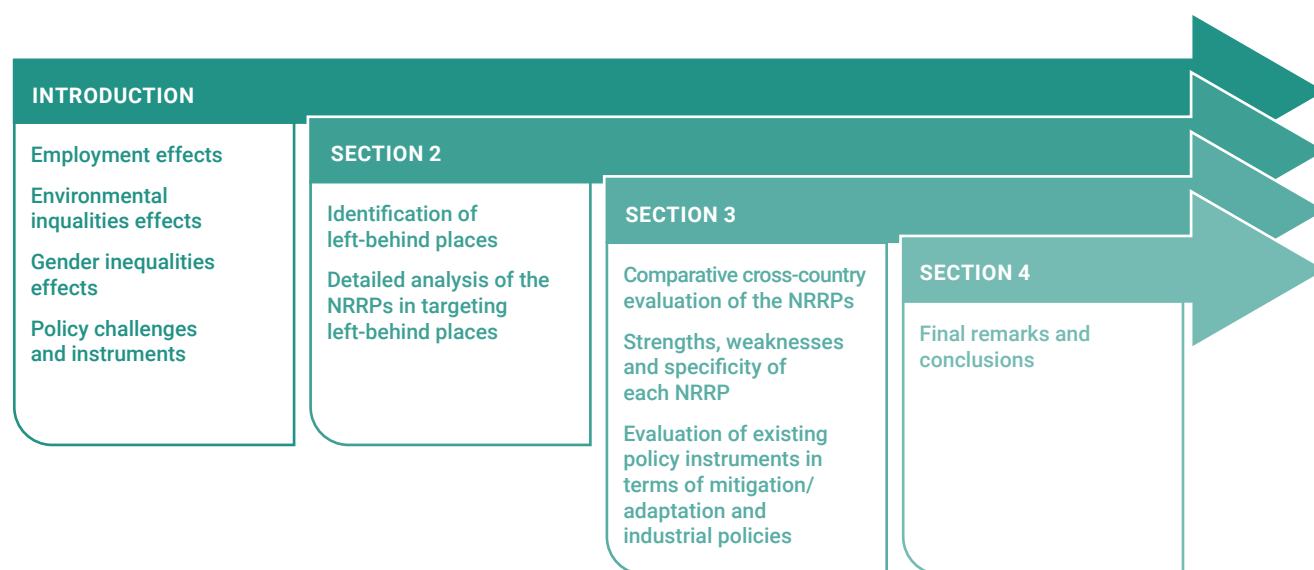
Given the policy challenges raised by the climate transition, this policy study analyses, within the recovery framework, how the NRRPs of five countries – Germany, Slovakia, Spain, Italy and Sweden – tackle these key policy challenges, namely: new job opportunities and potential job losses in the energy and automotive sectors; and inequalities from a territorial (sacrifice zones) and a gender perspective.

The research questions addressed in this policy study are as follows:

1. To what extent do the NRRPs developed by the EU member states under NextGenerationEU (NGEU) envisage direct policy intervention to combine environmental sustainability and employment stability?
2. What are the types of “mitigation and adaptation” policies that have been implemented/designed to accompany job stability in potentially labour-exPELLING sectors, such as income guarantees, professional upgrading and gender policies?
3. Are there industrial policies directed towards the creation of decarbonising activities and jobs?
4. How effective are these measures in obtaining/facilitating a just transition in terms of working conditions and standards (preliminary evaluation)?

Figure 2 details the steps of this analysis and the contents of the sections that follow. Section 2 presents the methodology and rationale for the analysis, in particular an overview of the impact of the climate transition on employment in the automotive industry and in the energy sector in the countries mentioned, identifying specific cases of job creation and job losses. In particular, the identification process of the cases draws upon: (1) evidence of job losses and job gains in the energy and automotive sectors respectively; and (2) geographical selection, namely converted or unconverted sacrifice zones. Section 3 analyses the climate transition in the NRRPs by country, in relation to employment stability, sacrifice zones in general and in relation to the identified cases and gender inequality. Section 4 provides a cross-country comparative analysis in terms of the NRRPs, highlighting their strengths, and of other mitigation/adaptation and industrial policies not directly under the scope of the NRRP frameworks, in order to compare the overall climate-policy actions undertaken by countries in relation to employment stability and equitable paths and as a way to rationalise the achievements they are making inside the NRRPs.

**FIGURE 2. Structure of the analysis.**



## 2. METHODOLOGY

The methodology consists of a comparative perspective along three main directions of investigation: sectoral, territorial and policy analysis for five European countries – Germany, Slovakia, Italy, Spain and Sweden. Specifically, this Recovery Watch is not limited to studying the climate transition displayed in the NRRPs in general, rather it adopts the identification of sacrifice zones in relation to job creation and job destruction in the energy and in the automotive sectors as the main criterion of the analysis.

As explained in Sections 2.1 and 2.2, the cases are identified before checking whether the NRRPs under analysis directly target such cases. This captures whether the NRRPs address the actual consequences of the climate transition already taking place, from a local perspective, and whether the reforms of the NRRPs push or not the climate transition towards equitable paths.

In addition, the NRRPs are evaluated in relation to other existing policies, beyond the recovery framework. The guess expectation is that existing and previous policy actions act as “reinforcement” policies, spurring virtuous mechanisms which strengthen existing conditions, creating synergies between the socio-economic system and different institutions, fostering positive externalities for which a country is more likely to be successful in the transition since it has already built the prerequisites to be. Likewise, the lack of existing policy actions to foster environmental sustainability and employment stability might undermine the overall efficacy of the NRRP.

In what follows, we specify each step of the methodology, namely the country case selection criteria, the sectoral and territorial focus, policy analysis and the adopted sources.

### COUNTRY CASE SELECTION

The rationale behind the country choice is the following: Germany as a continental country; Slovakia as a central eastern-European country; Italy and Spain to compare two Mediterranean countries; and Sweden as a “virtuous” Scandinavian country. In particular, Germany can be considered as the “productive engine of the European Union”, both in terms of the automotive and of the energy sectors (especially for renewable resources). Slovakia, as one of the Visegrad countries, is among the main suppliers and producers for the

German automotive industry (among other countries), but it is still economically and environmentally transitioning. The automotive sector is important both for the Spanish and the Italian economies and they are the countries benefiting from the largest share of resources from the recovery plans. Sweden employs a large proportion of workers in manufacturing and in the automotive industry and it is a positive benchmark case for environmental policies.

### SECTORAL AND TERRITORIAL FOCUS

In order to assess the research questions presented in the Introduction, the analysis focuses on the positive impact that the climate transition is expected to have on employment in the energy sector and on the negative impact expected in the automotive sector. Theoretically, we distinguish “green” versus “sacrifice” zones in each country/sector, investigating whether new green zones are the result of the conversion of sacrifice zones or, alternatively, whether existing sacrifice zones are planned to be converted into sustainable productive units to tackle the social-economic and health damages, controlling for the institutional and the public-policy involvement. We take into consideration a territorial dimension in order to understand not only at the macro, but also at the more local-geographical level, the effects of such policies.

To provide evidence of the impact of the climate transition on employment, specific cases in each country under analysis have been singled out, both for the energy and the automotive sectors. Section 2.1 reports a short overview of the cases, to have a first understanding of the impact of the climate transition in terms of job losses and new jobs. Specific cases will be developed in relation to the analysis of the NRRPs by country in Section 2.2.

For both sectors of interest, the main sources for the identification of the green and sacrifice zones and the EV and hybrid plants are the Global Petrochemical Map, the Automotive Manufacturer Solutions website, documents provided by the European Commission, academic and grey literature, newspapers and dedicated websites.



## 2. METHODOLOGY

### POLICY ANALYSIS

Given the chosen country, sectoral and territorial focus, we analyse the extent to which the NRRPs envisage intervening to achieve a just transition according to the four questions listed above. The NRRP analysis (Section 2.2) examines whether the NRRP of each country includes the selected cases as “policy target”. For the policy analysis, the main sources are the recovery plans, the dedicated web pages on the European Commission website and each country’s government’s dedicated websites and documents.

Taking a path-dependent approach to policy analysis, the extent to which previous policy initiatives have already been implemented or designed in the identified territorial areas is accounted for. The main source is the International Energy Agency (IEA) and dedicated websites of the public institutions implementing the policies. Specifications for the policy and comparative analysis are presented at the beginning of the dedicated sections, namely Sections 2.2 and 3.

### 2.1 IDENTIFIED CASES

This section presents evidence of the impact of the climate transition on employment, from a sectoral and territorial point of view. Tables 1 and 2 report the identified cases, considered to be informative in terms of employment effects, conversion of sacrifice zones into green zones, and targets by the NRRPs and of other policy initiatives different from the recovery plans. The focus on sectors, in particular the energy and the automotive sectors, allows us to identify and quantify the job creation versus job destruction dichotomy of the climate transition. The sacrifice zones identification is the key selection criterion to target the policy analysis, in relation to the just transition concept as well. Additional information is provided in the Appendix.

Table 1 for the energy sector is structured as follows: the first column reports the geographical area; the second column reports the name of the green case, that can be either a project, facility or plant;<sup>21</sup> and the third column reports the expected impact in terms of job creation. “NA” indicates that it was not possible to get this information for the existent cases or, when there is no green case, that the net impact on employment in the area is not known.

Take, for instance, the city of Taranto in Southern Italy. It is characterised by a long history in the steel industry, providing jobs but at the same time the cause of serious environmental and health damage to the area. Despite the explicit acknowledgement of the need for conversion of the steel plant and the proposal of different projects, no information about the conversion and the job impact is detectable. The same reasoning applies to the coal-mining area in Sulcis-Iglesias in Sardegna in Italy.

The fourth column of Table 1 identifies whether or not the green case is the outcome of the conversion of a sacrifice zone. “NO” highlights that the green case is not the outcome of the conversion of a sacrifice zone, namely the area was not a sacrifice zone in the first place: it is instead the result of a greenfield policy. For instance, the “Clean Energy Valley” in Germany in Schleswig-Holstein (Case 1) which was the first state (Land) in Germany to reach the target of 100% of renewable resources, in 2014, was not the outcome of the conversion of a sacrifice zone, but rather the result of a greenfield initiative. At the opposite end, “YES” highlights that the area was a sacrifice zone or the project/facility/plant employs dismissed plants in the area. For instance, the Italtel gigafactory in Scaramagno (Italy) has been based on the site of the former and dismissed typewriter-production firm Olivetti.

Finally, the fifth column specifies whether the green cases are the outcome of a public-policy initiative and the sixth column specifies whether the NRRP targets the case. The final column specifies the advancement status of the case: “LOW” means that the case is a project which has been only planned and requires to be implemented and even to be financed; “MEDIUM” refers to a project which has been developed but has yet to start, while “ADVANCED” means that the production activity is operative.

From Table 1, the expected impact of the green cases in the energy sector are all positive. Indeed, the climate transition is inducing the growth of “green” sectors, creating new job opportunities, specifically in energy.

Table 2 reports the identified cases for the automotive sector. The first column reports the country and the area, the second column specifies the original equipment manufacturer (OEM) and the third column whether the plant under consideration has shifted to the production of electric engines, indicated by “YES”, or whether the identified case is a gigafactory or pursues a different production activity in the supply chain of the automotive sector



(like Kechnec in Slovakia). The fourth column indicates whether the activity is taking place in a converted sacrifice zone. For instance, NEVS produces electric engines in the former plant of the dismissed car manufacturer Saab in Trollhättan in Sweden.<sup>22</sup>

Table 2, as for Table 1, specifies the expected job impact and – given that in the automotive industry several losses are observed – whether the workers who have lost or will

lose their job will be reallocated. The final three columns report the policy involvement both in the NRRPs and of the policy framework out of the recovery facility and the advancement status of the case. As seen from the expected impact, job losses are found and mainly no reallocation in the plants which are converting their production activity into the production of the electric engine, while job gains are found in gigafactories and manufacturing activities related to electric-engine manufacturing.

**TABLE 1. Identified cases in the energy sector.**

	COUNTRIES AND AREAS	GREEN CASE	EXPECTED JOB IMPACT	CONVERSION OF A SACRIFICE ZONE	POLICY INITIATIVE	NRRP	ADVANCEMENT STATUS
1	Germany, Schleswig-Holstein	Clean Energy Valley	NA	NO	YES	YES	High
2	Germany, Bittelfeld-Wolfen	The Solar Valley	NA	YES <sup>23</sup>	NO	NO	High
3	Slovakia, Trenčín, Horná (Upper) Nitra	NA	NA	YES	YES	NO <sup>24</sup>	Low
4	Spain, Mallorca	Green Hysland	NA	YES <sup>25</sup>	NO	YES	Low
5	Spain, Asturias	Iberdrola	NA	YES	NO	YES	Low
6	Spain, Puertollano	Iberdrola & Fertiberia	+700 created, +4,000 (2,000 by 2023)	NO	NO	YES	Medium
7	Italy, Valle d'Agri (Basilicata)	Energy Valley	+300	YES	NO	YES	Low
8	Italy, Terni	LIFE3H	NA	YES <sup>26</sup>	YES	YES	Low
9	Italy, Civitavecchia and Altopiano delle Rocche	LIFE3H	NA	YES <sup>27</sup>	YES	YES	Low
10	Italy, Alto Adriatico with Croatia and Slovenia	Northern Hydrogen Valley	NA	NO	YES	YES	Low
11	Italy, Taranto	NA	NA	YES	YES	YES <sup>28</sup>	NA
12	Italy, Sulcis-Iglesias	NA	NA	YES	YES	NO <sup>29</sup>	NA
13	Italy, Scarmagno	Italtolt, Gigafactory	+13,000	YES	NO	YES	Medium
14	Sweden, Norrbotten	T25-Project	+25,000	YES	YES <sup>30</sup>	NO	Low
15	Sweden, Göteborg	Northvolt, Gigafactory	+3,000	YES <sup>31</sup>	NO	YES	Medium
16	Sweden, Skellefteå	Northvolt, Gigafactory	+3,000	NO	NO	YES	Medium
17	Sweden, Borlänge	Northvolt, Gigafactory	+1,000	YES <sup>32</sup>	NO	YES	Medium



## 2. METHODOLOGY

**TABLE 2. Identified cases in the automotive sector.**

	COUNTRIES AND AREAS	OEM	SHIFT TO THE ELECTRICENGINE	EXPECTED JOB IMPACT	REALLOCATION	CONVERSION OF A SACRIFICE ZONE	POLICY INTERVENTION	NRRP	ADVANCEMENT STATUS
1	Germany	Audi	YES	-9,500 +2,000 by 2025	NO	NO	YES	NO	LOW
2	Slovakia, Bratislava	Volkswagen	YES	-3,000	NO	NO	NO	NO	Advanced
3	Slovakia, Kechnec	Magna	NO (Manufacturing of assistance components for electric cars)	+100 by the 4th quarter 2022 +600 by 2027	NA	YES	NO	NO	Medium
4	Spain, Martorell	SEAT	YES	-2,400 direct jobs (Martorell) -1,000 (El Prat)	NA	NO	YES	YES	Advanced
5	Spain, Sagunto	Volkswagen	YES (gGigafactory)	+3,000	NA	NO	YES	YES	Low
6	Italy, Bari	Bosch	YES	NA	NA	NO	YES	NO	Low
7	Italy, Bari	Marelli	YES	-550	NA	NO	NA	NO	Low
8	Italy, Grugliasco	Stellantis (Maserati)	YES	-1,100	YES	NO	NO	NO	Medium
9	Italy, Termoli	Stellantis	YES (gGigafactory)	+2,400	NA	NO	YES <sup>33</sup>	YES	Low
10	Sweden, Trollhättan	NEVS	YES	+tThousands (since 2019)	NA	YES	NO	NO	Advanced

Table 3 reports the total jobs created and total job losses from the identified cases in Tables 1 and 2 respectively. In the next section we cover the Recovery Watch analysis.

