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# Pilot scoping study for indicators of industrial research, innovation and technologies in the field of Industry 5.0

## Background of the study

The study was was implemented between December 2022 and August 2024. It aimed to develop a first scoping of available indicators for a future Industry 5.0 indicator framework and test it in two ecosystems, including Automotives and Energy Intensive Industries (EII). The concept of Industry 5.0 is focused on the three pillars of Human-centricity, Resilience and Sustainability. In this study, each Industry 5.0 pillar is defined by specific concepts that capture the inputs, behaviours, and results of EU firms and industries along the three pillars.

The team developed a set of Specific, Measurable, Accurate, Robust and Timely (SMART) indicators for the three pillars of Industry 5.0. Data was collected from company and patent databases (Orbis, Dealroom, Technote, PATSTAT), labour force and company surveys (EU Labour Force Survey, Community Innovation Survey), statistical databases (Eurostat) and several other data sources. In the final phase of the study, the team produced an in-depth analysis of 21 Industry 5.0 indicators, which provided the most robust data.

The study could not capture data from the publicly available sources on other indicators related to behaviours, technology and product design (e.g. eco-design, human-centric design, biomimicry), company-level organisational, environmental and social innovation that are also key to achieving Industry 5.0 outcomes across the three pillars. Therefore, this list of indicators should be taken as a starting point for further development with the Industry 5.0 Community of Practice.

With the above caveat, we present the study's main findings below and showcase examples of the progress in the selected industrial ecosystems along the three Industry 5.0 dimensions.

## Key finding 1

### Available evidence suggests that the overall uptake of Industry 5.0 is at a nascent stage

The study team estimates that **around 5-10% of EU automotive and energy-intensive companies actively adhere strongly to Industry 5.0 principles**. Multiple data points suggest this share, e.g. between 2-7% of EU workers in the two analysed industrial ecosystems received on-the-job or outside-of-the-job training as per EU LFS data. Fewer than 10% of EU companies actively addressed UN Sustainable Development Goals, and between 5-13% of companies obtained sustainability/environment ISO standards.

Nevertheless, the analysis results also show that the EU-27 made commendable strides in sustainability, outperforming global averages across several indicators within the EII ecosystem and demonstrating a competitive edge in the automotive/mobility industry. This includes a higher share of companies engaged in low carbon, circular, and clean energy technologies and those upholding high sustainable development standards. Notably, the EU boasts a significantly higher share of firms adhering to sustainability ISO standards and contributing to SDG 12, underscoring a robust commitment to sustainable practices compared to the global landscape.

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Patent data reveals a stronger inclination towards low-carbon technology (LCT) patents, indicating a focused investment in sustainability-oriented innovation. This trend is more pronounced than investments in clean/renewable energy industries technology (CREI) or circular economy industries technology (CEI), highlighting a sector-specific approach to adopting green technologies.

The contribution to SDG 12, aimed at ensuring sustainable consumption and production patterns, marks a critical indicator of the industry's alignment with broader sustainability goals. Despite a low overall share of firms contributing to this goal, the EU's performance doubles the global average, showcasing a leading role in adopting sustainability practices.

While not particularly focused on the analysed ecosystems due to a lack of data at this granular level, the indicators already provide a picture of key aspects that need improvement towards Industry 5.0 especially for the human-centricity pillar. For instance, industries invest differently in their employees' upskilling in each Member State: 0,6% of employees received up-skilling or re-skilling support on the job in Bulgaria versus 20% in Finland in 2022.

Industries and other ecosystem stakeholders like educational actors also need to take action to contribute to better skills mismatch: the divergence seems to be quite high across different European Member States, with the share of workers with educational levels lower than the job requirements ranging from 5-22% across the EU.

However, the low sample sizes and variation across member states suggest a need for further data collection and investigation to display industry contributions towards sustainable development with more clarity.

## Key finding 2

### Synergetic effects between the three pillars of Industry 5.0

A statistical analysis conducted to understand how the different indicators are related to each other sheds insights on the synergetic effects between the three pillars of Industry 5.0.

