

COAL REGIONS IN TRANSITION: THE RHOMOLO-IO INDIRECT JOBS ESTIMATES

GIOVANNI MANDRAS, ANDREA CONTE, AND SIMONE SALOTTI

- Coal accounts for nearly a quarter of the total electricity production in the EU and provides jobs to around 240,000 people in mines and power plants.
- The European Commission is working in order to ensure a smooth transition to cleaner forms of energy production and to implement innovative technologies such as carbon capture and storage to meet the commitment to reduce CO₂ emissions by at least 40% by 2030.
- There are currently around 200 coal-fired power plants in more than 100 NUTS-2 EU regions and over 120 mines in 41 regions employing almost 240,000 workers in total.
- In 2017, the Platform for Coal Regions in Transition was launched to minimise the economic and social impact of decarbonisation.
- Reliable data are key for the management of the transition and estimates of the number of jobs indirectly related to coal activities are needed.
- This Policy Insight presents the indirect jobs estimated using the input-output (IO) data of the RHOMOLO-IO modelling framework. The estimates suggest that 215,000 additional jobs can be potentially affected by the shift away from coal towards a low-carbon economy.

1. Policy context

In her letter to Elisa Ferreira, Commissioner-designate for Cohesion and Reforms, the President-elect of the European Commission Ursula von der Leyen drew attention to the profound effects that climate change is having on the lives of European citizens.

Among the new initiatives proposed for the future work of the European Commission, a *Just Transition Fund* will be implemented to offer – among other objectives – tailored support to the most affected regions, for instance those industrial, coal and energy-intensive ones undergoing significant local transformations. The operational activity of this new Fund will be aligned as much as possible with both the ESF (European Social Fund – see Sakkas, 2018) and the InvestEU which comes as a follow-up of EFSI (European Fund for Strategic Investments – see Christensen et al., 2018 and 2019).

In the EU, coal accounts for 16% of gross inland energy consumption and 24% of the power generation mix. The importance of coal has decreased over time and the need to reduce greenhouse gas emissions (the EU has committed to reduce CO₂ emissions by at least 40% by 2030) has led to active discouragement of coal activities with stringent post-2020 emission requirements and high CO₂ emission allowance prices.

The European Commission is working in order to ensure a smooth transition to cleaner forms of energy production and to implement innovative technologies such as carbon capture and storage. It is widely recognised that the shrinkage of the coal sector may have negative consequences on employment and on the economies of the regions hosting coal and lignite mining activities as well as coal-fired power plants.

As a result, the European Commission launched the Platform for Coal Regions in Transition in 2017 to design policies aimed at minimising the economic and social impact of decarbonisation by supporting public authorities and other relevant stakeholders to manage the decarbonisation process.

In 2018, there were 207 coal-fired power plants in 103 NUTS-2 regions (15% of the total EU power generation capacity) and 128 coal mines in 41 regions producing annually 500 million tonnes (55% of gross EU consumption). According to DG GROW data, the coal sector directly employs 237,000 people, 185,000 of which in coal mining. Half this workforce is located in Poland, and other countries employing more than 10,000 workers are Germany, Czech Republic, Romania, and Bulgaria.

The perspective of coal mines and power plants being closed down in the near future means that the

workers involved in these activities will lose their jobs, with potentially dramatic consequences for their well-being and for that of the regions relying on coal for their economies. Moreover, concentrating on the direct jobs only could be misleading and could lead to underestimate the economic impact of decarbonisation. Although indirectly, there are workers whose jobs are related to the coal business and to the economic activity that it generates and it is plausible to assume that these jobs will also be affected by the structural change of the energy sector away from coal.

Since official data on the number of jobs indirectly related to coal activities do not exist, estimates help to gauge the importance of this additional dimension when managing the necessary transition towards decarbonisation. This Policy Insight reports the estimated number of indirect jobs obtained using the RHOMOLO-IO modelling framework (Mandras et al., 2019) which covers the 267 NUTS-2 regions of the EU and, for the purpose of this analysis, 14 economic sectors (the disaggregation of the coal-related sectors has been made using direct jobs data provided by DG GROW).

