

MAPPING LOW-CARBON INDUSTRIAL TECHNOLOGIES PROJECTS FUNDED BY ERDF IN 2014-2020

ANABELA MARQUES SANTOS, PETER RESCHENHOFER, JULIA BACHTRÖGLER-UNGER, ANDREA CONTE AND NIELS MEYER

- Industrial activities were responsible for around 20% of the greenhouse gas emissions in Europe in 2019.
- Cement, chemicals and steel industries are among the most energy-intensive industries (EIs).
- Around €26,522 Million (ML) of the European Regional Development Fund (ERDF) were used to support projects related to the development of low-carbon industrial technologies (15% of total ERDF in 2014-2020).
- 16% of ERDF low-carbon projects are associated with Research & Innovation (R&I) funding (€4,255 ML).
- 13% of R&I low-carbon projects (€549 ML) are transnational and interregional cooperation projects (under the Interreg programme).
- A higher share of low-carbon projects is observed in central and eastern Europe.
- ERDF projects aimed at reducing the carbon footprint are mainly located in the most polluting regions.
- ERDF projects in the chemicals industry (€407 ML) registered a substantially higher amount than those in cement (€101 ML) or steel (€89 ML) industries.

1. CONTEXT

Industrial activities were responsible for around 20% of the greenhouse gas (GHG) emissions in 2019 in the EU (EEA, 2021). Together with energy supply and transport, they are one of the main contributors of GHG emissions in the EU (EEA, 2021). Despite the recorded emissions reduction by industrial sectors between 1990 and 2019, the transition to a climate neutral economy by 2050 will require a significant effort by all industrial economic activities. In turn, this will be especially relevant for energy-intensive industries (EIs) such as cement, chemicals and steel industries*.

Several EU policy instruments have been put in place to support the green transition and the uptake / development of low-carbon technologies. This policy brief shows in which regions the European Regional Development Fund (ERDF) was used to support those type of projects. The analysis is based on the JRC-WIFO ERDF database (Bachtrögler *et al.*, 2021)[†]. By means of text analysis techniques, it is possible to extract relevant information on the territorial allocation of beneficiaries, projects and investments under the different areas relevant to the broad category of low-carbon industrial technologies (see box methodology on page 3).

* Based on Eurostat data on GHG emissions per capita in 2019 [env_ac_ainah_r2]. Energy-intensive industries include cement, ceramics & refractory, chemicals, ferro-alloys & silicon, fertilizers, glass, lime, non-ferrous metals, pulp & paper, refining and steel industries (EC, 2019).

[†] This database comprises around 600,000 observations on ERDF project beneficiaries during the 2014-2020 period providing a unique coverage and level of details on the ERDF operations.

2. EU STRUCTURAL AND INVESTMENT FUNDS (ESIF)

Over half of EU funding is channelled through the [European structural and investment \(ESI\) funds](#).[‡] The purpose is to invest in job creation and a sustainable and healthy European economy and environment. They mainly focus on five areas: research and innovation; digital technologies; supporting the low-carbon economy; sustainable management of natural resources and small businesses.