The analyses reveal that companies that are contributing to UN SDGs, have productivity above the median, and invest and are active in LCT/CEI/CREI technologies perform well alongside the other indicators measuring Industry 5.0. These three companies' characteristics consistently increase (or decrease) alongside other indicators measuring Industry 5.0, pointing to synergetic effects across the three pillars.

Despite minor differences, the highlighted effects hold true even when focusing solely on companies in EII or in the automotive/mobility sector. It should be noted that data limitations in these sectors prevent a comprehensive analysis of the synergetic effects across the three pillars of Industry 5.0.

## Glossary

**CREI**: clean and renewable energy industries technology
**LCT**: low-carbon technology
**CEI**: circular economy industries technology
**EII**: Energy Intensive Industries

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# **Industry 5.0 resilience pillar:** Examples of indicators tested in the Automotives Industrial Ecosystem

**95,6%**
Companies' survival rate (EU27 average, 2023)

**Source:** Indicator R17. Company's survival rate. **Data source:** Orbis

**4,6%**
Median Added value per employee (EU27 average, 2021)

**Source:** Indicator R17. Company's survival rate. **Data source:** Orbis

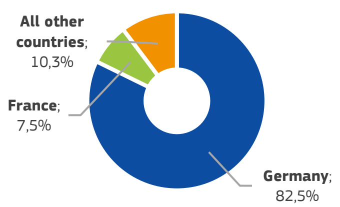
**22,4%**
of all direct material inputs used in the EU (economy as a whole) are imported

**Source:** Indicator R16. Raw material import dependency. **Data source:** Eurostat, 2022

**57,5%**
of all energy consumed in the EU (economy as a whole) is imported

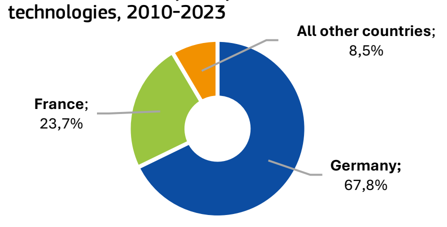
**Source:** Indicator R15. Energy dependency. **Data source:** Eurostat, 2022

### Total patent count in advanced technologies, 2010-2023



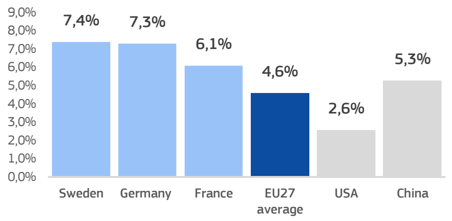

**Source:** Indicator R9 Total patent count in advanced technologies. **Data source:** PATSTAT and Technote data

### R&D investments by companies active in advanced technologies, 2010-2023



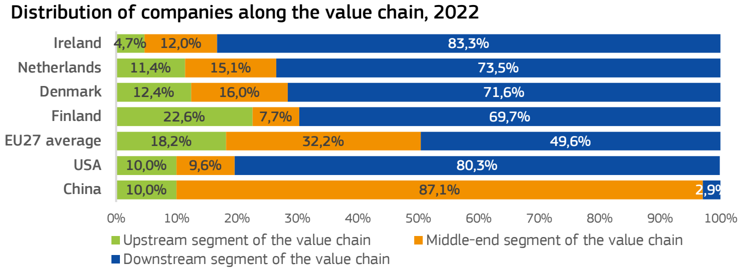

**Source:** Indicator R12 R&D investments by companies active in advanced technologies. **Data source:** PATSTAT and Technote data