2. The modelling assumptions

The IO (Leontief) model is an ideal tool to study the relationships among the industries of an economy. The interindustry transactions table constitutes the bulk of an IO dataset and contains information on the flows of products among the sectors that both produce and consume such products.

As explained by Mandras et al. (2019), the IO framework permits to carry out a number of different economic analyses mainly based on the so-called IO output multipliers. The economic effects of a change in demand such as an investment project in a certain sector can be analysed via multipliers quantifying the knock-on effects throughout the economy generated by the initial demand change.

The initial increase in demand for a certain sector (the so-called direct effect) generates additional economic activity in all the rest of the sectors that must produce intermediate inputs for the final products of that initial sector (this is the indirect effect). The sum of the direct and indirect effects divided by the initial change in demand is normally referred to as type-I multiplier.

Complementing the IO table with employment data allows to use the type-I multipliers to estimate the number of indirect jobs related to a certain activity. A crucial information to produce these estimates is the number of jobs directly related to coal activities, which in this case was provided by the European Commission's DG GROW. Thissen et al. (2019) offer an overview of the RHOMOLO-IO data used to perform the analysis building on DG GROW employment numbers.

The RHOMOLO-IO results rely on a number of assumptions such as constant returns to scale, fixed production techniques, and the absence of any supply constraints. Thus, the results reported in the following section have to be interpreted keeping these hypotheses in mind.

The policy impact of this research

The results of this analysis are featured in the JRC Science for Policy Report entitled "EU coal regions: opportunities and challenges ahead" (Alves Dias et al., 2018). That report is a comprehensive study of several dimensions related to the decarbonisation transition including its consequences on employment, an analysis of the coal-related emissions, as well as the potential opportunities in terms of development of greener technologies.

3. Main results

Table 1 below reports the number of direct jobs in coal-related activities (source: DG GROW), and the number of estimated indirect jobs using Type-I multipliers of the RHOMOLO-IO model. These jobs are not related directly to coal mining and coal power plants activities but rather to their supply chain, and therefore may be impacted by the EU decarbonisation process.

The numbers of the "intra-regional" column represent the jobs that a country would lose should it shut down its coal-related activities. The numbers of the "inter-regional" also include the indirect jobs that would be lost due to the shutting down of the coal activities in the rest of the EU. Thus, the difference between the two columns can be interpreted as a measure of the importance of the employment effects of trade indirectly related to coal activities.

Of the more than 237,000 people directly involved with coal activities, around 185,000 are employed in

coal mining and about 52,000 in coal-fired power plants. Of the latter, Poland holds the largest number of jobs (13,000) followed by Germany (11,000) and the UK (4,100). The countries with more person employed in coal mining are Poland (almost 100,000), Germany (25,000), and the Czech Republic (18,000). These three countries are also those with the highest numbers of jobs directly related to coal overall.