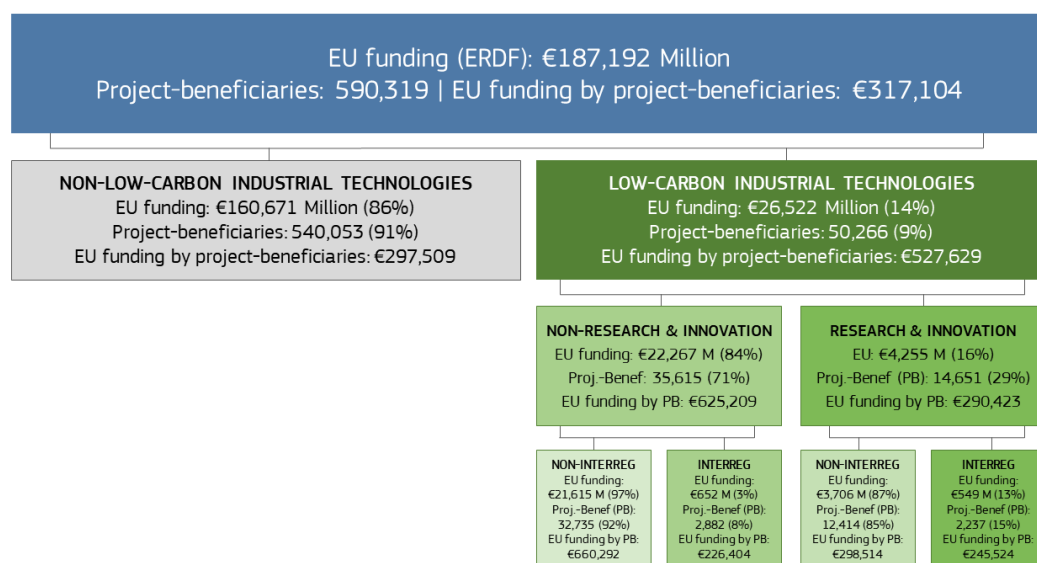
ESI funds contribute to reinforce the innovation eco-system both in the up-stream and/or down-stream of the innovation process or the value chain (EC, 2014). ESI funds can support innovation by building capacity, such as R&I infrastructure, equipment and skills – pre-conditions for successful engagement into subsequent R&I activities (up-stream investments). Moreover, ESI funds can complement Horizon 2020 initiatives, which are usually more focused on basic and applied research (low and medium technology readiness level – TRLs), by providing financial support for technology development or to launch product in the market (medium-high TRLs) (down-stream investments).

3. ERDF PROJECTS ON LOW-CARBON INDUSTRIAL TECHNOLOGIES: AN OVERVIEW

Over the period 2014-2020, around €26,522 Million were used to support ERDF projects related to low-carbon industrial technologies – around 15% of the total ERDF (Figure 1). This amount is divided into Research & Innovation (R&I) (16%) and non-R&I projects (84%). Non-R&I projects are mainly associated with capacity building (e.g. energy and environmental infrastructures and business development) to support climate change objectives.

[‡] The ESIF includes the ERDF (European Regional Development Fund), Cohesion Fund, ESF (European Social Fund), EAFRD (European Agricultural Fund for Rural Development) and EMFF (European Maritime and Fisheries Fund).

Figure 1. Low-carbon industrial technologies projects over the total ERDF projects, 2014-2020, EU27 + UK, by innovation and cooperation typologies



Source: Own elaboration based on Bachtrögler et al. (2021).

Note: Projects relating to low-carbon technologies were identified through text analysis. The classification of Research & Innovation projects is associated with the ERDF intervention fields. Interreg refers to transnational and interregional cooperation projects.

R&I projects are related to the development and implementation of technologies with a focus on the low carbon economy. They, for instance, include expenditures on infrastructures, researchers, processes, technology transfer and cooperation (between enterprises and university-enterprise). 13% of low-carbon project funding (€549 ML) are associated with transnational and interregional cooperation projects, under the Interreg programme.[§]

Below we report some key evidence emerging on the monitoring of ERDF projects over the period 2014-2020.

On average, the *size* of ERDF projects on low-carbon industrial technologies appear much bigger than projects classified outside this category (527k versus 298k Euros) (Figure 1).

In terms of *geographical patterns*, the relative shares of low-carbon projects over the total ERDF regional allocation – both in terms of *funding* and *beneficiaries* (Figure 2 – left and right, respectively) – allow to identify specialisation patterns across Europe. Central and Eastern European regions (as well as the UK) appear to have a relatively higher share of low-carbon projects over 2014-2020.

Figure 3 provides evidence on *funding intensity* under three different measures. Regions in Croatia, Greece, Poland, Romania and Lithuania have the highest amount of ERDF per capita associated with low-carbon projects (left). The share of R&I funding of these projects is higher in some regions of Belgium, UK and the Netherlands (centre). Finally, some regions of UK, Poland, and Finland have the

highest R&I funding of low-carbon projects in per capita terms (right).

Furthermore, an analysis of the relationship between the concentration of ERDF low-carbon projects and CO2 emissions from energy-intensive industries (EII) facilities** reveals a positive correlation at regional level. In other terms, ERDF projects aimed at reducing the carbon footprint are indeed located in the most polluting regions. Such relationship is even higher for R&I low-carbon projects, in comparison with non-R&I projects. In turn, this suggests that regions with a higher CO2 emissions from EII facilities have a stronger focus on developing and implementing R&I-related low-carbon technologies rather than simply targeting (non R&I) capacity building in low-carbon economy.