### Company's productivity, 2021



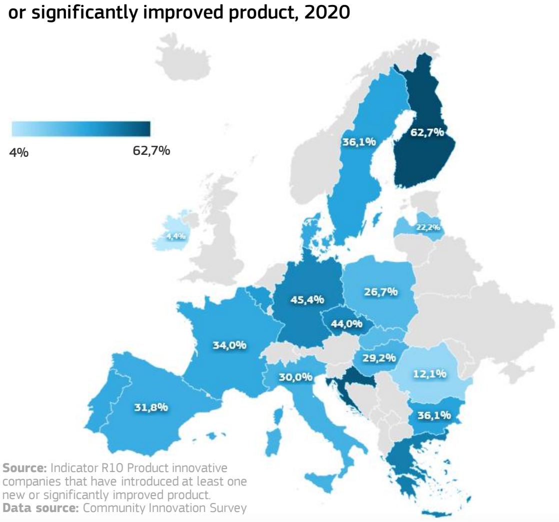

**Source:** Indicator R7. Company's productivity. **Data source:** Orbis

### Distribution of companies along the value chain, 2022



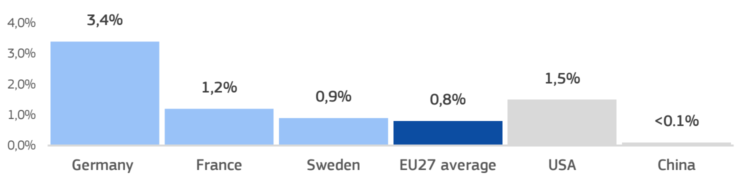

**Source:** Indicator R11. Distribution of companies along the value chain. **Data source:** Orbis, Dealroom and Technote data

### Share of companies that have introduced at least one new or significantly improved product, 2020




**Source:** Indicator R10 Product innovative companies that have introduced at least one new or significantly improved product. **Data source:** Community Innovation Survey

### Company's R&D intensity, 2021




**Source:** Indicator R2. Company's R&D intensity. **Data source:** Orbis

### Detailed view

| | **R9. TOTAL PATENT COUNT BY ADVANCED TECHNOLOGY** (2010-2023) | **R10. PRODUCT INNOVATIVE COMPANIES THAT HAVE INTRODUCED AT LEAST ONE NEW OR SIGNIFICANTLY IMPROVED PRODUCT** (2022) | **R11. DISTRIBUTION OF COMPANIES ALONG THE VALUE CHAIN** (2022) | | | | | | **R17. SURVIVAL RATE OF COMPANIES** (2023) |
|---|---|---|---|---|---|---|---|---|---|
| | NACE C29 - Manufacture of motor vehicles, trailers and semi-trailers | NACE C29 - Manufacture of motor vehicles, trailers and semi-trailers | Upstream segment of the value chain | | Middle-end segment of the value chain | | Downstream segment of the value chain | | |
| Austria | 62 | N/A | 17,1% | (60) | 21,7% | (76) | 61,1% | (214) | 96,5% |
| Belgium | 355 | 39,1% | 14,3% | (59) | 23,3% | (96) | 62,4% | (257) | 94,9% |
| Bulgaria | 1 | 36,1% | 10,1% | (7) | 49,3% | (34) | 40,6% | (28) | 97,1% |
| Croatia | 2 | 59,5% | 10,8% | (4) | 54,1% | (20) | 35,1% | (13) | 98,5% |
| Cyprus | 1 | N/A | 16,7% | (1) | 16,7% | (1) | 66,7% | (4) | N/A |
| Czechia | 25 | 44,0% | 21,1% | (47) | 66,4% | (148) | 12,6% | (28) | 100,0% |
| Denmark | 22 | 33,3% | 12,4% | (21) | 16,0% | (27) | 71,6% | (121) | 94,9% |
| Estonia | N/A | N/A | 8,1% | (5) | 50,0% | (31) | 41,9% | (26) | 100,0% |
| Finland | 38 | 62,7% | 22,6% | (50) | 7,7% | (17) | 69,7% | (154) | 94,7% |
| France | 1456 | 34,0% | 24,7% | (319) | 37,2% | (480) | 38,2% | (493) | 92,3% |
| Germany | 16035 | 45,4% | 20,5% | (632) | 21,0% | (648) | 58,5% | (1804) | 96,4% |
| Greece | N/A | 48,4% | 6,5% | (3) | 47,8% | (22) | 45,7% | (21) | 100,0% |
| Hungary | 17 | 29,2% | 10,5% | (17) | 74,7% | (121) | 14,8% | (24) | 96,1% |
| Ireland | 6 | 4,4% | 4,7% | (7) | 12,0% | (18) | 83,3% | (125) | 99,5% |
| Italy | 512 | 30,0% | 25,2% | (373) | 33,3% | (492) | 41,5% | (613) | 94,6% |
| Latvia | N/A | 22,2% | 4,0% | (1) | 28,0% | (7) | 68,0% | (17) | 90,8% |
| Lithuania | N/A | N/A | 18,9% | (7) | 27,0% | (10) | 54,1% | (20) | 96,0% |
| Luxembourg | 17 | N/A | 17,6% | (3) | 29,4% | (5) | 52,9% | (9) | N/A |
| Malta | N/A | N/A | N/A | | 50,0% | (6) | 50,0% | (6) | N/A |
| Netherlands | 98 | N/A | 11,4% | (56) | 15,1% | (74) | 73,5% | (360) | 94,3% |
| Poland | 4 | 26,7% | 12,9% | (82) | 55,0% | (350) | 32,1% | (204) | 97,5% |
| Portugal | 3 | 33,3% | 6,7% | (17) | 39,0% | (99) | 54,3% | (138) | 96,8% |
| Romania | 60 | 12,1% | 9,0% | (15) | 78,3% | (130) | 12,7% | (21) | 99,2% |
| Slovakia | N/A | 25,6% | 10,3% | (16) | 82,7% | (129) | 7,1% | (11) | 99,7% |
| Slovenia | 4 | N/A | 17,8% | (8) | 71,1% | (32) | 11,1% | (5) | 97,1% |
| Spain | 678 | 31,8% | 12,2% | (143) | 39,4% | (461) | 48,4% | (567) | 94,9% |
| Sweden | 99 | 36,1% | 21,2% | (87) | 15,9% | (65) | 62,9% | (258) | 93,6% |
| **EU-27 average/total** | **19442** | **N/A** | **18,2%** | **(2040)** | **32,2%** | **(3599)** | **49,6%** | **(5541)** | **95,6%** |