The Appendix presents some descriptive statistics on CO2 and NOX emissions of the identified cases.

**TABLE 3. Total new/lost jobs from the identified cases.**

	ENERGY SECTOR	AUTOMOTIVE SECTOR		
		(-)	OEMS, GIGAFACTORIES (+)	OTHERS (+)
Total number of new/lost jobs	+47,000	-17,550	5,400 (Volkswagen and Stellantis) + thousands (NEVS)	+2,700 (Audi and Magna)

## 2.2 RECOVERY WATCH: CLIMATE TRANSITION IN THE NRRPS

Moving to the central theme of the analysis, the following investigates whether each country's NRRP targets the identified cases and, if so, how. The most relevant cases briefly presented in Section 2.1, in Tables 1 and 2, are described in relation to the NRRPs. The interventions in terms of just transition are focused on, namely whether the plans entail:

- intervening in sacrifice zones;
- preserving jobs;
- reskilling the workforce; and
- addressing gender asymmetries spurred by the climate transition.



2. METHODOLOGY



## GERMANY

### RESOURCES FOR THE CLIMATE TRANSITION AND ENERGY SECTOR

The German NRRP entitles Germany to subsidies of around €23.641 billion and 40% of them will be devoted to climate action. Specifically, 11.1% for decarbonisation using renewable hydrogen, 22.6% for climate-friendly mobility and 9% for climate-friendly renovation and construction. According to the plan, investments in green and digital technologies will boost productivity and create 135,000 new jobs, with green hydrogen being identified as the driving technology.

### AUTOMOTIVE SECTOR

Regarding the automotive industry, the plan extends the market incentive programme of 2016, providing for a bonus for purchases of electric vehicles and resources for the charging infrastructures. In addition, this programme entails the transformation of the automotive sector overall, as a consequence of the impact of the climate transition, specifically the maintenance and creation of jobs, growth and the industry's viability in the future.<sup>34</sup> Also, the Development of skills alliances for small and medium-sized enterprises (SMEs) promotes innovation and training for a future-oriented economy and labour market.<sup>35</sup> (See Audi, Case 1, Table 2.)<sup>36</sup>

### PLACE SPECIFIC

The German NRRP does not directly refer to specific sacrifice zones and places subject to the transition, neither in the energy nor in the automotive sector. Indirectly, it refers to the role that the Länder have in the climate transition. Indeed, one of the main objectives among others is to integrate projects in the entire supply value chain by building up large-scale electrolysis capacity to produce green hydrogen in places already characterised by high availability of electricity from renewable resources. According to the analysis here, Schleswig-Holstein could be a target region for the production of green hydrogen, given that it is considered as the crib of the Energiewende, the “clean energy valley” (Case 1, Table 1), and employs 19,000 people in the renewable-energy facilities.<sup>37,38</sup> The German NRRP also mentions that the federal government is supporting the areas hit by coal phase-out structural change, but it does not directly refer to specific areas.

### GENDER

The German NRRP does not address gender inequality in the climate transition.

2. METHODOLOGY



## SLOVAKIA

### RESOURCES TO THE CLIMATE TRANSITION AND ENERGY SECTOR

The Slovak NRRP allocates €2.301 billion to the green transition, corresponding to 43% of total resources to be developed into five main directions: decarbonisation of the economy; deployment of renewable energy sources and energy infrastructure; climate-change adaptation; sustainable transport; and building renovation.

According to the analysis by the ZOE Institute for Future-fit Economies,<sup>39</sup> the Slovak NRRP has a great potential to adapt its economy transition to the climate transition. In particular, green jobs are expected to be created in the public transportation sector, and the retrofitting of private and public buildings for energy efficiency will foster employment, especially for SMEs, upskilling the workforce.

### AUTOMOTIVE SECTOR

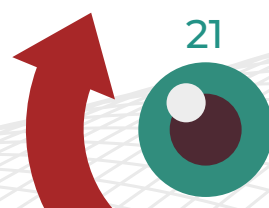
Although the Slovak economy being heavily reliant on the automotive-manufacturing industry,<sup>40</sup> the Slovak recovery plan does not include the effects of the transition of the sector on employment, despite job losses in plants where the production has shifted to electric-vehicles manufacturing, as in the Volkswagen plant in Bratislava (Case 2, Table 2) where 3,000 jobs have been lost.<sup>41</sup> Slovakia has been characterised by a strong dependency on foreign technology and capital transfers, and the supply of skilled low-cost labour, thus the Slovak employment and economy is at high risk in the case of shocks in the sector.<sup>42</sup> For instance, the possibility to offset job losses by creating new job opportunities within battery manufacturing would be excluded if lithium-ion batteries for EVs were imported, just as with other technologies in the past. An example is the German supplier and contract manufacturer Magna investing in a new plant in Kechnec (Case 3, Table 2) to produce components for assistance systems for electric cars.<sup>43</sup> The NRRP only refers to the taxation programme for CO<sub>2</sub> emissions.

### PLACE SPECIFIC

The Slovak NRRP directly mentions only the Trenčín, Horná Nitra (Upper Nitra) case. One of the objectives to reach within decarbonisation is the conversion of the Horná Nitra region (Case 3, Table 1), where the coal-mining activity has provided for energy independence and secure employment. Indeed, the region counts 7,000 jobs in the coal-mining sector.<sup>44</sup> No resources of the NRRP will be devoted to the region, given that they are eligible for other European resources (the Just Transition Fund), while other locations are not.<sup>45</sup> According to the NRRP, 10,000 jobs are expected to be created.

### GENDER

The Slovak recovery and resilience plan does not directly refer to gender inequality or, for the sake of this analysis, to gender differences in the climate transition.



2. METHODOLOGY





## SPAIN

### RESOURCES TO THE CLIMATE TRANSITION AND ENERGY SECTOR

40.29% of the investments of the Spanish NRRP are devoted to the climate transition. The plan specifies the need for a “just” transition. 9.2% of the resources of the NRRP will be invested to obtain a fair and inclusive climate transition. In particular, 4.6% will go to renewable energies implementation and integration, 2% will go to electrical infrastructures (promotion of smart networks and deployment of flexibility and storage), 2.2% will go to renewable hydrogen and sectoral integration and 0.4% will go to a fair-transition strategy. Regarding the impact on employment, the NRRP highlights that the resources have to promote jobs and training in the sectors of the future.<sup>46</sup>

### AUTOMOTIVE SECTOR

The Spanish recovery plan does not consider the effect that the electrification and digitalisation of industry and mobility as consequences of the climate transition may have on employment in the automotive sector, despite ongoing job losses (SEAT, Case 4, Table 2).<sup>47</sup> However, Volkswagen and SEAT are building a gigafactory in Sagunto (Case 5, Table 2) for which 3,000 new jobs are expected to be created.<sup>48</sup> Indeed, SEAT’s Future Fast Forward plan is the first Strategic Projects for Economic Recovery and Transformation (PERTE) presented for the automotive sector, a new form of public–private partnership promoted by the Spanish NRRP.

### PLACE SPECIFIC

The Spanish NRRP specifically tackles the issue of “sacrifice zones” according to the definition adopted in this policy study, but no reference directly addresses specific places. €91.35 million, €113.65 million and €103 million respectively are invested in 2021, 2022 and 2023 to sustain employment to dismissed coal mines and to coal-fired power stations where 3,300 workers are directly employed and 10,000 indirectly, specifically supporting women, the young, and unemployed individuals over 52 years old.<sup>49</sup> For instance, the dismissed coal-fired power station in Lada, Asturias, is the target of the company giant Iberdrola to produce green hydrogen (Case 5, Table 1; see also the Iberdrola and Fertiberia project,<sup>50</sup> Case 6, Table 1).<sup>51</sup>

Within the hydrogen strategy, the Spanish NRRP addresses the “Smart Islands” projects, aimed at promoting the use of renewable-energy transition on islands. Mallorca, with the “Green Hysland” project, will be the first ecosystem producing and delivering green hydrogen in Southern Europe<sup>52</sup> (Case 4, Table 1). The NRRP does not mention this project and Mallorca directly.

### GENDER

Spain’s NRRP presents the expected effects of the plan on the gender gap in employment, wages and digital skills. Particularly relevant for the gender dimension of the climate transition, the plan presents investments in the creation of early education places (€670 million), actions to promote STEM professions in schools (€256 million), investments to support female entrepreneurship (€46 million) and support for female victims of gender-based violence (€153 million).

2. METHODOLOGY



## ITALY

### RESOURCES TO THE CLIMATE TRANSITION AND ENERGY SECTOR

Italy is the country which has received the highest share of resources for the recovery, €68.9 billion in grants and €122.6 billion in loans to be invested between 2021 and 2026. Particularly, the plan allocates 37% of the resources to the climate transition, focusing on the implementation of green hydrogen valleys, specifically in dismissed existing inactive industrial plants already connected to the electricity grid.

The Italian NRRP highlights the importance of encompassing complementary and adaptation reforms outside the NRRP but that are crucial for the success of the NRRP measures, as the national budgetary fund of €31 billion and the Development and Cohesion Fund 2021-2027 as an integration to the NRRP.

### AUTOMOTIVE SECTOR

The Italian NRRP does not mention any intervention for the expected job losses in the automotive sector, despite several jobs being at risk (Magnet Marelli, Case 7, Table 2; Bosch in Bari, Case 6, Table 2; Maserati Stellantis in Grugliasco, Case 9, Table 2).<sup>53</sup>

### PLACE SPECIFIC

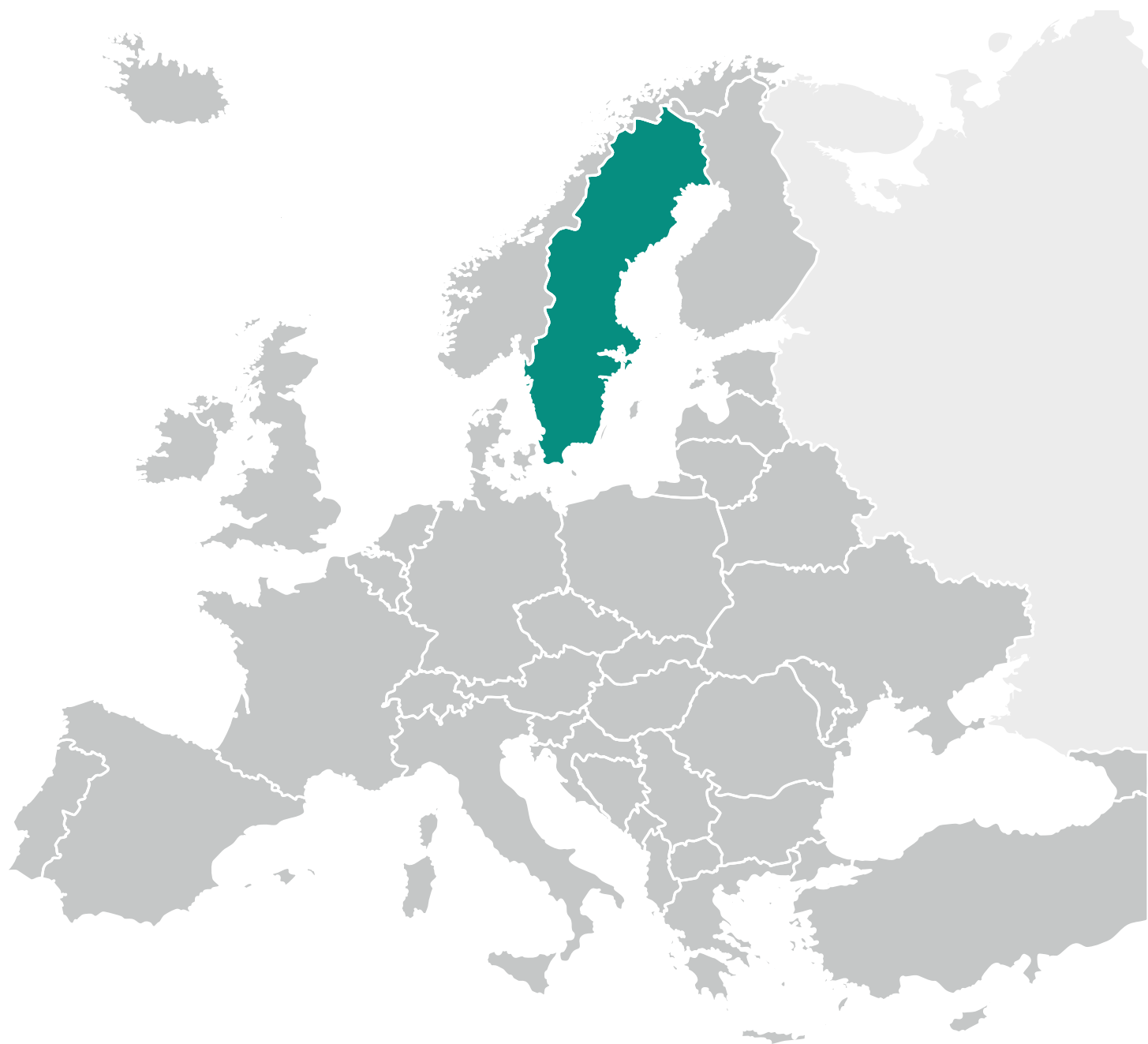
The Italian NRRP does not identify specific places, only the general case, specifically the conversion of the steel sector, the production, use and supply of green hydrogen, and agri-solar parks.