Countries like The Netherlands, Finland and Slovakia, with an intensity of CO2 emissions from EII almost the double than the EU average, are using more than 20% of the ERDF budget to projects in low-carbon technologies (Table 1). Croatia, Bulgaria and Latvia are also displaying more than 25% of the ERDF budget to low-carbon projects, even if the intensity of emissions from EII is lower than the EU average.

The policy impact of this research

The main results of this Policy Insight are included in the *ERA industrial technology roadmap for low-carbon technologies in energy-intensive industries* (European Commission, 2022).

[§] Interreg aims at promoting cooperation between regions and countries to help their economic and social development and tackle the obstacle of borders (for more details, see Commission [webpage](#)).

** Correlation matrix and scatterplot available upon request.

Figure 2. Specialisation patterns: EU regions investing ERDF co-funding in low-carbon industrial technologies, 2014-2020, EU27 + UK

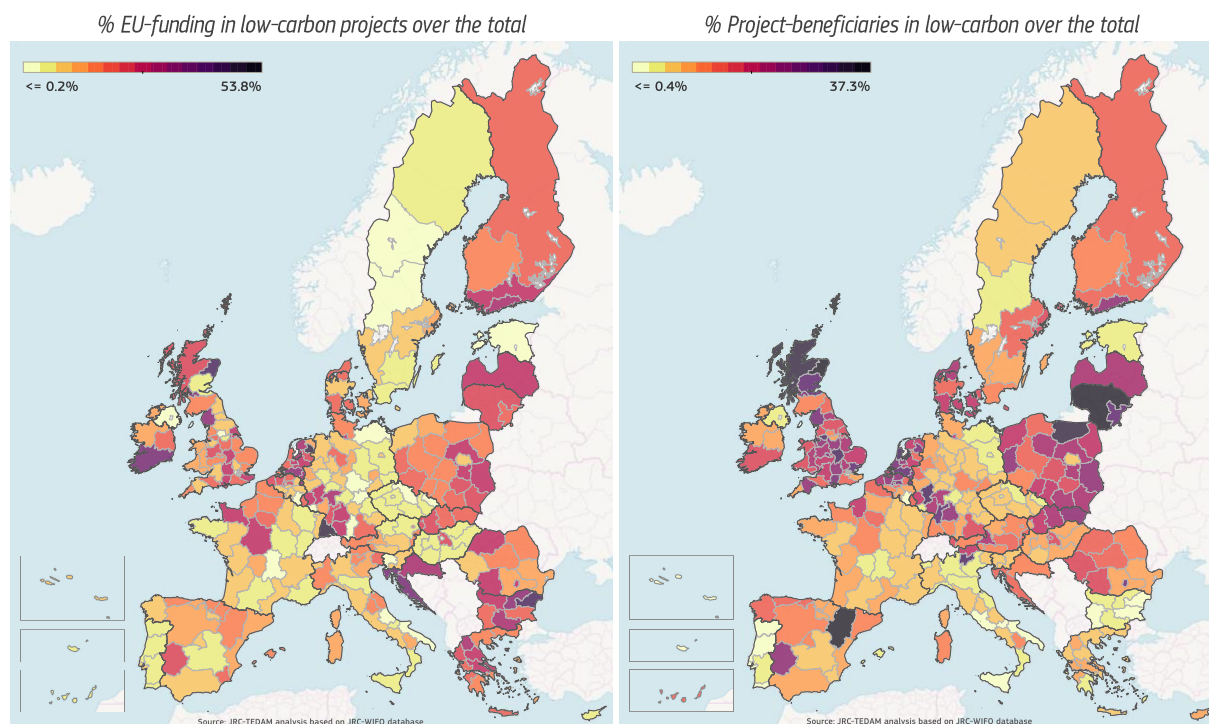
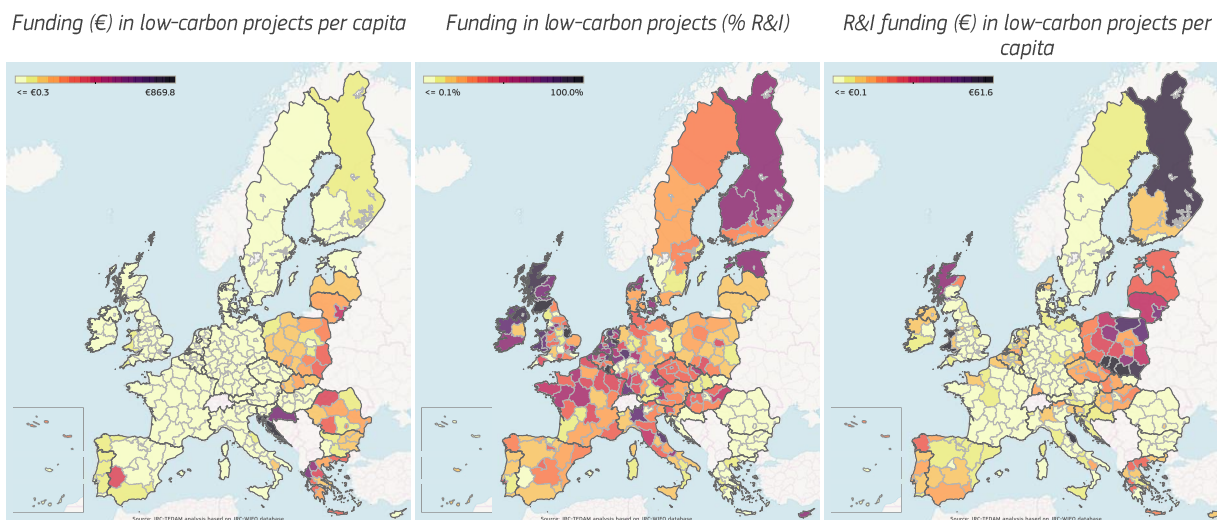