# **Industry 5.0 resilience pillar:** Examples of indicators tested in Energy Intensive Industries

**97,9%**
Companies' survival rate (EU27 average, 2023)

**Source:** Indicator R17. Company's survival rate. **Data source**: Orbis

**5,1%**
Median added value per employee (EU27 average, 2021)

**Source:** Indicator R17. Company's survival rate. **Data source**: Orbis

**22,4%**
of all direct material inputs used in the EU (economy as a whole) are imported.

**Source:** Indicator R16. Raw material import dependency. **Data source**: Eurostat, 2022

**57,5%**
of all energy consumed in the EU (economy as a whole) is imported

**Source:** Indicator R15. Energy dependency. **Data source:** Eurostat, 2022

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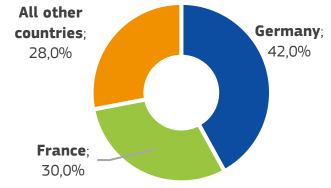
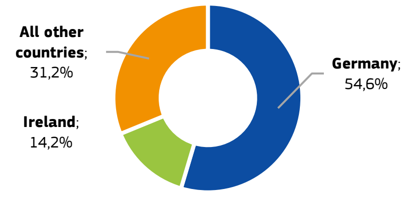


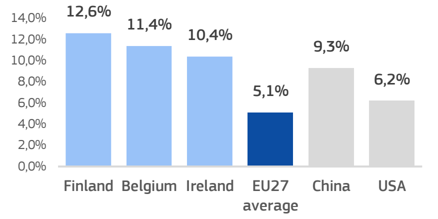

**Source:** Indicator R9 Total patent count in advanced technologies. **Data source:** PATSTAT and Technote data

## R&D investments by companies active in advanced technologies, 2010-2023



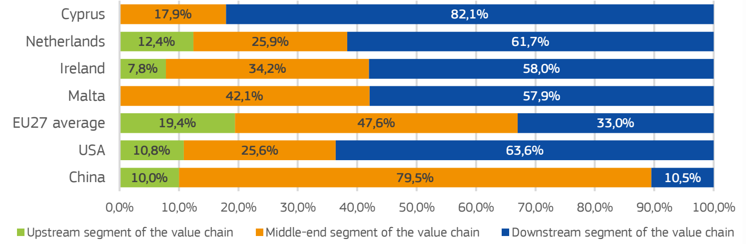

**Source:** Indicator R12 R&D investments by companies active in advanced technologies. **Data source:** PATSTAT and Technote data