The Italian NRRP mentions the long history of the steel sector in Italy and the need to decarbonise the production process of steel by deploying green hydrogen. A plan is provided in relation to the transition toward a “green steel” production of Taranto’s steel plant (Case 11, Table 1) where 20,000 jobs are at risk.<sup>54</sup> The Hydrogen Valley in the city of Terni (Case 8, Table 1) will use the hydrogen for the production of steel (see also Cases 9<sup>55</sup> and 10<sup>56,57</sup> in Table 1). In addition, the Italian NRRP addresses the climate transition through the promotion of “agri-solar” parks (Case 7, Table 1)<sup>58</sup> and the production of batteries for EV engines in the transport sectors and of vehicles (gigafactory in Scarmagno,<sup>59</sup> Case 13, Table 1; gigafactory in Termoli,<sup>60</sup> Case 9, Table 1), to increase Italian competitiveness and create new jobs by investing in human capital and upskilling.

### GENDER

The Italian NRRP aims at fostering female education in STEM subjects,<sup>61</sup> but the NRRP does not directly address it in relation to the climate transition. However, the NRRP directly refers to gender inequality in the climate-friendly renovation and construction of public residential housing. Because of gender imbalances in household roles, mostly women are single parents and suffer from housing shortages more than men.

2. METHODOLOGY



## SWEDEN

### RESOURCES TO THE CLIMATE TRANSITION AND ENERGY SECTOR

As mentioned in the Swedish NRRP, Sweden is close to reaching the zero-emissions target thanks to its long history in ambitious environmental policy framework. Investments need to be undertaken in “climate-smart” techniques, which will be able to foster employment, driving fossil-free and circular solutions, fostering competition and export opportunities in order to enable other countries to reach the climate targets as well. Within the green recovery the resources will be devoted to investments in the industrial transition (2.9 billion Swedish kroner) and to the climate transition (5.35 billion Swedish kroner). Investments in fossil-free productive activities and in circular sectors will not only foster Swedish competitiveness, but also create new jobs.

### AUTOMOTIVE SECTOR

The Swedish NRRP does not directly refer to the automotive sector.

### PLACE SPECIFIC

On the one hand, the NRRP relates to complementarity to the Just Transition Fund intervention in specific regions, directly mentioning those identified in Table 1. On the other hand, it refers to engineering and technical programmes being augmented with environmental curricula. The Universities of applied sciences have introduced skills-updating and environmental adaptation of the economic system, but the plan does not mention a specific example such as the T-25 project in Norrbotten (Case 14, Table 1). With this project, the University of Luleå<sup>62</sup> is planning to attract 25,000 people into the territory, increasing the number of students in engineering and providing an occupation after their graduation in new productive activities, for instance in Northvolt’s gigafactory<sup>63</sup> (Cases 15, 16 and 17, Table 1)<sup>64, 65, 66</sup>. The Swedish NRRP does not directly mention these cases, either.

### GENDER

Concerning the gender dimension, the plan directly states that since the climate transition has affected male-dominated sectors, such as manufacturing and the construction industry, the climate transition is characterised by a possible enhancement of gender inequality if not tackled. Indeed, the Swedish plan suggests that the Swedish Protection Environmental Agency together with the regional governments should specifically tackle gender inequality in their core activities together with the Gender Inequality Authorities, toward a gender-equal climate transition. At the same time, the plan establishes that the Environmental Protection Agency evaluates projects applying for the recovery funds also on the basis of lack of gender bias.

### 3. COMPARATIVE ANALYSIS

In this section we outline a comparative analysis of the countries regarding the reforms for the climate transition planned under their respective NRRPs as well as the mitigation/adaptation policies outside their NRRP. We compare the strengths of the different countries in terms of policy interventions, both including the NRRPs analysed so far and mentioning different policies from the Recovery Facility.

As defined in the Introduction and Glossary, industrial policies consist of top-down, strategically defined investment policies directly affecting the productive dimension of the economic system, with the aim to spur new industrial activities or to push existing ones toward a new direction (for example, the creation of new jobs via investments promoting new gigafactories or hydrogen valleys). “Mitigation” refers to policies to avert future damage and reduce the cost of transitioning, while “adaptation” refers to policies to prevent degradation from causing damage, to cope with changing scenarios and reducing the mismatch (for example, the reskilling of workers, avoiding job losses in the automotive sector because of the shift to EV engines). Policies are labelled as industrial-mitigation/adaptation through the text.

Examining the involvement of policies and public investments different from the NRRP completes the evaluation of the climate transition of each country under analysis, given that such policies may act like reinforcement policies to the recovery reforms. As explained in the Methodology, deepening the analysis of policy involvement allows us to identify differences within and across the countries in responding to the impact of climate transition, on the implementation of virtuous cases and by taking care of socio-economic consequences in the negative cases. In particular, we find that existing policy frameworks are one of the underlying explanations of the differences across the NRRPs. In fact, the most virtuous cases identified are mainly the result of efficient synergy across public and private institutions driven by existing policy relationships and contexts. Existing policies create positive feedback effects.

The positive relationship between the virtuousness of the reforms for the climate transition entailed by the recovery plans and the presence of existing policy actions is particularly evident for Spain and Sweden.

“

The Swedish NRRP distinguishes itself by the strong focus on the climate transition, in particular for the "Do no significant harm" principle (DNSH), gender inequality and sacrifice zones.

”

**Sweden** can be defined as a best-practice example with respect to the other countries under analysis in achieving a just climate transition. Sweden is also identified as the global leader of the decarbonisation process of its economy,<sup>67</sup> the first to introduce carbon pricing. As early as 1975, the Swedish government was funding research into the use of renewable resources and has taxed emissions since 1991. In 2006, education reform included the introduction of sustainability programmes (law 1992:1434, mitigation/adaptation policy), while since 2009 the Vehicle Strategic Research and Innovation (FFI) programme<sup>68</sup> (mitigation/adaptation policy) has accompanied the transition of the automotive industry. The Swedish NRRP distinguishes itself by the strong focus on the climate transition, in particular for the “Do no significant harm” principle (DNSH),<sup>69</sup> gender inequality and sacrifice zones. Indeed, we could define the Swedish NRRP as the highest benchmark with respect to the other countries under analysis, as it envisages the best practices to achieve a just transition. For each component of the plan, we can find the possible environmental (and digital) implications (DNSH). For instance, in the education component, we find that the investments in education have to entail training and reskilling of the workforce to match the demand on a greener labour market. Furthermore, all the recovery measures are expected to be complementary to the action of the Just Transition Fund (industrial policy) in order to achieve a just climate transition. Therefore a multi-dimensional, integrated policy perspective is put forward.

**Germany** has implemented its Energiewende (industrial policy) since 2010. This is a climate transition plan aimed at fostering efficiency of the economic system, making it sustainable by the deployment of renewable resources. The NRRP presents several strengths to achieve climate sustainability. The main distinct factor of the German NRRP is the attention given to the automotive sector. Indeed, the NRRP entails a vehicle manufacturer/supply industry programme which regards environmental and digital investments, assessing also training programmes. In addition, the Development of skills alliances for SMEs provide for innovation clusters with training programmes to match the demand of a new labour market. Interventions in sacrifice zones are not considered by the plan since it highlights the fact that structural changes funded by different instruments than the NGEU, such as the Just Transition Fund (industrial policy), should be evaluated in a broader examination of the German policy framework. The NRRP highlights the potential of its investments in the creation of thousands of green jobs. The NRRP relies significantly on the interventions of the Länder. In particular, the German recovery plan allocates funds to foster the use of renewable resources in areas where the production and supply of renewable energy is already taking place. Indeed, the existence of a policy framework at regional level is crucial to achieve the climate targets aimed by the NRRP.

Other measures worth mentioning are the Zukunftsfonds Automobilindustrie (mitigation/adaptation policy) measure aimed at developing a just transition of the automotive industry,<sup>70</sup> especially in terms of maintaining and creating jobs, and the Sustainable Battery Cells Production (industrial policy) measure fostering a new sector to increase competitiveness and employment, by reskilling the workforce in future-oriented sectors.<sup>71</sup>

“

The German recovery plan allocates funds to foster the use of renewable resources in areas where the production and supply of renewable energy is already taking place.

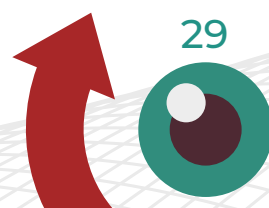
”

“

The Spanish NRRP intervenes in the requalification of sacrifice zones (coal-mining areas) and the reskilling of the workforce living in these areas, with a specific focus on employment opportunities for women.

”

**Spain** has implemented several policy interventions in previous years, given its socio-economic delay with respect to other European countries. Such pre-NRRP investments have turned out to be fertile grounds for an efficient allocation of the NRRP resources.<sup>72</sup> The country's NRRP envisages achieving a multi-dimensional just transition including conversion of left-behind places, tackling gender inequality and creation of new job opportunities. The Spanish NRRP covers all the main issues of the climate transition: it intervenes in the requalification of sacrifice zones (coal-mining areas) and the reskilling of the workforce living in these areas, with a specific focus on employment opportunities for women. Through the PERTE instrument provided by the recovery plan, SEAT and the Spanish government are applying for resources to ease the transition of the automotive industry towards EV production. The main policies that differ from the NRRP of concern for our analysis are the Plan del carbon (mitigation/adaptation policy), which saved thousands of jobs in the coal-mining sectors in 2018, the Globalisation Adjustment Fund for Displaced Workers (mitigation/adaptation policy) to which Catalonia<sup>73</sup> applied to subsidise workers because of the automotive-sector crisis, the automotive sector competitive plan<sup>74</sup> and the Spain mobility stimulus<sup>75</sup> (industrial policy), which are built on the premise of avoiding job losses and reskilling the workforce in the automotive sector, plus the subsidies for employment in the green sector<sup>76</sup> (mitigation/adaptation policy).



### 3. COMPARATIVE ANALYSIS

**Italy** presents weak ex ante policy frameworks, and lack of public investments present poorly detailed and specific policy interventions in the NRRP to address the policy challenges of the climate-change transition. The Italian NRRP distinguishes itself by the conversion of dismissed industrial areas and plants into green energy production and supply systems. The plan allocates resources to the upskilling of the workforce, defined as fundamental for a successful transition, and it entails the need to foster female representation in STEM activities. The Development and Cohesion Fund (industrial policy) financed by the government and complementary to the recovery fund is the main policy intervention out of the Recovery Facility framework, which is expected to create positive synergies with the recovery reforms. The role of Italian regions emerges as a key player in the implementation of virtuous cases, such as the proposal of the region Puglia for the conversion of the steel plant in Taranto (industrial policy) together with the involvement of the Just Transition Fund (industrial policy). No other planned specific mitigation or industrial policies have been identified.

“

The Italian NRRP distinguishes itself by the conversion of dismissed industrial areas and plants into green energy production and supply systems. The plan allocates resources to the upskilling of the workforce, defined as fundamental for a successful transition, and it entails the need to foster female representation in STEM activities.

”

“

The climate transition planned by the Slovak NRRP has great potential to preserve the environment and create green jobs. As pointed out by the IEA, Slovakia has implemented only European Union regulations, therefore it lacks industrial and mitigation policies within the climate-policy framework.

”

**Slovakia** is still economically transitioning, since it is one of the Visegrad countries. Its economy heavily relies on foreign direct investments, especially from the German economy in the automotive industry<sup>77</sup> and it has based its production on coal-mining activities and oil. Its energy supply relies in part also on hydro and geothermal power and the NRRP aims at fostering the deployment of these energy resources. The Slovak NRRP allocates resources to the conversion of sacrifice zones, but not of the Upper Nitra region since it has already benefited from the Just Transition Fund (industrial policy) and the Slovak government prefers to devote resources to other regions which are not eligible (also because of the “no double funding” principle to be respected by the NRRP imposed by the European Commission). The climate transition planned by the Slovak NRRP has great potential to preserve the environment and create green jobs. As pointed out by the IEA, Slovakia has implemented only European Union regulations, therefore it lacks industrial and mitigation policies within the climate-policy framework.



In what follows, we provide synoptic tables to summarise the main findings from the comparative analysis of the NRRPs and other policies in place. Table 4 summarises the main strengths of the NRRPs for each country; Table 5 presents the specific NRRP measures and other industrial and mitigation/adaptation policies targeting

the energy sector and the automotive sector; and Table 6 shows the policy actions for the labour market, in particular the reskilling and creation of jobs and the gender-based policies for transition. Notice that no policy out of the recovery framework has been implemented to tackle gender inequality.

**TABLE 4. Strengths of the NRRPs, by country.**

	SPAIN	SWEDEN	GERMANY	ITALY	SLOVAKIA
MAIN STRENGTHS OF NRRP	<p>Policies to avoid job losses</p> <p>Reskilling in sacrifice zones and declining and transition sectors</p> <p>Improvement in female employment</p>	<p>Strong emphasis on achieving a just climate transition focusing on the gender dimension, through a holistic and consistent assessment of sustainability issues via DNSH</p> <p>Linking climate and digital policies</p>	<p>Comprehensive plan for transition of automotive-sector jobs</p> <p>Integration /coordination with regional (<i>Länder</i>) initiatives</p>	<p>Conversion of dismissed production sites into green production ecosystems</p>	<p>Development of alternative energy</p> <p>Conversion of sacrifice zones</p>



### 3. COMPARATIVE ANALYSIS

**TABLE 5.** Comparative analysis of policies for the energy sector in sacrifice zones and the automotive sector, by country.

