

Regional Industrial Transitions to Climate Neutrality

Summary of results – full draft paper can be shared at a later stage before the conference

Identifying most affected sectors

Why are regional industrial transitions to climate neutrality important?

- Industrial transitions to reach climate neutrality by 2050 are key for regional development. Emission intensive manufacturing accounts for a large share of global GHG emissions and these emissions have grown markedly. These sectors are among the most difficult to decarbonise, requiring deep transformations in production methods. Energy inputs are important. These sectors are also capital-intensive. Assets are often long-lived, exposing them to stranded asset risks.
- Sectoral manufacturing activities and employment are often regionally concentrated, potentially making regions vulnerable to persistent regional economic effects, a key concern for the just transition. Some industries will shed employment, mostly on a small scale on aggregate, but regionally concentrated.
- There are shared and sector-specific characteristics to the transformations industries require to reach climate neutrality by 2050, with impacts on, costs, local comparative advantage, jobs and skills. Shared transformations include reducing energy consumption and shifting to zero-carbon energy sources as well as moving towards a circular economy. Some will require hydrogen and some carbon capture and storage to remove process emissions. Transformations also result because climate neutrality requires different manufacturing goods. They also result from impacts on value chains and new infrastructure requirements.

How have key sectors been identified?

- A key criterion for selecting manufacturing industries is the extent to which their emissions are covered by the EU's Emissions Trading System (ETS). This is because ETS emissions data are available by region.
- Matching ETS data with business data allows to identify the sectors of origin of ETS emissions, according to the main activity of businesses or their subsidiaries. This paper therefore creates new emissions statistics by NACE sector.
- ETS covers emissions in manufacturing sectors to varying degrees. For 6 sectors ETS covers more than 50% of emissions. These are the manufacture of paper and paper products (NACE 17), manufacture of coke and refined petroleum products (NACE 19), manufacture of chemicals and chemical products (NACE 20), manufacture of non-metallic mineral products (NACE 23), manufacture of basic metals (NACE 24) and manufacture of motor vehicles (NACE 29).
- These sectors contribute the most to manufacturing emissions, with the exception of the manufacture of motor vehicles (NACE 29). In car manufacturing, transformation challenges result instead from the production of zero-emission vehicles. These sectors are among the sectors which may shed employment on aggregate.
- Outside the selected sectors, emissions are also important in the food industry (NACE 10). Within the selected sectors, some subsectors stand out for the emissions and energy intensity, in particular the manufacture of pulp, paper and paperboard (NACE 171), cement, lime and plaster (NACE 235), basic iron, steel and of ferro-alloys (NACE 241) and the production of aluminium (NACE 2442).

Identifying vulnerable regions

How have vulnerable regions been identified?

- Employment shares and emissions per capita in the key manufacturing sectors are indicators for the intensity of needed transformations.
- Regions with high employment shares have a concentration of employment and activity in manufacturing sectors undergoing large transformations. Employment may be further concentrated in NUTS 3 regions, but this can only be analysed for a few countries with available data. Making more granular regional NACE sectoral data available, at least at the 3-digit level, would allow a more precise identification of regional transition risks, as subsectors within 2-digit NACE sectors are often diverse with respect to transformations they need to undergo.
- Regions with higher emissions per capita are more exposed to particularly emissions-intensive manufacturing. Using EU ETS data, and using an innovative approach to match ETS data to company data, emissions from installations can be attributed not only to regions but also to the sectors in fine detail. However, installations that fall below the EU ETS threshold or belong to companies not covered in ORBIS are not picked up.

Which are the regions with workers who are at risk?

- High employment shares of the key manufacturing sectors are mainly concentrated in Central and Eastern Europe. Although employment in car manufacturing dominates, several regions in Central Europe have high employment in multiple manufacturing sectors undergoing large transformations.
- Regions with high employment shares and high emissions per capita in the manufacture of chemicals and chemical products are mostly in Central and Western Europe. In some cases, high employment in this sector overlaps with high employment in oil refining as both are often closely related.
- Regions with high employment shares in manufacturing of basic metals are geographically dispersed. Not all regions have both high employment shares and high emissions per capita. Regions with high emissions per capita in steel and aluminium are mostly in Northern and Central Europe.
- Employment in the manufacture of other non-metallic mineral products is spread throughout most of Europe, with emissions from the manufacture cement, lime and plaster mainly concentrated in Poland, Germany and Spain.
- Northern European regions have the highest employment shares in the manufacture of paper and paper products, as well as the highest emissions per capita in the manufacture of paper, pulp and paperboard alongside some Southern European regions.
- Regions with high employment shares in the manufacture of motor vehicles, trailers and semi-trailers are found in Central and Eastern Europe.

Next steps

- In some of the regions vulnerable to regional industrial transitions to climate neutrality identified in this paper, some key manufacturing sectors require access to infrastructure to produce in a climate-neutral way. This includes in particular infrastructure relating to carbon capture and storage, hydrogen and zero-carbon freight transport. These questions are addressed in the third working paper of this series.
- To prepare policies for a just transition to support most vulnerable workers, firms and regions, the socio-economic vulnerabilities of the regions most vulnerable to regional industrial transitions should be determined, as well as the vulnerabilities of individual workers and firms and their capacity to respond to the transformation. These questions are addressed in the fourth working paper of this series.