## Company's productivity, 2021



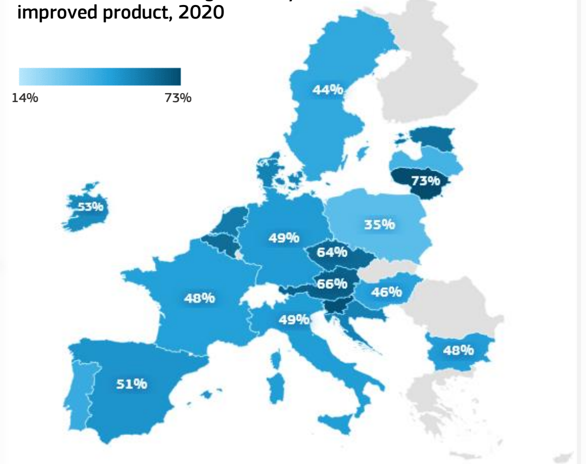

**Source:** Indicator R7. Company's productivity. **Data source:** Orbis

## Distribution of companies along the value chain, 2022



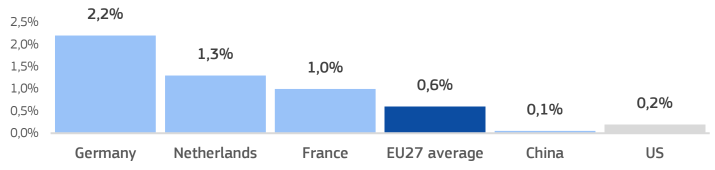

**Source:** Indicator R11. Distribution of companies along the value chain. **Data source:** Orbis, Dealroom and Technote data

## Share of companies that have introduced at least one new or significantly improved product, 2020




**Source:** Indicator R10 Product innovative companies that have introduced at least one new or significantly improved product. **Data source:** Community Innovation Survey