	SPAIN	SWEDEN	GERMANY	ITALY	SLOVAKIA
<b>ENERGY SECTOR: SACRIFICE ZONES</b>					
NRRP	Requalification of dismissed coal-mining areas and activities	Complementary measures to the Just Transition Fund in regions based on iron, steel and coal-mining production activities	NO	Deployment of dismissed industrial areas	Acknowledgement of the need for conversion of the Horná Nitra region and allocation of resources to areas which can't benefit from the Just Transition Fund.
INDUSTRIAL POLICY	Just Transition Fund (regional)	Norrbottn sustainable future (regional)	<i>Energiewende</i> Just Transition Fund (regional)	Proposal of the region Puglia for the conversion of the steel plant in Taranto (regional)  Just Transition Fund (regional)	Upper Nitra conversion.  Just Transition Fund (regional)  Government projects
OTHER MITIGATING/ ADAPTATION MEASURES	Plan del carbon	NO	NO	NO	NO
<b>AUTOMOTIVE SECTOR</b>					
NRRP	Indirectly, SEATs' Future Fast Forward plan	NO	Vehicle manufacturer/ supply industry programme  Assessing also training programmes	NO	NO
INDUSTRIAL POLICY	Automotive sector competitive plan  Spain mobility stimulus	NO	Sustainable battery cells production measure	NO	NO
OTHER MITIGATION/ ADAPTATION MEASURES	Globalisation Adjustment Fund for Displaced Workers	Vehicle Strategic Research and Innovation (FFI programme)	Zukunftfonds Automobil Industrie	NO	NO

**TABLE 6. Comparative analysis of labour-market policy action for the climate transition: gender inequality measures and policies for reskilling workforce, by country.**

	SPAIN	SWEDEN	GERMANY	ITALY	SLOVAKIA
MEASURES FOR GENDER INEQUALITY IN RELATION TO THE CLIMATE TRANSITION					
NRRP	<p>Focus on the investments for requalification of sacrifice zones</p> <p>Promotion of STEM professions in schools (€256 million)</p>	<p>Focus on gender inequality in the creation of green jobs</p> <p>Control for gender bias in the selection process of projects</p>	NO	<p>New Skills Fund</p> <p>Fostering female representation in STEM</p> <p>Gender imbalances in the climate-friendly renovation and construction of public residential housing</p>	NO
PRESERVING JOBS/ RESKILLING FOR THE CLIMATE TRANSITION					
NRRP	<p>Requalification in sacrifice zones</p>	<p>Introduction of sustainability programmes in all schools</p>	<p>Vehicle manufacturer/ supply industry programme</p> <p>Development of skills alliance for SMEs</p>	<p>Upskilling for a successful green transition</p> <p>Use of dismissed industrial plants</p>	<p>Potential of the reforms within the climate transition</p> <p>Retrofitting buildings</p>
OTHER MITIGATING/ ADAPTATION MEASURES	<p>Subsidies for employment in the green sector</p> <p>Automotive sector competitive plan</p>	<p>1992: 1413 University Act, reform of 2006</p>	NO	NO	NO

## 4. FINAL REMARKS AND CONCLUSIONS

This policy study aims to address the extent to which the national recovery and resilience plans adopted by member states are able to combine environmental sustainability and employment stability. In other words, how a climate transition can be reconciled with the notion of a just transition. This framing question has been looked at through the lens of economic geography, with a specific territorial focus on “left-behind” places. We have identified three main policy challenges, namely employment effects, environmental inequalities and gender inequalities. Given this theoretical framework, we have examined the presence of mitigation/adaptation policies for the labour markets, as defined by the ILO, and of industrial policies. Overall, the scope of this policy study is to evaluate whether the policy actions are actually able to confront the policy challenges listed and how effective they are in doing that, specifically targeting left-behind places and the most vulnerable areas.

In terms of sectoral dynamics, we have analysed the automotive and the energy sectors in five selected countries, namely Germany, Slovakia, Spain, Italy and Sweden, chosen in order to be telling of different types of national experiences. For each country-sector we have identified both positive experiences of “green areas” and negative experiences of “sacrifice zones” and examined the role of private and public actors involved in the definition of such areas.

With respect to our first research question, we find that despite country heterogeneity, none of the NRRPs envisage direct policy interventions concerning environmental sustainability and employment stability with a multi-level, integrated approach. On the one hand, the NRRPs and national policies entail the implementation of battery manufacturing and the training of workers in new, growing green sectors, the need for reskilling the workforce, and the promotion of e-mobility and the purchase of electric vehicles through tax exemptions and purchase bonuses. On the other hand, no assessment is found for the job losses in the automotive sector. Given that lithium-ion battery manufacturing is expected to absorb part of the job losses in the automotive sector, the issue looks to be only indirectly tackled via market-based mechanisms. However, it is expected that battery manufacturing will not be able to absorb the entire expelled workforce. Hence, there will be unemployed workers whose future is still uncertain, given that there are no explicit considerations on this topic within the respective NRRPs.

With respect to the second research question, as highlighted in the comparative analysis, Sweden, Spain and Germany have all implemented industrial and coordinated policies for the climate transition, both in the energy and in the automotive sector, investing in infrastructures to promote sustainable mobility and battery cells production, addressing sacrifice zones by means of the Just Transition Fund. In addition, both mitigation/adaptation policies specially aimed at enhancing workforce skills to sustain the conversion of the labour market in the climate transition are envisaged. Indeed, country heterogeneity stands out: in general, countries already tackling the climate-change transition with effective policy interventions, as in the case of Sweden, are able to benefit more from the NRRPs. In turn, these NRRPs are also far more targeted, specific and better elaborated. Likewise, the lack of previous policy experience in tackling climate-change transition and employment stability results in more generic and less precise policy guidelines, not able to properly and directly address the policy challenges.

“

None of the NRRPs envisage direct policy interventions concerning environmental sustainability and employment stability with a multi-level, integrated approach.

”

Indeed, with respect to the third research question, the main industrial policies creating decarbonising activities and related job opportunities that we find in the NRRPs are in hydrogen production and supply, and in gigafactories. Investments in sustainable mobility and battery cells production are the main industrial policies launched and implemented out of the recovery framework.

“

The only interventions are reskilling mitigation policies which are indirectly addressed to women as well, but no industrial policies aimed at creating employment opportunities for women are conceived.

”

Therefore, we expect countries with established policy interventions to be more successful in achieving a just transition as addressed by the fourth question. Although the potential growing employment trend predicted by many studies, the energy sector will hardly be able to compensate for the overall employment losses deriving from expelling sectors, the former characterised by a low employment share and by high capital-intensity. At the same time, gender policies directly assessing the gender dimension in the climate transition are not explicitly found. To achieve a successful, just transition, gender inequality should also be addressed. Because of occupational segregation and low female representation in STEM subjects, women risk being left out of the new job opportunities in growing sectors. The only interventions are reskilling mitigation policies which are indirectly addressed to women as well, but no industrial policies aimed at creating employment opportunities for women are conceived.

Finally, market-based mechanisms such as incentives and fiscal deductions still play a larger role in the implementation phase of the policy initiative. Indeed, the very same policy objective assumes different effects in regard to the instrument of implementation.

Market-based mechanisms tend to be ineffective and too slow in allowing the goal of a decarbonised economy under social and environmental equality to be reached. In that, they do not represent the appropriate policy strategy to pursue a just transition.

Given these analyses, a European policy framework able to provide support to the European industrial capacity is recommended – in terms of innovative investments, R&D and workforce training in those sectors expected to grow. In particular:

- the supply chain of battery manufacturing including not only production, but also recycling and waste management;
- sustainable public mobility; and
- energy infrastructure and provision.

The Green Deal is a policy framework already moving in such directions and includes initiatives such as the European Battery Alliance and the Circular Economy Action Plan. However, a dedicated Public European Agency for Industrial Policy able to coordinate the policy initiatives of the European Industrial Strategy is recommended. The Public European Agency for Industrial Policy should be responsible for transforming guidelines in actions at the member-state level, reinforcing the effectiveness and the cohesiveness of the policies.

The risks of the climate transition such as unemployment and noxious de-industrialisation are unevenly distributed across countries, places and communities. To pursue a just transition the following are recommended:

- Policies that ought to be place specific to tackle environmental inequalities in sacrifice zones.
- The envisaging of labour-market policies such as reskilling and upskilling of the workforce that is eventually expelled, guaranteeing occupational and income stability.
- Green industrial policies creating decent jobs that also remove gender barriers for women, to overturn occupational gender segregation and increase the representation of women in STEM subjects.

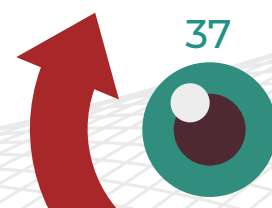
## 4. FINAL REMARKS AND CONCLUSIONS

Despite these policy recommendations, three questions remain difficult to address:

- First, the extent to which the eventually newly created jobs will be “good” ones in terms of working conditions, pay rate, gender access and career benefits is an open issue: will the workers in gigafactories experience better or worse working conditions compared to existing workers in the automotive sector? Although the automotive sector has been deeply affected in terms of standards to reach and production rhythms, it remains a unionised sector able to grant rights and ameliorations for workers beyond the sector in itself, given the strength of the social dialogue it is able to produce. Will the workers employed in gigafactories or, more generally, in energy supply chain production – which should offset the loss of metalworker jobs in car manufacturing – be able to obtain good employment conditions and rights?
- Second, still an open issue is the extent to which the productive capacity of Europe will be sufficient in sustaining the energy transition or, alternatively, Europe will become increasingly more dependent on East Asia, and particularly China, for both the automotive and energy supply chains (electrolysers, PV solar panel productions and wind turbines). Some studies point at an increasing productive dependence on the Chinese supply chains not only in traditional, but also in green manufactured products,<sup>78</sup> calling for a direct industrial policy action at the EU level in selected sectors. Indeed, all NRRPs adopt a horizontal industrial policy perspective, without specific public investment plans directed at creating productive capacity and related employment growth. The plans oversee grants and funds to private investment actions which should be aimed at reducing environmental damage, but do not tackle at all the direct public intervention of specific actors, for example an industrial European agency. Indeed, incentive-based schemes and national calls favour existing big conglomerates to benefit more from such funds representing distorting policy interventions. The reinforcement of oligopolistic market structures, particularly in the energy sector, allows for rent-seeking behaviours and aggressive concentration strategies of the big players in the market.
- Third, still an open issue is whether the employment effects of the climate-change transition will be able to curb a series of long-lasting issues with the European labour markets, such as structural female underemployment, the gender wage gap, north–south and west–east gaps, and even more centre-periphery structural asymmetries in labour markets and in the productive structure. In general, convergence policy actions are much more effective when acting by means of non-market-based, but rather targeted public-policy interventions to reach an objective. At the opposite end, market-based incentive schemes tend to exacerbate existing asymmetries. Given that the NRRPs have largely taken a market-based perspective, with the state limited to being a provider of funds and controller of final objectives to be met, the chances of getting convergence across member states are few. Quite probably the climate-change-induced transition will increase productive asymmetries of European member states and their dependence on global production chains.

# END NOTES

- 1 "European Battery Alliance". European Commission website. [https://single-market-economy.ec.europa.eu/industry/strategy/industrial-alliances/european-battery-alliance\\_en](https://single-market-economy.ec.europa.eu/industry/strategy/industrial-alliances/european-battery-alliance_en)
- 2 "European industrial strategy: Accelerating twin transitions". European Commission website. [https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy\\_en#accelerating-twin-transitions](https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en#accelerating-twin-transitions)
- 3 Amelang, S. (2021) "How many car industry jobs are at risk from the shift to electric vehicles?". Clean Energy Wire, 7 July. [www.cleanenergywire.org/factsheets/how-many-car-industry-jobs-are-risk-shift-electric-vehicles](http://www.cleanenergywire.org/factsheets/how-many-car-industry-jobs-are-risk-shift-electric-vehicles)
- 4 International Energy Agency (2021) "Net zero by 2050: A roadmap for the global energy sector". [https://iea.blob.core.windows.net/assets/7ebafc81-74ed-412b-9c60-5cc32c8396e4/NetZeroBy2050-ARoadmapfortheGlobalEnergySector-SummaryforPolicyMakers\\_CORR.pdf](https://iea.blob.core.windows.net/assets/7ebafc81-74ed-412b-9c60-5cc32c8396e4/NetZeroBy2050-ARoadmapfortheGlobalEnergySector-SummaryforPolicyMakers_CORR.pdf)
- 5 IRENA (2019) "Renewable energy and jobs annual review 2019". <https://www.irena.org/publications/2019/Jun/Renewable-Energy-and-Jobs-Annual-Review-2019>
- 6 "A clean energy transition". European Commission website. [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/energy-and-green-deal\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/energy-and-green-deal_en)
- 7 Jaden, K. and M. Mohommed (2022) "Jobs impact of green energy". Working paper. IMF. [www.imf.org/en/Publications/WP/Issues/2022/05/27/Jobs-Impact-of-Green-Energy-518411](http://www.imf.org/en/Publications/WP/Issues/2022/05/27/Jobs-Impact-of-Green-Energy-518411)
- 8 Dierdorff, E. C., J. J. Norton, D. W. Drewes et al. (2009) "Greening of the world of work: Implications for O\*NET®-SOC and new and emerging occupations". National Center for O\*NET Development prepared for U.S. Department of Labor Employment and Training Administration. Submitted by the National Center for O\*NET Development, 12 February.
- 9 IRENA (2021a) "Renewable energy and jobs: Annual review 2021", October. <https://www.irena.org/publications/2021/Oct/Renewable-Energy-and-Jobs-Annual-Review-2021>
- 10 IRENA (2021b) "World energy transitions outlook 2021: 1.5°C pathway"; <https://irena.org/publications/2021/Jun/World-Energy-Transitions-Outlook>; IRENA (2022) "World energy transitions outlook 2022: 1.5°C pathway". <https://irena.org/publications/2022/mar/world-energy-transitions-outlook-2022>
- 11 "CO<sub>2</sub> emission performance standards for cars and vans". European Commission website. [https://ec.europa.eu/clima/eu-action/european-green-deal/delivering-european-green-deal/co2-emission-performance-standards-cars-and-vans\\_en](https://ec.europa.eu/clima/eu-action/european-green-deal/delivering-european-green-deal/co2-emission-performance-standards-cars-and-vans_en)
- 12 Ecorys (2021) "The future of the EU automotive sector". Publication for the committee on Industry, Research and Energy. Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg.
- 13 Cambridge Econometrics for the European Climate Foundation (2022) "Electromobility in the Visegrad region – Slovakia", February. <https://www.camecon.com/wp-content/uploads/2022/03/Final-report-Slovakia.pdf>; Institute for Employment Market Research (2019), "Electromobility 2035: Economic and labour market effects through the electrification of powertrains in passenger cars". IAB discussion paper 08/209, April; Amelang, S. (2021) "How many car industry jobs are at risk from the shift to electric vehicles?". Clean Energy Wire, 7 July. [www.cleanenergywire.org/factsheets/how-many-car-industry-jobs-are-risk-shift-electric-vehicles](http://www.cleanenergywire.org/factsheets/how-many-car-industry-jobs-are-risk-shift-electric-vehicles)
- 14 Feltrin, L., A. Mah and David Brown (2021) "Noxious deindustrialization: Experiences of precarity and pollution in Scotland's petrochemical capital". Environment and Planning C: Politics and Space: 23996544211056328; Bez, C., and M. E. Virgillito. Toxic pollution and labour markets: Uncovering Europe's left-behind places. No. 2022/19. LEM Working Paper Series, 2022.
- 15 Boyce, J. K. (2020) "Distributional issues in climate policy: Air quality co-benefits and carbon rent", in Handbook on the Economics of Climate Change (Edward Elgar Publishing).
- 16 Davies, T. (2018) "Toxic space and time: Slow violence, necropolitics, and petrochemical pollution". Annals of the American Association of Geographers, 108(6): 1537-1553. DOI: 10.1080/24694452.2018.1470924 <https://www.tandfonline.com/doi/full/10.1080/24694452.2018.1470924>
- 17 Garcia-Garcia, P., O. Carpintero and L. Buendia (2020) "Just energy transitions to low carbon economies: A review of the concept and its effects on labour and income". Energy Research & Social Science, 70: 101664.
- 18 Goldin, C. (1984) "The historical evolution of female earnings functions and occupations". Explorations in Economic History, 21(1): 1-27.
- 19 Altonji, J. G. and R. M. Blank (1999) "Race and gender in the labor market". Handbook of Labor Economics, 3: 3143–3259; Jonsson, J. O. (1999) "Explaining sex differences in educational choice: An empirical assessment of a rational choice model". European Sociological Review, 15(4): 391-404; Wang, Ming-Te and J. Degol (2013) "Motivational pathways to STEM career choices: Using expectancy–value perspective to understand individual and gender differences in STEM fields". Developmental Review, 33(4): 304-340; Charles, M. and K. Bradley (2002) "Equal but separate? A cross-national study of sex segregation in higher education". American Sociological Review, 67(4): 573-599; Allison, M. and T. A. DiPrete (2013) "Trends in gender segregation in the choice of science and engineering majors". Social Science Research, 42(6): 1519-1541; S. Sassler et al. (2017) "The missing women in STEM? Assessing gender differentials in the factors associated with transition to first jobs", Social Science Research, 63: 192-208.
- 20 Heffernan, R., P. Heidegger, G. Köhler et al. (2021) "A feminist European Green Deal: Towards an ecological and gender just transition". Friedrich Ebert Stiftung. <https://library.fes.de/pdf-files/iez/18990.pdf>; Allwood, G. (2022) "The EU's transition to climate justice and gender equality: How just and how equal?". Foundation for European Progressive Studies, June. <https://feps-europe.eu/publication/the-eus-transition-to-climate-justice-and-gender-equality/>
- 21 "NA" refers to sacrifice zones which would need to be converted but for which we have no information, both because they might be involved in different competing projects of reconversion, or no action has been taken at all.
- 22 "Saab-fabriken i Trollhättan ska bygga hundratusentals tyska elbilar". Teknikens Värld website, 17 April 2019. <https://teknikensvarld.expressen.se/nyheter/bilbranschen/saab-fabriken-i-trollhattan-ska-bygga-hundratusentals-tyska-elbilar/>
- 23 Anhalt-Bitterfeld used to be the most polluted town in Europe and a sacrifice zone. Characterised by a long history in the petrochemical industry, engineering, a skilled workforce and industrial planning, Anhalt-Bitterfeld became the German "Solar Valley", providing for 20,000 jobs. Nevertheless, after 2008 the production in the Solar Valley almost ceased and Bitterfeld, from being a successful conversion from a sacrifice zone into a green case, was left behind, as in the past. Brock, A., B. K. Sovacool and A. Hook (2021) "Volatile photovoltaics: Green industrialization, sacrifice zones, and the political ecology of solar energy in Germany". Annals of the American Association of Geographers, 111(6): 1756-1778; Interreg Central Europe (2018) "ChemMultimodal: Final implementation report". Saxony-Anhalt, 30 November.