- To identify the transformations most vulnerable regions need to undertake in key manufacturing sectors with precision, as well as the resulting just transition challenges, more granular regional employment data is necessary. Granular value-added and wage data will also help assess regional development implications. The fourth working paper in this series provides an overview of available data allowing to identify gaps.
- The analysis could be extended to other major manufacturing sectors which need to undergo important transformations to reach climate neutrality, such as in the food industry. This analysis would benefit from emissions data with sector and region of origin. If not available, granular employment and other economic data are particularly important.
- This analysis can be extended to cover regions in other countries where data are available, notably in countries covered by the EU ETS.

Identifying regional access to hydrogen carbon capture and storage, hydrogen and climate neutral freight

How have vulnerable regions been identified?

- Former offshore hydrocarbon extraction sites under the North Sea are the most likely CO₂ storage sites. Onshore sites are uncertain in economic, regulatory and perhaps also safety conditions, notably with respect to CO₂ re-emergence. Transportation infrastructure investments are substantial, preferably by pipeline, and are subject to scale economies. Cement production point sources pose the biggest challenges. Process emission mitigation in cement production depends the most on CCUS and production sites are geographically dispersed.
- Green hydrogen production depends on renewable potentials. Hydrogen production with nuclear electricity is an alternative but most growth in zero-carbon electricity generation will come from renewables. Low-cost hydrogen and derived product imports are likely to be important. Industrial production sites close to ports or well connected to existing natural gas pipeline networks will have best access to hydrogen imports.
- Regions with less dense rail infrastructure may be less able to substitute rail for road freight, which is difficult to decarbonise. Freight transport from and to ports, today often by road, contributes substantially to transport costs.

Which are the regions at risk?

- Remote unclustered production sites with process emissions, frequent in cement production, may face the biggest CO₂ transport costs. If CCS below the North Sea prevails, costs may be highest in the southern and eastern EU regions. Regions with dispersed cement production far from the North Sea may require the most effort to explore reliable onshore CO₂ storage sites.
- Regions far from potential storage sites may be most under pressure to reach climate neutrality without CCS in chemicals and steel but may not be the most technologically advanced to stem the required deeper transformations.
- Hydrogen import dependence is strongest in chemical industry clusters in North-western EU regions, which are relatively well connected to ports and gas pipelines.
- Rail network density is lowest in peripheral regions of the EU, especially in regions distant from ports, while major ports are located in the North.

Identifying potential socio-economic impacts

Understanding the socio-economic vulnerabilities in the key transition regions, their workers and their businesses will help policy makers identify targeted policy support, laying the basis for a regionally balanced and just transition.

- Lower GDP per capita and employee compensation as well as more widespread poverty risk make many key transition regions more vulnerable than their respective countries on average, and in some cases also relative to the EU as a whole. Unemployment is often relatively low, perhaps in part reflecting the strength of manufacturing in these regions.
- Employee compensation in the key manufacturing sectors is often substantially higher than average regional employee compensation, in particular in regions where regional employee compensation and GDP per capita are relatively low. This will reinforce regional development implications of risks to jobs in key sectors.
- Several key transition regions stand out for multiple vulnerabilities. In these regions vulnerabilities are also often more intense and reflected in net regional emigration.
- Individual worker vulnerabilities in the production of non-metallic mineral differ across key transition regions, although the sector and regions can only be broadly identified on the basis of the EU's *Structure of Earnings Statistics*. For example, low earnings vulnerability is low in Belgium's *Région wallonne* but high in Italy's *Centro*.
- Low educational attainment or employment in low-skill occupations are relatively widespread among workers in the manufacture of non-metallic mineral products in Italy's *Centro* and Poland's *Makroregion południowo-zachodni* and *Makroregion centralny*, making them less-well prepared for new skill requirements.
- Young workers need to build their careers with the transition to climate neutrality. In the key transformation regions they are particularly vulnerable to industrial transitions that will require skill upgrades as they are more likely to be on temporary contracts. In *Région wallonne* as well as in *Makroregion południowo-zachodni* and *Makroregion centralny* they are often on low earnings. All of these may hinder access to training.
- In *Makroregion południowo-zachodni* and *Makroregion centralny*, in particular, older workers are subject to heightened poverty risk from early retirement or job loss.
- High collective bargaining coverage may protect otherwise vulnerable workers in *Région wallonne* and *Centro Italia*. Collective worker representation in the Polish regions is low, and collective agreements may not include provisions on training.
- Highly productive firms in the key sectors are likely to be able to better integrate new technologies in production processes. They are also more likely to be profitable and have the resources to invest in them. Regions with many highly productive firms will therefore be better able to address challenges and take advantage of opportunities in the transition to climate neutrality.
- In sectors where employment is likely to shrink on aggregate, notably automobiles and oil refining, regions with establishments of less productive firms may be the most at risk of closure or of downsizing or may be among the first to close or downsize.
- Regions differ substantially with respect to the labour productivity of companies active in them, notably in the production of chemicals and steel. However, data are available only for few companies. In the chemicals industry key transition regions with lowest productivity tend to be most emission-intensive.