Table 1: Direct and indirect jobs in coal-related activities

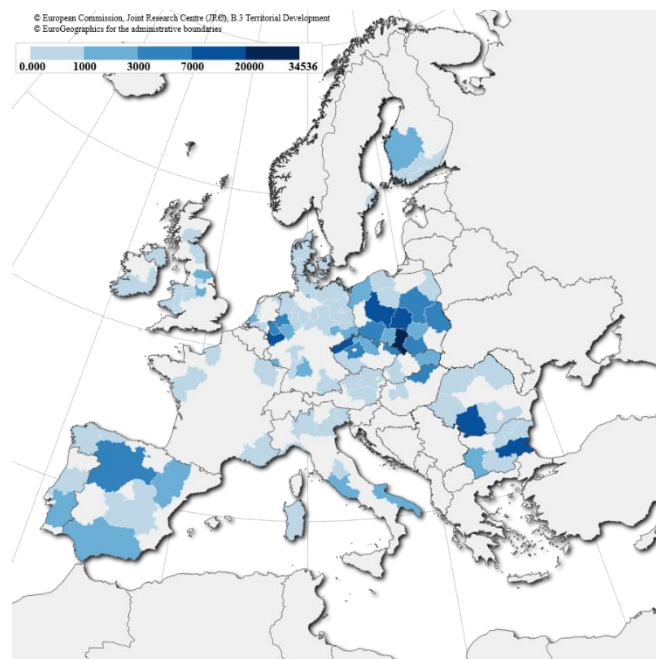
| Country | Direct | Indirect: intra-regional | Indirect: inter-regional |
|-----------------------|----------------|--------------------------|--------------------------|
| Austria | 500 | 769 | 1,943 |
| Bulgaria | 14,500 | 9,452 | 15,220 |
| Croatia | 200 | 339 | 385 |
| Czech Republic | 21,600 | 10,018 | 19,229 |
| Denmark | 1,000 | 1,019 | 2,429 |
| Finland | 1,100 | 1,693 | 3,240 |
| France | 600 | 525 | 1,237 |
| Germany | 35,700 | 14,089 | 34,366 |
| Greece | 6,500 | 1,843 | 4,166 |
| Hungary | 2,500 | 2,255 | 4,735 |
| Ireland | 400 | 280 | 378 |
| Italy | 2,700 | 906 | 3,970 |
| Netherlands | 900 | 1,777 | 3,995 |
| Poland | 112,500 | 48,746 | 87,760 |
| Portugal | 700 | 344 | 1,229 |
| Romania | 18,600 | 6,194 | 10,101 |
| Slovakia | 2,700 | 1,189 | 2,058 |
| Slovenia | 1,900 | 1,270 | 1,833 |
| Spain | 6,700 | 5,107 | 9,643 |
| Sweden | 100 | 275 | 573 |
| UK | 6,100 | 2,133 | 6,276 |
| TOTAL | 237,500 | 110,223 | 214,766 |

Source: DG GROW (direct jobs) and JRC elaborations based on the RHOMOLO-IO model (indirect jobs).

The RHOMOLO-IO estimates indicate that the largest number of persons employed in activities indirectly related to coal is in Poland (almost 90,000). 55% of them work in the supply chain of national coal mines and power plants, while the remaining jobs are generated from coal activities in the rest of the EU. In accordance with the direct jobs numbers, the country with the second largest workforce indirectly related to coal is Germany, where almost 35,000 persons are estimated to work in the coal supply chain. Almost 60% of these jobs are generated from activities outside Germany, reflecting a productive structure more open to trade than the Polish one. Other countries with significant workforces indirectly related to coal activities include the Czech Republic

(almost 20,000 jobs), Bulgaria (more than 15,000 jobs), and Romania and Spain (about 10,000 jobs each). These numbers mask a noteworthy within-country regional heterogeneity. Indeed, figure 1 shows the distribution of indirect jobs in inter-regional supply chains in the NUTS-2 regions of the EU.

Figure 1: Distribution of indirect jobs in inter-regional supply chains, EU NUTS-2 regions



Source: RHOMOLO-IO model elaborations based on DG GROW data on direct jobs in coal-related activities.

The NUTS-2 region with the largest workforce employed in activities indirectly related to coal is the Silesian province (PL22) with more than 34,000 estimated jobs in activities indirectly related to coal. Moreover, the following six regions host more than 7,000 jobs in the same type of activities:

- the Łódź and Wielkopolska provinces (PL11 and PL41 - 19,459 and 8,090 jobs, respectively), also in Poland;
- the Yugoiztochen Planning Region (BG34 - 12,064 jobs) in Bulgaria;
- Severozápad (CZ04 - 10,310 jobs) in the Czech Republic;
- Cologne (DEA2 - 8,275 jobs) in Germany;
- and Sud-Vest Oltenia (RO41 - 8,214 jobs) in Romania.