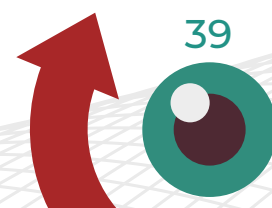




- 24 The Slovak recovery plan entails the issue of converting the coal mines in Upper Nitra, but it states it will not allocate resources given that there already are resources and policy initiatives dedicated to the case.
- 25 The old cement plant of Lloseta is employed in the process.
- 26 The process of production of the hydrogen will use the emissions of the steel plant in Terni.
- 27 The Port of Civitavecchia is an industrial and polluted area.
- 28 The Italian recovery plan will invest in the transformation of the production of "green steel", a plan combined with the decarbonisation of the steel plant in Taranto.
- 29 Conversion of the site of the former typewriter-production firm Olivetti.
- 30 Synergies of different public and private institutions.
- 31 Industrial and highly polluted area.
- 32 Conversion of an old paper mill.
- 33 The Ministry of Economic Development is one of the actors coordinating and implementing the project.
- 34 "Deutscher Aufbau- und Resilienzplan, Komponente 1.2: Klimafreundliche Mobilität", pp. 155-156. Bundesministerium der Finanzen website. [www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Europa/DARP/deutscher-aufbau-und-resilienzplan.html](http://www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Europa/DARP/deutscher-aufbau-und-resilienzplan.html)
- 35 Federal Ministry of Finance (2020) "German Recovery and Resilience Plan". Draft, December, p. 30. [www.bundesfinanzministerium.de/Content/EN/Standardartikel/Press\\_Room/Publications/Brochures/2021-01-13-german-recovery-and-resilience-plan.pdf?\\_\\_blob=publicationFile&v=8](http://www.bundesfinanzministerium.de/Content/EN/Standardartikel/Press_Room/Publications/Brochures/2021-01-13-german-recovery-and-resilience-plan.pdf?__blob=publicationFile&v=8)
- 36 Schwägerl, A. (2019) "Audi concludes fundamental agreement with Works Council on economic and forward-looking realignment". Audi MediaCenter website. [www.audi-mediacycenter.com/en/press-releases/audi-concludes-fundamental-agreement-with-works-council-on-economic-and-forward-looking-realignment-12373](http://www.audi-mediacycenter.com/en/press-releases/audi-concludes-fundamental-agreement-with-works-council-on-economic-and-forward-looking-realignment-12373)
- 37 Wettengel, J. (2017) "Wind power course at stake in election in 'cradle of Energiewende". Clean Energy Wire website, 5 May. [www.cleanenergywire.org/news/wind-power-course-stake-election-cradle-energiewende](http://www.cleanenergywire.org/news/wind-power-course-stake-election-cradle-energiewende)
- 38 "Aufbau einer nachhaltigen Wasserstoffwirtschaft" – Wasserstoffrichtlinie". WT.SH website. <https://wtsh.de/de/aufbau-einer-nachhaltigen-wasserstoffwirtschaft--wasserstoffrichtlinie>
- 39 "Recovery index for transformative change". ZOE institute for future-fit economies website. <https://zoe-institut.de/en/project/recovery-index-for-transformative-change/>
- 40 Pirie, J., C-M Suta, J. Hidi et al. (2022) "Electromobility in the Visegrad region – Slovakia". Cambridge Econometrics for the European Climate Foundation, February. <https://www.camecon.com/wp-content/uploads/2022/03/Final-report-Slovakia.pdf>
- 41 Harper, J. (2019) "VW Slovakia's future uncertain". Deutsche Welle, 4 February [www.dw.com/en/vw-slovakia-faces-uncertain-future-as-electric-cars-loom/a-48146132](http://www.dw.com/en/vw-slovakia-faces-uncertain-future-as-electric-cars-loom/a-48146132); Jancarikova, T. and M. Kahn (2019) "RTP-warning light flashing for Slovakia's auto industry". Reuters website, 5 July [www.reuters.com/article/autos-easterneurope-idUKL8N2463SE](http://www.reuters.com/article/autos-easterneurope-idUKL8N2463SE); Minarechová, R. (2021) "New investments, but also layoffs. The pandemic is not the only influence on the business sector in Slovakia". The Slovak Spectator, 13 December. <https://spectator.sme.sk/c/22802536/2021-investment-highlights-new-investments-but-also-layoffs.html>
- 42 P. Pavlínek, B. Domański and R. Guzik (2009) "Industrial upgrading through foreign direct investment in Central European automotive manufacturing". European Urban and Regional Studies, 16(1): 43-63.
- 43 Beutnagel, W. (2022) "Magna eröffnet neues Werk in der Slowakei". Automobil Produktion website, 22 April. [www.automobil-produktion.de/produktion/magna-eroeffnet-neues-werk-in-der-slowakei-868.html](http://www.automobil-produktion.de/produktion/magna-eroeffnet-neues-werk-in-der-slowakei-868.html)
- 44 Furmanczuk, Z. (2018) "Coal mining sector transition in Slovakia". Slovak Renewable Energy Agency, November.
- 45 Slovakia's recovery and resilience plan, pp. 154, 158, 160. "Plán obnovy: cestovná mapa lepšiemu Slovensku". [https://www.mfsr.sk/files/archiv/1/Plan\\_obnovy\\_a\\_odolnosti.pdf](https://www.mfsr.sk/files/archiv/1/Plan_obnovy_a_odolnosti.pdf); "Recovery and resilience plan of the Slovak Republic". European Website on Integration, 13 July 2021; [https://ec.europa.eu/migrant-integration/library-document/recovery-and-resilience-plan-slovak-republic\\_en](https://ec.europa.eu/migrant-integration/library-document/recovery-and-resilience-plan-slovak-republic_en) Other policy actions have been undertaken to face the dismissal of coal-mining activities after the EU Council Decision of 2010. In 2018, the Slovak government with the European Commission submitted the "Action plan for the transformation of the Horná Nitra coal region" (updated 2021). <http://www.prievidza.sk/akcnyplan/>
- 46 Government of Spain (2021) "Recovery, transformation and resilience plan". Executive summary, p. 10. [www.lamoncloa.gob.es/temas/fondos-recuperacion/Documents/05052021-Executive\\_Summary\\_Recovery\\_Plan.pdf](http://www.lamoncloa.gob.es/temas/fondos-recuperacion/Documents/05052021-Executive_Summary_Recovery_Plan.pdf)
- 47 "Los sindicatos advierten: el coche eléctrico asegura el futuro pero amenaza 3.000 empleos en Seat". CincoDías, 15 February 2022. [https://cincodias.elpais.com/cincodias/2022/02/14/companias/1644864181\\_644661.html](https://cincodias.elpais.com/cincodias/2022/02/14/companias/1644864181_644661.html)
- 48 "La gigafactoría de Sagunto impulsará la agenda del coche eléctrico en España". CincoDías, 24 March 2022. [https://cincodias.elpais.com/cincodias/2022/03/23/opinion/1648059671\\_355999.html](https://cincodias.elpais.com/cincodias/2022/03/23/opinion/1648059671_355999.html)
- 49 Government of Spain (2021) "Recovery, transformation and resilience plan". Component 10: "Just Transition Strategy. [www.lamoncloa.gob.es/temas/fondos-recuperacion/Documents/160621-Plan\\_Recuperacion\\_Transformacion\\_Resiliencia.pdf](http://www.lamoncloa.gob.es/temas/fondos-recuperacion/Documents/160621-Plan_Recuperacion_Transformacion_Resiliencia.pdf)
- 50 Iberdrola commissions the largest green hydrogen plant for industrial use in Europe". Iberdrola website. <https://www.iberdrola.com/about-us/lines-business/flagship-projects/puertollano-green-hydrogen-plant>
- 51 The company is, however, part of a strong oligopolistic market that manages the energy sector and it has also been blamed for aggressive investment strategies. Nonetheless, oligopolistic market structure in the management of the production and storage of green hydrogen calls for a public investment agency. Indeed, rent-seeking behaviour of private companies to obtain state financing have been identified, particularly in the renewable sector. Espinosa, V. I., J. A. Peña-Ramos and F. Recuero-López (2021) "The political economy of rent-seeking: Evidence from Spain's support policies for renewable energy". Energies, 14(14): 4197.
- 52 "About Green Hysland". Green Hysland website. <https://greenhysland.eu/about-green-hysland/>
- 53 di Diego, L. (2021) "Stellantis chiude lo stabilimento Maserati di Grugliasco, sindacati divisi". La Repubblica, 13 October. [https://torino.repubblica.it/cronaca/2021/10/13/news/stellantis\\_chiude\\_lo\\_stabilimento\\_maserati\\_di\\_grugliasco\\_sindacati\\_divisi-322000484/](https://torino.repubblica.it/cronaca/2021/10/13/news/stellantis_chiude_lo_stabilimento_maserati_di_grugliasco_sindacati_divisi-322000484/)
- 54 Servizio Studi-Dipartimento Bilancio, Piano nazionale di ripresa e resilienza (PNRR) – La proposta del Governo del 12 gennaio 2021. [http://documenti.camera.it/leg18/dossier/testi/DFP25\\_parte\\_I.htm#\\_Toc62559507](http://documenti.camera.it/leg18/dossier/testi/DFP25_parte_I.htm#_Toc62559507)