Figure 3. Funding intensity: EU regions investing ERDF co-funding in low-carbon industrial technologies, 2014-2020, EU27 + UK, Total and Research & Innovation (R&I)



Source: Own elaboration based on data from Bachtrögler et al. (2021).

Methodological approach

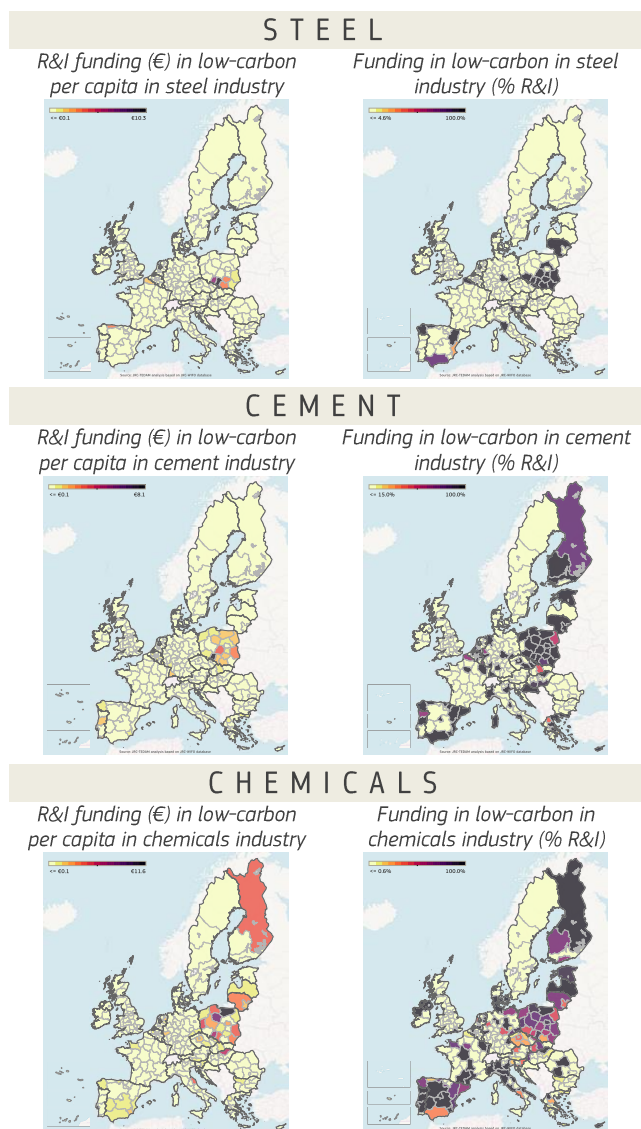
- A text analysis approach is used to identify low-carbon industrial technologies projects. Based on a list of keywords, several text algorithm runs are made on the text of the projects descriptions to identify those subsets of investments related to “low-carbon industrial technologies”. Ex-post quality checks are then made on the resulting sample via an iterative process to refine the final list of keywords. Finally, this is used for sample identification and the calculation of the relevant related statistics.
- ERDF categories of intervention associated to each projects are used to distinguish between R&I and non-R&I projects. Moreover, to identify low-carbon projects by industries (steel, cement and chemicals), in addition to specific keywords associated to these activities, also NACE codes of the beneficiaries were used.