These numbers suggest that, although the shift away from coal would affect the whole EU, some regions are particularly at risk in terms of employment vulnerability. This suggests the need for territorial-specific policies aimed at supporting workers in their

search for alternative occupations during and after the transition away from coal activities.

4. Conclusions

The analysis summed up in this Policy Insight provides estimates of the jobs indirectly related to coal activities in those EU Member States where either coal mines or coal-fired power plants (or both) are currently active. This is an information that policy makers should take into account when managing the transition to cleaner forms of energy production in order to meet the commitment to reduce CO₂ emissions by at least 40% by 2030 in the EU.

As for any modelling outcome, the numbers reported here should be interpreted with care as they result from a number of assumptions (see Section 2). Nevertheless, they provide evidence on the economic importance that coal activities have in the EU and highlight the importance of the need for a strategically planned retirement of coal assets and a gradual industrial restructuring process to support redundant coal-related workers.

How to cite:

Mandras, G., Conte, A., and Salotti, S. (2019). Coal regions in transition: the RHOMOLO-IO indirect jobs estimates. Territorial Development Insights Series, JRC118641, European Commission.

Read more

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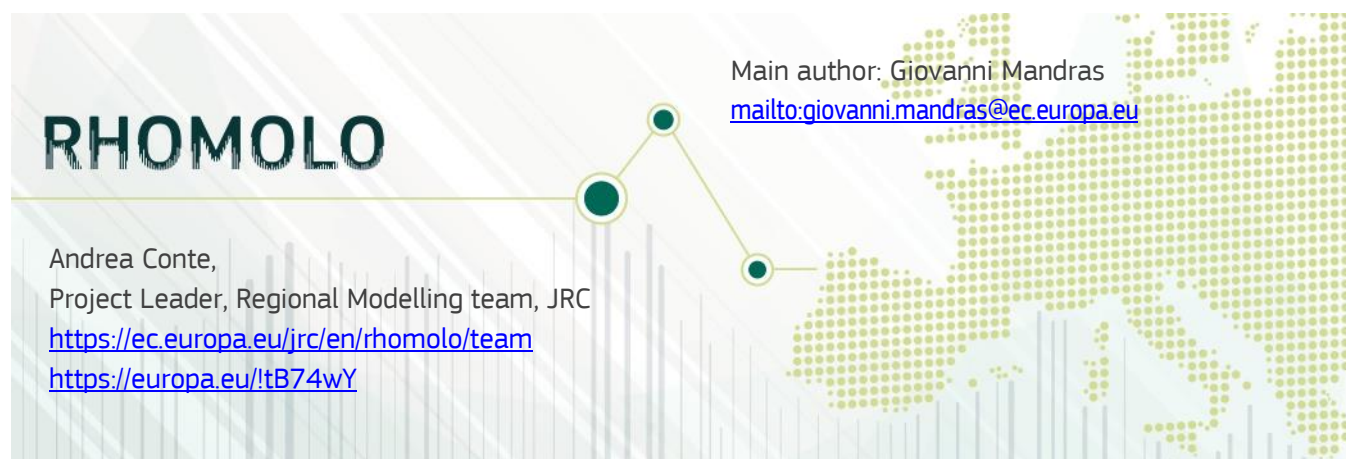
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The graphic features the RHOMOLO logo in large, bold, black letters on the left. Below it, the text identifies Andrea Conte as the Project Leader of the Regional Modelling team at JRC, with two URLs: <https://ec.europa.eu/jrc/en/rhomolo/team> and <https://europa.eu/!tB74wY>. On the right, a stylized map of Europe is composed of green dots. A line with three circular nodes connects the map to the text 'Main author: Giovanni Mandras' and his email address <mailto:giovanni.mandras@ec.europa.eu>.