## Company's R&D intensity, 2021




**Source:** Indicator R2. Company's R&D intensity. **Data source:** Orbis

## Detailed view

| | **R9. TOTAL PATENT COUNT BY ADVANCED TECHNOLOGY** | **R10. PRODUCT INNOVATIVE COMPANIES THAT HAVE INTRODUCED AT LEAST ONE NEW OR SIGNIFICANTLY IMPROVED PRODUCT** | | | | | | | **R11. DISTRIBUTION OF COMPANIES ALONG THE VALUE CHAIN** | | | | | | **R17. SURVIVAL RATE OF COMPANIES** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **C16** - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials | **C17** - Manufacture of paper and paper products | **C19** – Manufacture of coke and refined petroleum products | **C20** - Manufacture of chemicals and chemical products | **C22** - Manufacture of rubber and plastic products | **C23** – Manufacture of other non-metallic mineral products | **C24** - Manufacture of basic metals | Upstream segment of the value chain | | Middle-end segment of the value chain | | Downstream segment of the value chain | | |
| **Austria** | 408 | N/A | N/A | N/A | 66,4% | N/A | 23,8% | 34,7% | 21,7% | (256) | 45,7% | (539) | 32,6% | (385) | 98,5% |
| **Belgium** | 1038 | 18,4% | 60,6% | N/A | 62,8% | 51,2% | 25,3% | 41,2% | 20,0% | (430) | 45,0% | (966) | 34,9% | (750) | 97,9% |
| **Bulgaria** | 14 | 17,5% | 34,0% | 33,3% | 47,9% | 29,0% | 25,3% | 37,4% | 14,2% | (66) | 65,0% | (303) | 20,8% | (97) | 98,9% |
| **Cyprus** | 2 | 30,2% | 32,1% | N/A | N/A | 48,7% | 30,6% | N/A | 7,4% | (23) | 76,1% | (236) | 16,5% | (51) | 97,2% |
| **Croatia** | N/A | 32,2% | 43,3% | N/A | 56,8% | 45,3% | 31,8% | 45,0% | N/A | N/A | 17,9% | (7) | 82,1% | (32) | N/A |
| **Czechia** | 78 | 29,7% | 34,3% | N/A | 63,5% | 38,3% | 43,0% | 34,1% | 23,8% | (205) | 63,6% | (549) | 12,6% | (109) | 99,2% |
| **Denmark** | 98 | 24,7% | 15,2% | 50,0% | 56,5% | 39,4% | 19,8% | 31,6% | 15,9% | (138) | 36,3% | (315) | 47,8% | (415) | 97,0% |
| **Estonia** | 4 | N/A | N/A | N/A | 61,8% | N/A | 22,5% | 40,0% | 4,2% | (20) | 81,1% | (387) | 14,7% | (70) | 97,8% |
| **Finland** | 861 | 35,0% | 47,2% | N/A | N/A | 51,9% | 38,9% | 34,2% | 30,4% | (299) | 34,5% | (339) | 35,2% | (346) | 97,3% |
| **France** | 6098 | 15,8% | 27,3% | 50,6% | 47,8% | 41,4% | 26,7% | 38,7% | 20,3% | (1051) | 46,5% | (2401) | 33,2% | (1715) | 97,6% |
| **Germany** | 8508 | 30,9% | 32,1% | 54,2% | 48,7% | 36,7% | 29,6% | 31,9% | 25,6% | (2218) | 34,4% | (2980) | 39,9% | (3458) | 97,8% |
| **Greece** | 32 | N/A | 39,2% | N/A | N/A | 52,3% | 45,3% | 38,1% | 8,7% | (34) | 62,0% | (241) | 29,3% | (114) | 99,4% |
| **Hungary** | 37 | 12,9% | 16,4% | 50,0% | 45,7% | 26,9% | 21,9% | 15,4% | 14,0% | (75) | 68,4% | (366) | 17,6% | (94) | 97,7% |
| **Ireland** | 15 | 8,5% | 19,8% | N/A | 53,3% | 47,3% | 11,6% | 23,6% | 7,8% | (43) | 34,2% | (188) | 58,0% | (319) | 99,2% |
| **Italy** | 1408 | 21,4% | 30,5% | 12,8% | 48,5% | 38,4% | 41,1% | 22,7% | 21,8% | (2172) | 52,6% | (5252) | 25,6% | (2552) | 98,0% |
| **Latvia** | 5 | 11,9% | 12,9% | N/A | 39,5% | 32,2% | 28,3% | 0,0% | 8,8% | (19) | 61,4% | (132) | 29,8% | (64) | 97,8% |
| **Lithuania** | 5 | N/A | N/A | 75,0% | 72,5% | 46,5% | 26,3% | 22,2% | 8,5% | (19) | 61,9% | (138) | 29,6% | (66) | 97,9% |
| **Luxembourg** | 535 | N/A | N/A | N/A | N/A | 36,7% | 21,1% | 42,9% | 21,2% | (24) | 48,7% | (55) | 30,1% | (34) | 100,0% |
| **Malta** | N/A | 0,0% | 20,0% | N/A | 14,3% | 20,0% | 15,4% | N/A | N/A | N/A | 42,1% | (8) | 57,9% | (11) | N/A |
| **Netherlands** | 321 | N/A | N/A | N/A | 58,8% | N/A | 35,7% | 33,1% | 12,3% | (312) | 25,9% | (655) | 61,7% | (1560) | 97,4% |
| **Poland** | 122 | 11,6% | 17,7% | 58,3% | 34,8% | 25,5% | 16,3% | 20,7% | 15,1% | (483) | 60,1% | (1921) | 24,7% | (790) | 97,9% |
| **Portugal** | 39 | 16,1% | 41,0% | 62,5% | 42,4% | 47,6% | 24,9% | 24,5% | 9,0% | (93) | 62,6% | (649) | 28,4% | (295) | 99,2% |
| **Romania** | 14 | 1,5% | 6,5% | N/A | N/A | 7,0% | 14,8% | 3,0% | 8,2% | (47) | 75,5% | (432) | 16,3% | (93) | 97,3% |
| **Slovakia** | 14 | 12,7% | 6,0% | N/A | N/A | 11,9% | 14,0% | 22,7% | 16,8% | (66) | 70,7% | (277) | 12,5% | (49) | 98,5% |
| **Slovenia** | 24 | N/A | N/A | N/A | 71,3% | 47,3% | 49,0% | 34,4% | 15,7% | (50) | 66,4% | (211) | 17,9% | (57) | 97,4% |
| **Spain** | 247 | 13,5% | 20,5% | N/A | 50,9% | 25,7% | 12,6% | 18,9% | 14,0% | (563) | 53,1% | (2139) | 32,9% | (1326) | 98,1% |
| **Sweden** | 320 | 26,9% | 38,2% | 25,0% | 44,2% | 39,6% | 27,7% | 28,7% | 22,9% | (310) | 38,1% | (516) | 39,0% | (528) | 97,3% |