Table 1. CO2 emissions from energy-intensive industries (EII) facilities and the share of low-carbon projects (% total ERDF) by country

COUNTRY	CO2 emissions from EII per capita	Low-carbon projects (% total ERDF amount)
Belgium	2.7	12%
Slovakia	2.4	20%
Austria	2.4	12%
Finland	2.3	21%
Netherlands	2.2	25%
Luxembourg	2.1	20%
Lithuania	1.8	21%
Estonia	1.7	2%
Czechia	1.6	4%
Germany	1.5	8%
Cyprus	1.4	4%
Greece	1.3	18%
EU27 - average	1.3	14%
Spain	1.2	12%
Sweden	1.2	5%
Croatia	1.2	33%
Portugal	1.0	6%
Italy	1.0	8%
Poland	1.0	18%
Ireland	1.0	21%
France	0.9	10%
Bulgaria	0.9	27%
Slovenia	0.9	5%
Romania	0.8	18%
Hungary	0.8	4%
Denmark	0.7	13%
Latvia	0.5	26%

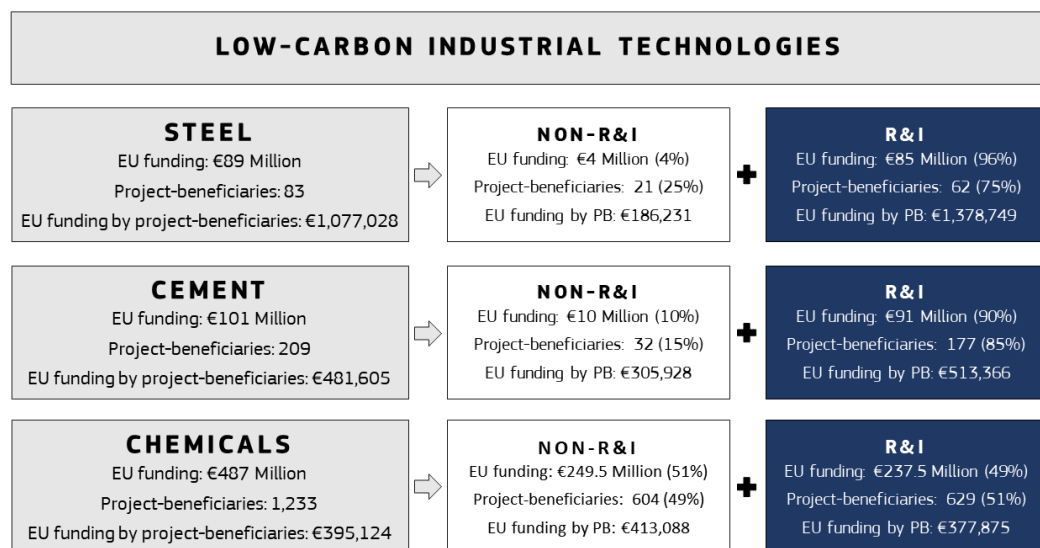
Source: Own elaboration based on data from Bachtrögler et al. (2021) for ERDF and data from Energy and Industry Geography Lab (JRC - Petten) for the CO2 emissions (2018). Note: Malta is not reported in the table because there are no facilities of the EII in the country covered by the ETS.