- 55 "LIFE3H (Hydrogen demonstration in city, port and mountain area to develop integrated hydrogen valleys)". Regione Abruzzo website, 15 February 2022. [www.regione.abruzzo.it/content/life3h-hydrogen-demonstration-city-port-and-mountain-area-develop-integrated-hydrogen](http://www.regione.abruzzo.it/content/life3h-hydrogen-demonstration-city-port-and-mountain-area-develop-integrated-hydrogen); "Making Hydrogen Valley a reality". Life3H website. [www.life3h.eu/](http://www.life3h.eu/)
- 56 "Creare filiere italiane dell'idrogeno: il Friuli Venezia Giulia in prima linea con la North Adriatic Hydrogen Valley". Università Degli Studi di Trieste website. [www.units.it/news/creare-filiere-italiane-dellidrogeno-il-friuli-venezia-giulia-prima-linea-con-la-north-adriatic](http://www.units.it/news/creare-filiere-italiane-dellidrogeno-il-friuli-venezia-giulia-prima-linea-con-la-north-adriatic)
- 57 "LIFE3H (Hydrogen demonstration in city, port and mountain area to develop integrated hydrogen valleys)". Regione Abruzzo website, 15 February 2022. [www.regione.abruzzo.it/content/life3h-hydrogen-demonstration-city-port-and-mountain-area-develop-integrated-hydrogen](http://www.regione.abruzzo.it/content/life3h-hydrogen-demonstration-city-port-and-mountain-area-develop-integrated-hydrogen); "Making Hydrogen Valley a reality". Life3H website. [www.life3h.eu/www.life3h.eu/](http://www.life3h.eu/www.life3h.eu/)
- 58 "In Val d'Agri nasce il progetto Energy Valley". Eni website. [www.eni.com/it-IT/attivita/italia-val-agri-progetto-energy-valley.html](http://www.eni.com/it-IT/attivita/italia-val-agri-progetto-energy-valley.html)
- 59 See Itavolt's website. [www.italvolt.com/it/](http://www.italvolt.com/it/)
- 60 di Mario, C. (2021) "Stellantis, a Termoli la gigafactory italiana. 30 mld nell'auto elettrica e nel software. 4 nuove piattaforme". 24 Motori website, 8 July. [www.ilsolo24ore.com/art/stellantis-strategia-elettrificazione-6-punti-chiave-dell-ev-day-oggi-AEU0CdV](http://www.ilsolo24ore.com/art/stellantis-strategia-elettrificazione-6-punti-chiave-dell-ev-day-oggi-AEU0CdV)
- 61 Governo Italiano Presidenza del Consiglio dei Ministri (2021) "Piano nazionale di ripresa e resilienza", pp. 32-35, 36-152. [www.governo.it/sites/governo.it/files/PNRR.pdf](http://www.governo.it/sites/governo.it/files/PNRR.pdf)
- 62 Together with Boliden, LKAB, Mobilaris, Northvolt, Skellefteå Kraft and SSAB.
- 63 "Northvolt to transform closed paper mill in Sweden into new Gigafactory". Northvolt website, 25 February 2022. <https://northvolt.com/articles/northvolt-to-transform-closed-paper-mill-in-sweden-into-new-gigafactory/>
- 64 "25 000 personer till industriföretagen i norra Sverige". Jernkontoret website, 19 May 2021. [www.jernkontoret.se/sv/publicerat/nytt-fran-jernkontoret/nyheter/2021/25-000-personer-till-industriforetagen-i-norra-sverige/](http://www.jernkontoret.se/sv/publicerat/nytt-fran-jernkontoret/nyheter/2021/25-000-personer-till-industriforetagen-i-norra-sverige/)
- 65 "So it begins". Northvolt website. <https://northvolt.com/career/Skelleftea>
- 66 "We are Northvolt". Northvolt website. <https://northvolt.com/about/>
- 67 "Sweden". IEA website. [www.iea.org/countries/sweden](http://www.iea.org/countries/sweden)
- 68 "Sidan kan inte hittas". Regeringskansliet website. [www.regeringen.se/pressmeddelanden/2021/03/fordonsstrategisk-forskning-och-innovation-staten-och-fordonsindustrin-tillsammans-for-framtidens-transportsystem/](http://www.regeringen.se/pressmeddelanden/2021/03/fordonsstrategisk-forskning-och-innovation-staten-och-fordonsindustrin-tillsammans-for-framtidens-transportsystem/); [www.vinnova.se/en/m/strategic-vehicle-research-and-innovation/about-ffi](http://www.vinnova.se/en/m/strategic-vehicle-research-and-innovation/about-ffi)
- 69 Each reform can't negatively impact on environmental objectives, including that the measures within the green transition cannot interfere with the environmental objectives of other climate actions.
- 70 "Renewed support for the automotive sector". IEA website, 18 March 2022. <https://www.iea.org/policies/13974-renewed-support-for-the-automotive-sector>
- 71 "Batterien ‚made in Germany‘ – ein Beitrag zu nachhaltigem Wachstum und klimafreundlicher Mobilität". Bundesministerium für Wirtschaft und Klimaschutz website. [www.bmwk.de/Redaktion/DE/Dossier/batteriezellfertigung.html](http://www.bmwk.de/Redaktion/DE/Dossier/batteriezellfertigung.html)
- 72 Government of Spain (2021) "Recovery, transformation and resilience plan". Executive summary, p. 29. [www.lamoncloa.gob.es/temas/fondos-recuperacion/Documents/05052021-Executive\\_Summary\\_Recovery\\_Plan.pdf](http://www.lamoncloa.gob.es/temas/fondos-recuperacion/Documents/05052021-Executive_Summary_Recovery_Plan.pdf)
- 73 However, the support relates to the shock caused by the huge crisis the automotive sector is experiencing mostly as a consequence of the pandemic. No solutions seem to be provided to reallocate future unemployed workers in the automotive industry because of the conversion to the electric engine for the climate transition. "European Globalisation Adjustment Fund: €2.8 million to support dismissed workers in the Spanish car industry". Press release. European Commission, 20 January 2022. [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_22\\_403](https://ec.europa.eu/commission/presscorner/detail/en/IP_22_403); "Applications". Employment, Social Affairs and Inclusion, European Commission website. <https://ec.europa.eu/social/main.jsp?catId=582&langId=en>
- 74 "Automotive Sector Competitiveness Plan". IEA website, 5 November 2017. <https://www.iea.org/policies/1593-automotive-sector-competitiveness-plan>
- 75 "Spain mobility stimulus: Promotion of training for new technologies, digitalisation and the medium for sustainable transport". Policy section of the IEA website. Last updated 23 March 2022. [www.iea.org/policies/11577-spain-mobility-stimulus-promotion-of-training-for-new-technologies-digitalisation-and-the-medium-for-sustainable-transport](http://www.iea.org/policies/11577-spain-mobility-stimulus-promotion-of-training-for-new-technologies-digitalisation-and-the-medium-for-sustainable-transport)
- 76 "Subsidies 2020 for employment in the green sector". IEA website, 23 March 2022. <https://www.iea.org/policies/12323-subsidies-2020-for-employment-in-the-green-sector>
- 77 The Vienna Institute for International Economic Studies (2021) "Monthly report, special issue: 30th anniversary of the Visegrád agreement", February. <https://wiiw.ac.at/monthly-report-no-2-2021-dlp-5601.pdf>
- 78 Cucignatto, G., M. Gaddi and N. Garbellini (2022) "Covid-19 and industrial restructuring: What future for transnational value chains". Working paper. ETUI, 24 February. <http://dx.doi.org/10.2139/ssrn.4042633>
- 81 "AMECO spring forecast 2022". ARDECO online, European Commission website. [https://knowledge4policy.ec.europa.eu/territorial/ardec-online\\_en](https://knowledge4policy.ec.europa.eu/territorial/ardec-online_en); "Urban Data Platform Plus". European Commission website. <https://urban.jrc.ec.europa.eu/?lng=en&ctx=udp>
- 82 "Erneuerbare Energien". Schleswig-Holstein website, 15 October 2022. [https://www.schleswig-holstein.de/DE/landesregierung/themen/energie/erneuerbare-energien/erneuerbare-energien\\_node.html#:~:text=Gem%C3%A4%C3%9F%20dem%20Ende%20M%C3%A4rz%202017,bis%20zum%20Jahr%202025%20angestrebt.](https://www.schleswig-holstein.de/DE/landesregierung/themen/energie/erneuerbare-energien/erneuerbare-energien_node.html#:~:text=Gem%C3%A4%C3%9F%20dem%20Ende%20M%C3%A4rz%202017,bis%20zum%20Jahr%202025%20angestrebt.)
- 83 Brock, A., B. K. Sovacool and A. Hook (2021) "Volatile photovoltaics: Green industrialization, sacrifice zones and the political ecology of solar energy in Germany". Annals of the American Association of Geographers, 111(6): 1756-1778.
- 84 Filčák, R., Institute for Forecasting and Slovak Academy of Sciences (2018) "Support for coal regions in transition: Final report". European Commission, October.
- 85 Furmanczuk, Z. (2018) "Coal mining sector transition in Slovakia". Slovak Renewable Energy, November.
- 86 "About Green Hysland". Green Hysland website. <https://greenhysland.eu/about-green-hysland/>
- 87 "LIFE3H (Hydrogen demonstration in city, port and mountain area to develop integrated hydrogen valleys)". Regione Abruzzo website, 15 February 2022. [www.regione.abruzzo.it/content/life3h-hydrogen-demonstration-city-port-and-mountain-area-develop-integrated-hydrogen](http://www.regione.abruzzo.it/content/life3h-hydrogen-demonstration-city-port-and-mountain-area-develop-integrated-hydrogen); "Making Hydrogen Valley a reality". Life3H website. [www.life3h.eu/](http://www.life3h.eu/)
- 88 L'Archivio Storico Ast. Acciai Speciali Terni website. [www.acciaiiterni.it/chi-siamo/storia/#:~:text=In%20questo%20periodo%20lo%20stabilimento,sette%20condotte%20forzate%20e%20caldariera](http://www.acciaiiterni.it/chi-siamo/storia/#:~:text=In%20questo%20periodo%20lo%20stabilimento,sette%20condotte%20forzate%20e%20caldariera)



# REFERENCES

- Altonji, J. G. and Rebecca M. Blank (1999) "Race and gender in the labor market", in *Handbook of Labor Economics*, 3, pp. 3143-3259.
- Bez, C., and M. E. Virgillito. Toxic pollution and labour markets: Uncovering Europe's left-behind places. No. 2022/19. LEM Working Paper Series, 2022.
- Brock, A., B. K. Sovacool and A. Hook (2021) "Volatile photovoltaics: Green industrialization, sacrifice zones, and the political ecology of solar energy in Germany". *Annals of the American Association of Geographers*, 111(6): 1756-1778.
- Boyce, J. K. (2020) "Distributional issues in climate policy: Air quality co-benefits and carbon rent", in *Handbook on the Economics of Climate Change* (Edward Elgar Publishing) 12–31, Graciela Chichilnisky and Armon Rezai editors
- Bundesministerium der Finanzen (2021) „Deutscher Aufbau- und Resilienzplan“.
- Charles, M. and K. Bradley (2002) "Equal but separate? A cross-national study of sex segregation in higher education". *American Sociological Review*, 2002: 573-599.
- Cucignatto, G., M. Gaddi and N. Garbellini (2022) "Covid-19 and industrial restructuring: What future for transnational value chains". Working paper. ETUI, 24 February. <http://dx.doi.org/10.2139/ssrn.4042633>
- Davies, T. (2018) "Toxic space and time: Slow violence, necropolitics, and petrochemical pollution". *Annals of the American Association of Geographers*, 108(6): 1537-1553. DOI: 10.1080/24694452.2018.1470924
- Dierdorff, E. C., J. J. Norton, D. W. Drewes et al. (2009) "Greening of the world of work: Implications for O\*NET@-SOC and new and emerging occupations". National Center for O\*NET Development. Prepared for U.S. Department of Labor Employment and Training Administration. Submitted by the National Center for O\*NET Development, 12 February.
- Ecorys (2021) "The future of the EU automotive sector". Publication for the committee on Industry, Research and Energy. Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg.
- Espinosa, V. I., J. A. Peña-Ramos and F. Recuero-López (2021) "The political economy of rent-seeking: Evidence from Spain's support policies for renewable energy". *Energies*, 14(14): 4197.
- European Commission (2020) "Asturias, Spain: Regional profile. Platform for coal regions in transition". [https://energy.ec.europa.eu/system/files/2020-07/asturias\\_regional\\_profile\\_-\\_start\\_technical\\_assistance\\_0.pdf](https://energy.ec.europa.eu/system/files/2020-07/asturias_regional_profile_-_start_technical_assistance_0.pdf)
- European Commission (2020) "Overview of investments guidance on the Just Transition Fund 2021-2027 for member states". Country Reports, Annex D. [https://ec.europa.eu/info/sites/default/files/annex\\_d\\_crs\\_2020\\_en.pdf](https://ec.europa.eu/info/sites/default/files/annex_d_crs_2020_en.pdf)
- Feltrin, L., A. Mah and David Brown (2021) "Noxious deindustrialization: Experiences of precarity and pollution in Scotland's petrochemical capital". *Environment and Planning C: Politics and Space*: 23996544211056328.
- Filčák, R., Institute for Forecasting and Slovak Academy of Sciences (2018) "Support for coal regions in transition: Final report". European Commission, October.
- Finansdepartementet (2021) "Sveriges återhämtningsplan". <https://www.regeringen.se/49bfc1/contentassets/dad10f1743b64c78a1c5b2d-71f81a6eb/sveriges-aterhamtningsplan.pdf>
- Gobierno de España (2021) Plan de Recuperación, Transformación y Resiliencia, retrieved April 29, 2022, from [https://www.lamoncloa.gob.es/temas/fondos-recuperacion/Documents/160621-Plan\\_Recuperacion\\_Transformacion\\_Resiliencia.pdf](https://www.lamoncloa.gob.es/temas/fondos-recuperacion/Documents/160621-Plan_Recuperacion_Transformacion_Resiliencia.pdf)
- Goldin, C. (1994) "The historical evolution of female earnings functions and occupations". *Explorations in Economic History*, 21(1): 1-27.
- International Energy Agency (2021) "Spain 2021: Energy policy review". <https://iea.blob.core.windows.net/assets/2f405ae0-4617-4e16-884c-7956d1945f64/Spain2021.pdf>
- Interreg Central Europe (2018) "ChemMultimodal: Final implementation report". Saxony-Anhalt, 30 November.
- Jonsson, J. O. (1999) "Explaining sex differences in educational choice: An empirical assessment of a rational choice model". *European Sociological Review*, 15(4): 391-404.

Mann, A. and T. A. DiPrete (2013) "Trends in gender segregation in the choice of science and engineering majors". *Social Science Research*, 42(6): 1519-1541.

Pablo, G.-G., O. Carpintero and L. Buendia (2020) "Just energy transitions to low carbon economies: A review of the concept and its effects on labour and income". *Energy Research & Social Science*, 70: 101664.

Pavlínek, P., B. Domański and R. Guzik (2009) "Industrial upgrading through foreign direct investment in Central European automotive manufacturing". *European Urban and Regional Studies*, 16(1): 43-63.

Pirie, J., C-M Suta, J. Hidi et al. (2022) "Cambridge Econometrics for the European Climate Foundation, Electromobility in the Visegrad region – Slovakia"., Cambridge Econometrics for the European Climate Foundation, February, 2022 <https://www.camecon.com/wp-content/uploads/2022/03/Final-report-Slovakia.pdf>

Sassler, S. et al. (2017) "The missing women in STEM? Assessing gender differentials in the factors associated with transition to first jobs". *Social Science Research*, 63: 192-208.

Wang, Ming-Te and J. Degol (2013) "Motivational pathways to STEM career choices: Using expectancy–value perspective to understand individual and gender differences in STEM fields". *Developmental Review*, 33(4): 304-340



# ABOUT THE AUTHORS



**Linnea Nelli** is a PhD student in innovation studies at the Department of Economic Policy, Università Cattolica del Sacro Cuore, Milan. Her research interests are the effects of labour-saving technologies on employment, in particular as a consequence of the green transition and from a gender perspective. She graduated in economics from the University of Pisa and School of Advanced Studies Sant'Anna, with a thesis comparing the effects of the Covid-19 crisis and the sovereign debt crisis on gender inequality in the Italian labour market.



**Maria Enrica Virgillito** is associate professor in economics at the Institute of Economics and EMbeDS Department, Sant'Anna School of Advanced Studies. Formerly she was assistant professor at the Department of Economic Policy, Università Cattolica del Sacro Cuore, where she is currently research fellow. She was fellow at the Labor and Worklife Program at Harvard University and she is currently GLO fellow. Maria Enrica Virgillito is actively engaged in EU H2020 projects as task coordinator (GROWINPRO and ISIGROWTH) and JRC tenders. She undertook research collaborations with the ILO and was invited as an expert by EU-OSHA. Her research interests range from technological change to industrial dynamics, labour-market organisations and institutions, macroeconomic dynamics, agent-based modeling, technology and labour relations, and evolutionary economics. She acts as editor for Industrial and Corporate Change (Macro and Development), she is a member of the editorial board of SINAPPSI, and associate editor for *Structural Change and Economic Dynamics* and for the *Review of Evolutionary Political Economy*.