Figure 5. EU regions investing R&I ERDF co-funding in low-carbon industrial technologies, 2014-2020, EU27 + UK, by industry



Source: Own elaboration based on data from Bachtrögler et al. (2021).

Figure 4. Low-carbon industrial technologies by industry specific, 2014-2020, EU27 + UK



Source: Own elaboration based on Bachtrögler et al. (2021).

Note: Projects relating to low-carbon technologies in chemicals industry were identified through text analysis and the NACE code of the beneficiaries (manufacture industries related to chemicals with project in low-carbon technologies). The classification of Research & Innovation projects is associated with the ERDF intervention fields.

4. LOW-CARBON INDUSTRIAL TECHNOLOGIES PROJECTS BY SPECIFIC INDUSTRIES

Chemicals-related projects account for more funding and beneficiaries than steel- and cement-related projects (Figure 4). The former have a relatively smaller funding average size and are almost equally divided into R&I and non-R&I investments. On the contrary, steel- and cement-related projects under ERDF are almost entirely R&I related.

R&I low-carbon projects in chemicals, cement and steel industries are concentrated in some EU regions/countries (Figure 5). For instance, the intensity of R&I funds expressed as per capita for chemical industry is particularly high in some regions of Poland, Hungary and Finland (bottom left). Some regions of Poland also show the highest intensity of R&I funds expressed as per capita in cement (top left) and steel industries (centre left). Furthermore, the share of R&I projects in chemicals, steel and cement industries (right) is 100% (or close to) in most of the regions with low-carbon projects in these specific industry.

5. CONCLUSION

Policy evaluation is a key element in the policy cycle, especially in the context of a transition to climate neutral economy. It helps to understand policy choice and regional patterns to support more effective policies. The present study provides for the first time a mapping of the low-carbon industrial technologies projects funded by ERDF in the programming period 2014-2020. The analysis takes advantage of the novel dataset (Bachtrögler et al., 2021) which includes the description of projects co-funded by the ERDF in 2014-2020.

The analysis is performed combining qualitative and quantitative techniques to provide useful evidences about the regional location of ERDF low-carbon industrial technologies projects. Findings show that ERDF investment projects to reduce the carbon footprint are essentially located in the most polluting regions. Some countries like Croatia, Bulgaria, Latvia and Netherlands are also displaying the highest share of low-carbon co-funded

projects over total ERDF budget, even if these countries (except Netherlands) display an intensity of CO₂ emissions from energy-intensive industries (EIIs) facilities below the EU average. Future analyses may be carried out to better understand why some industries, such as steel and cement, are benefiting less from the ERDF, as well as understanding the determinants of low carbon technologies projects (e.g. macro-economic conditions and maturity of the sector).

REFERENCES

- Bachtrögler, J., Arnold, E., Doussineau, M., and Reschenhofer, P. (2021). *UPDATE: Dataset of projects co-funded by the ERDF during the multi-annual financial framework 2014-2020*, JRC125008.
- EC (2014). *Enabling synergies between European Structural and Investment Funds, Horizon 2020 and other research, innovation and competitiveness-related Union programmes - Guidance for policy-makers and implementing bodies*. Luxembourg: Publications Office of the European Union. doi: 10.2776/84939.
- EC (2019). *Masterplan for a competitive transformation of EU energy-intensive industries enabling a climate-neutral, circular economy by 2050*, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Publications Office, 2019, <https://data.europa.eu/doi/10.2873/723505>
- EEA (2021). [EEA greenhouse gases - data viewer](#) (13 Apr 2021).

Acknowledgment

The authors would like to thanks JRC-Petten for the data provided on CO₂ emissions.

How to cite:

Marques Santos, A.; Reschenhofer, P.; Bachtrögler-Unger, J.; Conte, A and Meyer, N. (2022). *Mapping Low-Carbon Industrial Technologies projects funded by ERDF in 2014-2020*. Territorial Development Insights Series, JRC128452, European Commission.

REMO

Regional Economic Monitoring

Territorial Data Analysis and Modelling team (TEDAM)

<https://europa.eu/GvwdF4>

Contact information

Andrea Conte
European Commission, Joint Research Centre
Email: Andrea.CONTE@ec.europa.eu