**Andrea Roventini** is full professor of economics at the Institute of Economics of Scuola Superiore Sant'Anna, and research fellow at OFCE, Sciences Po (France). He holds a PhD in Economics and Management from Scuola Superiore Sant'Anna. His main research interests include complex system analysis, agent-based computational economics, business cycles, economic growth and the study of the effects of monetary, fiscal, technology, innovation and climate-change policies. He is currently the unit leader and coordinator of the [EEIST project](#) financed by the UK's Department for Business, Energy and Industrial Strategy (BEIS) and the Children's Investment Fund Foundation (CIFF). He has been the principal investigator and consortium coordinator of the Horizon 2020 [GROWINPRO](#) project and he has been involved in the projects IMPRESSIONS, DOLFINS and ISIGrowth financed by the European Commission.



## **THE FOUNDATION FOR EUROPEAN PROGRESSIVE STUDIES (FEPS)**

The Foundation for European Progressive Studies (FEPS) is the think tank of the progressive political family at EU level. Our mission is to develop innovative research, policy advice, training and debates to inspire and inform progressive politics and policies across Europe. FEPS operates as a hub for thinking to facilitate the emergence of progressive answers to the challenges that Europe faces today. FEPS works in close partnership with its members and partners, forging connections and boosting coherence among stakeholders from the world of politics, academia and civil society at local, regional, national, European and global levels.



## **FRIEDRICH EBERT STIFTUNG**

The EU Office of the Friedrich-Ebert-Stiftung (FES) participates in the European integration process, backs and accompanies the interests of the Federal Republic of Germany in Europe. As an agency of dialogue, education and consultancy, the Friedrich-Ebert-Stiftung fulfils its special role as a 'political network organisation' for and with the various European institutions.



## **INSTITUT EMILE VANDERVELDE (IEV)**

The Emile Vandervelde Institute is the research centre of the Belgian Parti Socialiste and devotes itself to research concerning all questions of an economic, social, financial, administrative, political, ethical and legal nature facing the party and its organizations. The IEV carries out analytical notes and studies on social issues and topical issues for the general public, associations and PS activists. The activities of the institute shall offer prospective and analyses accessible to all, thus contributing to the awareness, critical knowledge and engagement of citizens and activists in the social, economic, cultural and environmental debates.



## **FORUM DISUGUAGLIANZE E DIVERSITÀ**

Forum on Inequality and Diversity is an alliance of active citizens' organizations and academic and institutional scholars. It was launched in February 2018 and now counts more than 110 members and project partners. Its aim is to design public policies and collective actions in order to reduce inequalities and enhance everyone's substantive freedom (diversity). The Forum has built alliances and opened a permanent and constructive dialogue with the authorities responsible for decision-making.

# RECOVERY WATCH

# APPENDIX: SACRIFICE ZONE IDENTIFICATION AND DESCRIPTION

We present a short description of the identified sacrifice zones summarised in Table 3, with descriptive statistics about CO<sub>2</sub> and NO<sub>x</sub> emissions of the place under scrutiny, in order to help with the identification of such areas. In particular, CO<sub>2</sub> emissions usually are the most telling indicator for assessing the level of pollution, while NO<sub>x</sub> are emitted from industrial activities, specifically from combustion at high temperatures. Given that the majority of cases we have selected are characterised by industrial activities (as the coal-mining sector and steel industry), information about NO<sub>x</sub> emissions is relevant for characterising these places. Data are at level NUTS3 from the ARDECO database, except for one case in Germany, where data are at level NUTS2 since the area under analysis is a region and not a sub-region like the others.<sup>81</sup>

## GERMANY

### SCHLESWIG-HOLSTEIN

From being a rural area, Schleswig-Holstein has become the “energy hub” of the north of Germany.<sup>82</sup> Figure A1 shows the CO<sub>2</sub> and the NO<sub>x</sub> emissions in northeastern Germany at NUTS2 level. Schleswig-Holstein was the fourth region in 2015 and in 2020 with the highest change in level of emissions (the regions of Meckleburg-Vorpommern, Hamburg and Leipzig are smaller). By 2030, emissions in Schleswig-Holstein are expected to be at the same level as 2020.

### ANHALT-BITTERFELD, SAXONY-ANHALT

The Solar Valley in Anhalt-Bitterfeld has been the result of a successful sustainable transition of one of the most polluting areas in Germany, at least until 2008 when the German government decided to invest resources in off-shore wind and biogas, hence the Solar Valley was left behind.<sup>83</sup> Anhalt-Bitterfeld was the fourth sub-region over 14 sub-regions in Saxony-Anhalt for CO<sub>2</sub> emissions in 2015 and 2020 and it is expected to remain as such in 2030, similarly for NO<sub>x</sub> emissions (Figure A2)

# APPENDIX: SACRIFICE ZONE IDENTIFICATION AND DESCRIPTION

Figure A1. CO2 and NOX emissions in Schleswig-Holstein, bordering sub-regions and other sub-regions in eastern Germany.

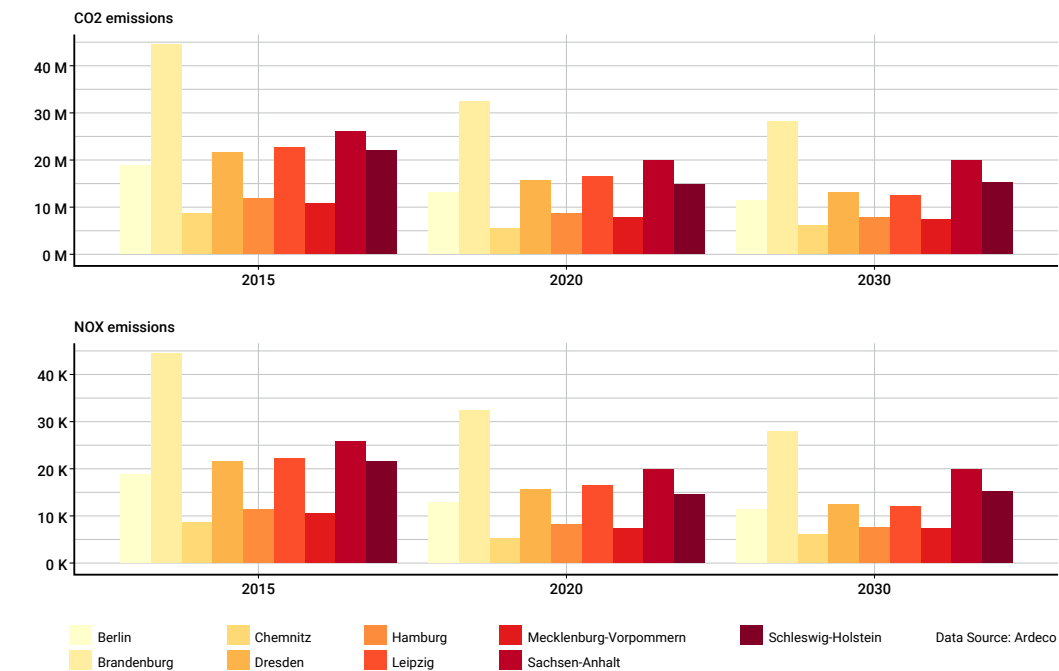
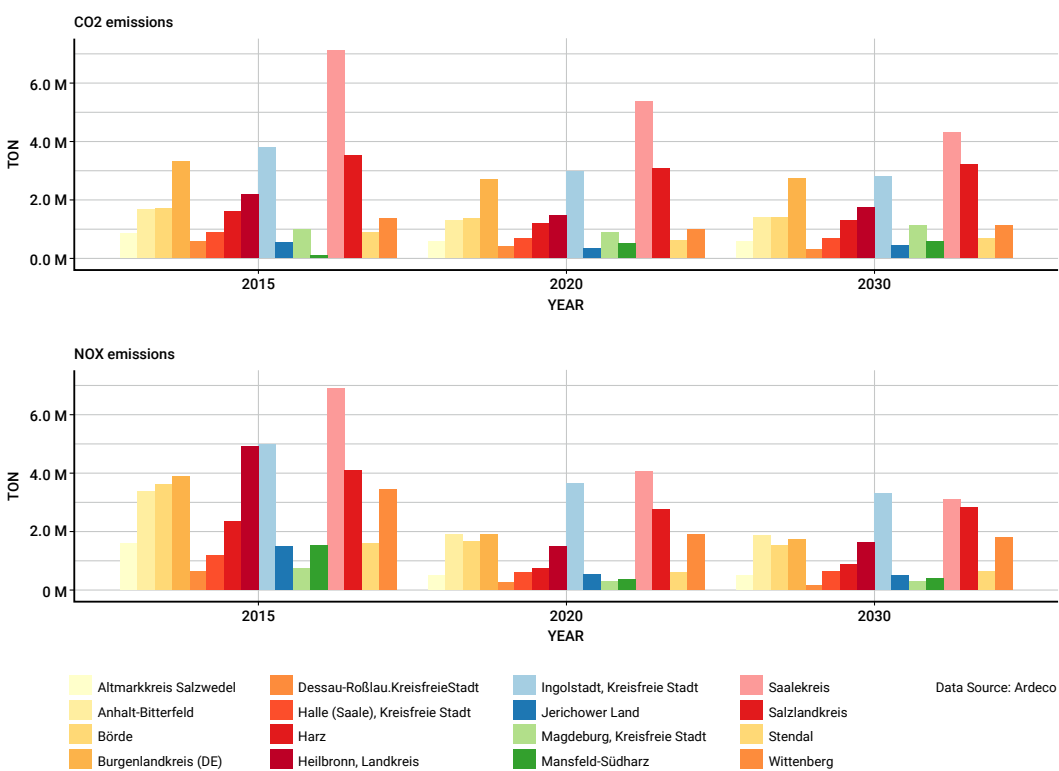


Figure A2. CO2 and NOX emissions in the region of Sachsen-Anhalt, sub-regions.



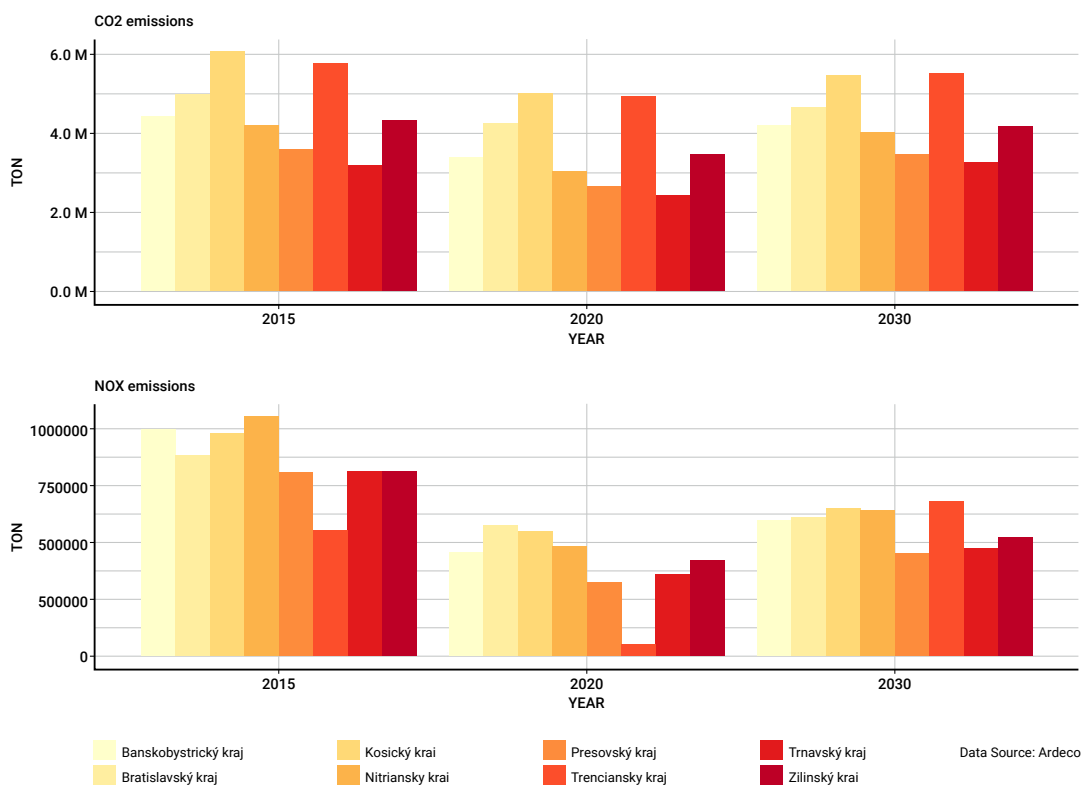


# SLOVAKIA

## TRENČÍN (UPPER NITRA)

The sub-region of Trenčín is the second sub-region in Slovakia with the highest level of CO2 emissions (Figure A3). While it has been the sub-region with the lowest level of NOX emissions in 2015 and 2020, it is expected to emit the highest level on tons of NOX emissions in 2030. Because of the coal-mining sector, the area has become highly polluted. In particular, the district of Prievidza has the highest level of solid pollutants<sup>84</sup> and the power plant of Nováky is the second greenhouse emitter in Slovakia<sup>85</sup>.

Figure A3. CO2 and NOX emissions in Slovakia.



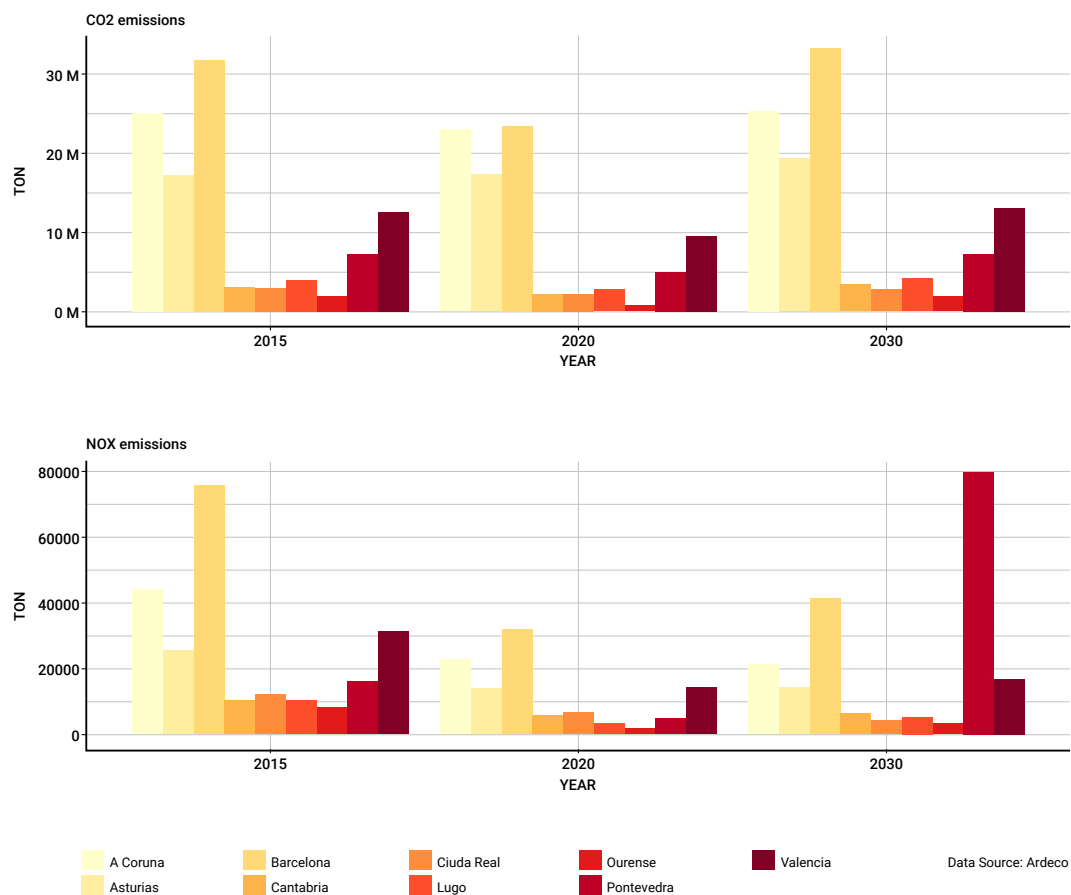
# APPENDIX: SACRIFICE ZONE IDENTIFICATION AND DESCRIPTION

## SPAIN

### MALLORCA

Mallorca will be the first ecosystem producing and delivering green hydrogen in Southern Europe.<sup>86</sup> Among the Balearic Islands, Mallorca has the highest level of CO2 and NOX emissions, given that it is the biggest and most populated island (Figure A4).

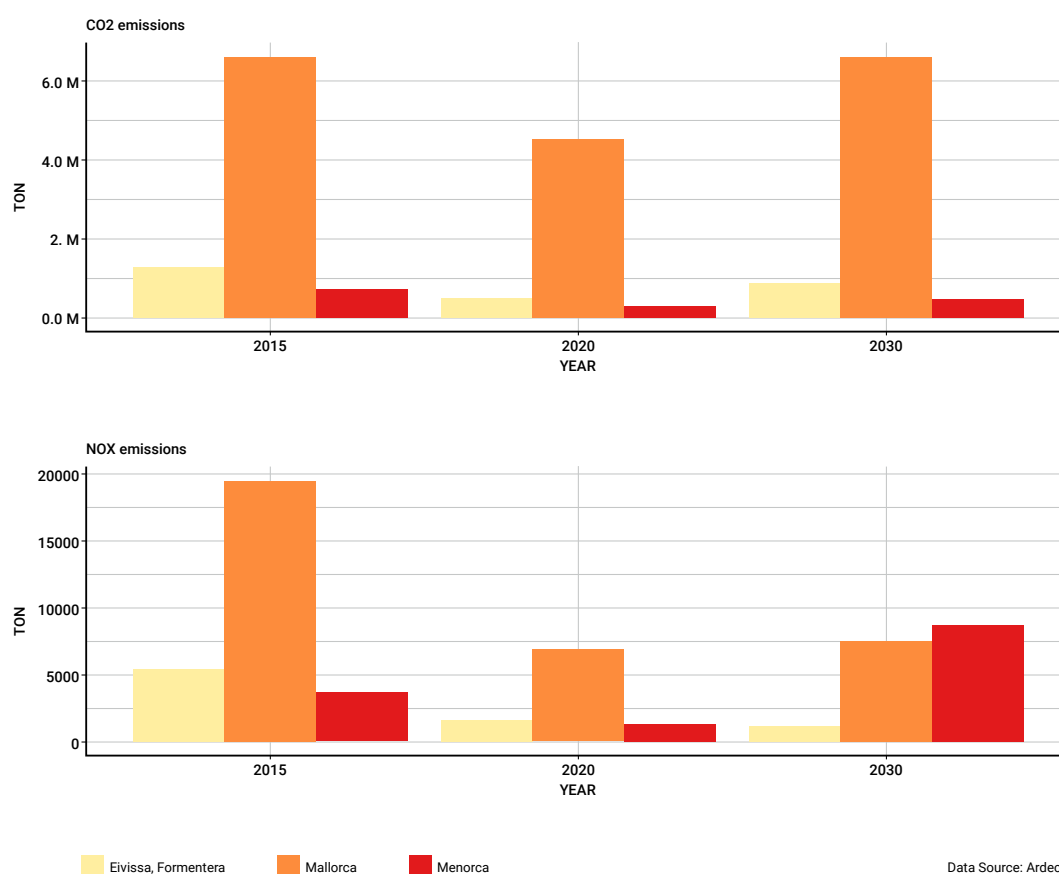
Figure A4. CO2 and NOX emissions in the Balearic Islands.



## ASTURIAS

The company giant Iberdrola, among the leaders in the supply of energy and more recently renewable energy in Spain, is planning to start producing green hydrogen in the dismissed coal-fired power station in Lada, Asturias. As we can see from Figure A5, after A Coruna, Asturias is the second sub-region of Noroeste for CO<sub>2</sub> emissions, as it was in 2015 and 2020 for NO<sub>x</sub> emissions. By 2030 NO<sub>x</sub> emissions are expected to decrease. Indeed, Asturias has based its economy on the coal-mining activities, which are highly polluting.

**Figure A5. CO<sub>2</sub> and NO<sub>x</sub> emissions in the sub-regions of Noroeste, with Valencia and Barcelona in comparison.**



# APPENDIX: SACRIFICE ZONE IDENTIFICATION AND DESCRIPTION

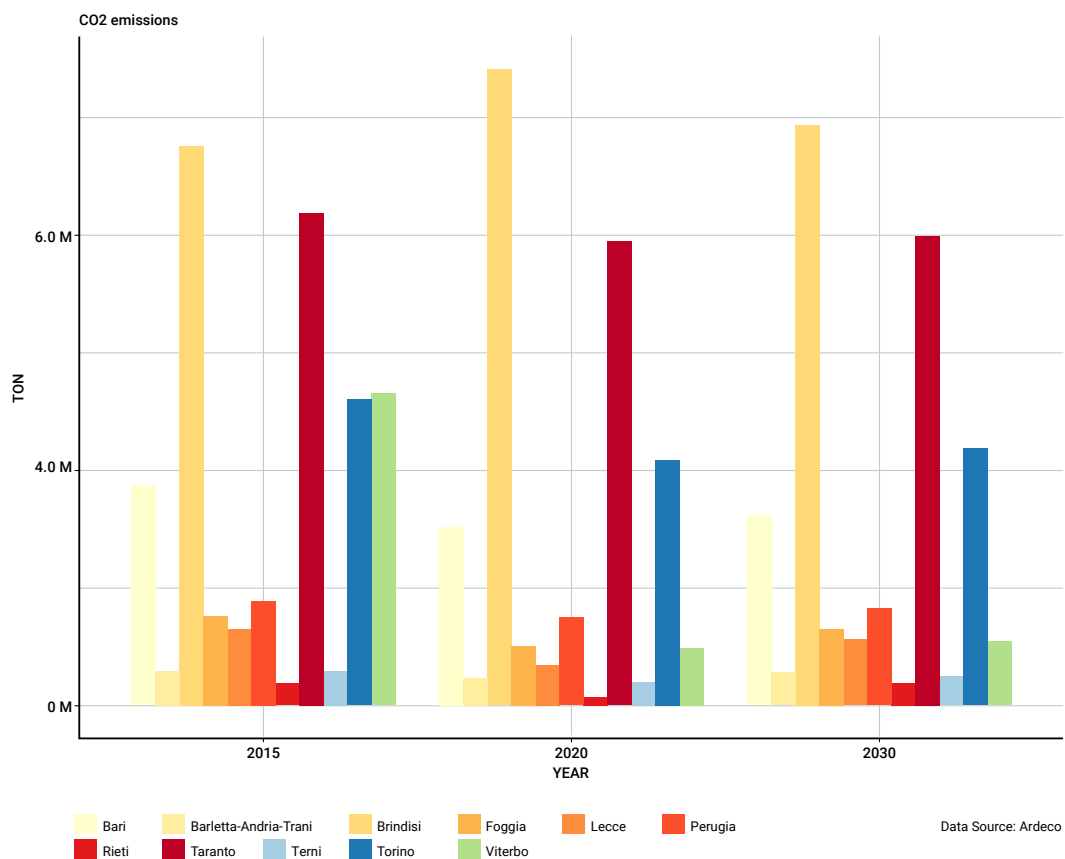
## ITALY

### TERNI AND TARANTO

The LIFE3H project, coordinated by the Italian region of Abruzzo, will develop three hydrogen valleys in central Italy, one in Terni, one in the port of Civitavecchia and one in Altopiano delle Rocche.<sup>87</sup> The city of Terni has a long history in steel production.<sup>88</sup> Despite the activity of the steel industry since 1884, the sub-region of Terni has low recorded levels of CO2 and NOX emissions with respect to Perugia, the other regional county seat in Umbria, and Viterbo and Rieti, two of the county seats in the region of Lazio close to Terni (Figure A6).

Another important steel industry in Italy is that in the city of Taranto, in the region of Puglia in southern Italy. After the sub-region of Brindisi, Taranto is the second sub-region for CO2 emissions, while it has lower recorded NOX emissions with respect to the other sub-regions in the larger region Puglia. At the same time, the CO2 emissions in Taranto are significantly higher than the ones in Terni (around 2 million versus over 20 million; see Figure A6).

**Figure A6. CO2 emissions in the previously mentioned sub-regions in Italy, sub-regions in Puglia, Umbria, bordering sub-region Viterbo, and Perugia and Torino.**

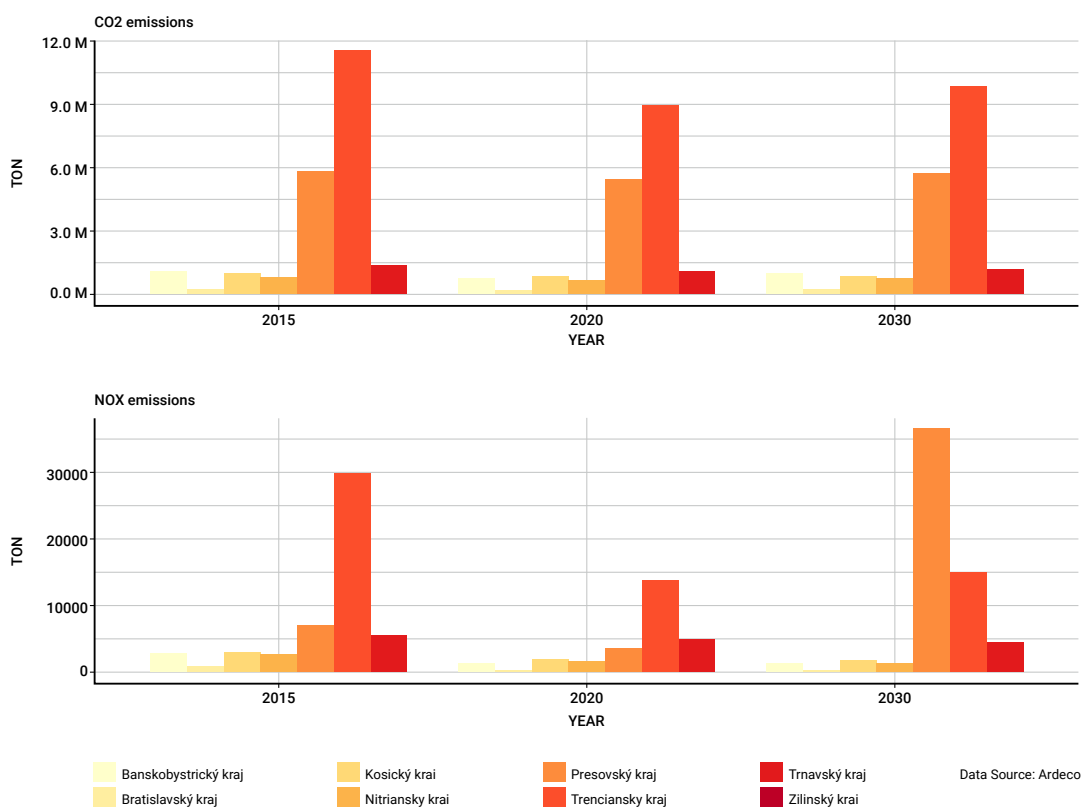


## SWEDEN

### NORRBOTTEN, VÄSTERBOTTEN AND GOTHENBURG

Both Norrbotten and Västerbotten have been identified among the eligible regions for the Just Transition funds. Given the loss in employment and in productivity in the last decade because of the decarbonisation process, the region of Norrbotten is the target region of project T-25. Northvolt, producer of batteries, has founded the first gigafactory of recyclable batteries for EV engines in Skellefteå, Västerbottens län. Another gigafactory has been founded in Gothenburg. The area of Gothenburg has a long industrial history, given the port, in highly polluting activities. Figure A7 shows the CO<sub>2</sub> and NO<sub>x</sub> emissions in different sub-regions in Sweden. Despite their long history in the steel industry, both Norrbotten and Västerbotten have the lowest levels of emissions, thanks to the decarbonising process, while Gothenburg is in the most polluted region under comparison, Västra Götlands län.

**Figure A7. CO<sub>2</sub> and NO<sub>x</sub> emissions in Norrbotten, bordering sub-regions and sub-regions under analysis.**



# RECOVERY WATCH





# RECOVERY WATCH

This policy study addresses the extent to which the national recovery and resilience plans (NRRPs) adopted by five EU member states are able to combine environmental sustainability and employment stability, and therefore to pursue a just transition. We employ the lens of economic geography, with a specific territorial focus on left-behind places, and identify three main policy challenges: employment effects; environmental inequalities; and gender inequalities. Given this theoretical framework, we investigate the presence of mitigation/adaptation policies for the labour markets and of industrial policies. Overall, the scope of this policy study is to evaluate whether the policy interventions are able to meet the policy challenges, and the effectiveness of these preventions – specifically in targeting left-behind places and the most vulnerable areas.

POLICY STUDY PUBLISHED IN DECEMBER 2022 BY

**FEPS**  
FOUNDATION FOR EUROPEAN  
PROGRESSIVE STUDIES



**FRIEDRICH  
EBERT  
STIFTUNG**



Knowledge partner



**FORUM**  
DISUGUAGLIANZE  
DIVERSITÀ

ISBN : 9782930769929