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# **Industry 5.0 human-centricity pillar:** Examples of indicators tested in the Automotives Industrial Ecosystem and Energy Intensive Industries

**92%**
of workers globally would stay at their company longer if it invested in helping them learn

**Source:** LinkedIn 2019 Workforce Learning Report

**72%**
of workers globally are excited about opportunities to learn and grow in their role

**Source:** PwC's Global Workforce Hopes and Fears Survey 2024 of 56,600 workers across 50 countries and regions

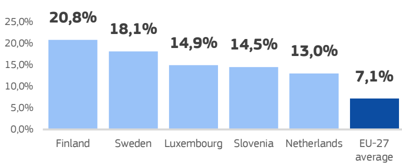
**7,1%**
Share of workers that participated in employee upskilling or re-skilling (on-the-job) in 2021 (EU27 average)

**Source:** Indicator HC1. Share of workers that participated in employee upskilling or re-skilling (on-the-job) in the last reference period (2021), **Data source:** Labour Force Survey (LFS)

**2,1%**
Share of workers that participated in employee upskilling or re-skilling (outside of the job) in 2021 (EU27 average)

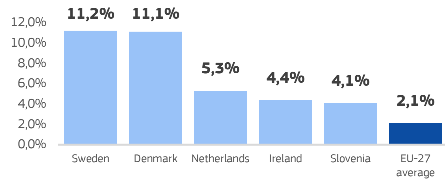
**Source:** Indicator HC1. Share of workers that participated in employee upskilling or re-skilling (outside of the job) in the last reference period (2021), **Data source:** Labour Force Survey (LFS)

### Share of workers that participated in employee upskilling or re-skilling (on-the-job), 2021
(economy-wide figures)



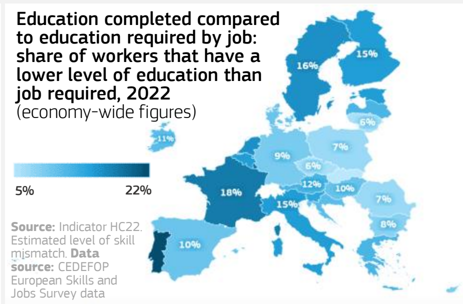

**Source:** Indicator HC1. Share of workers that participated in employee upskilling or re-skilling (on-the-job) in the last reference period (2021), **Data source:** LFS

### Share of workers that participated in employee upskilling or re-skilling (outside of the job), 2021
(economy-wide figures)



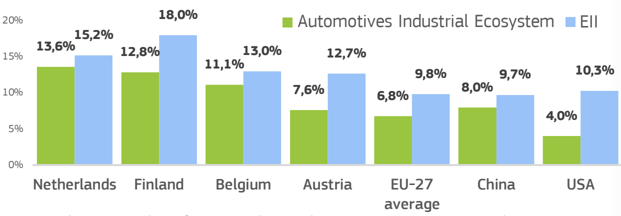

**Source:** Indicator HC1. Share of workers that participated in employee upskilling or re-skilling (outside of the job) in the last reference period (2021), **Data source:** LFS

### Education completed compared to education required by job: share of workers that have a lower level of education than job required, 2022
(economy-wide figures)



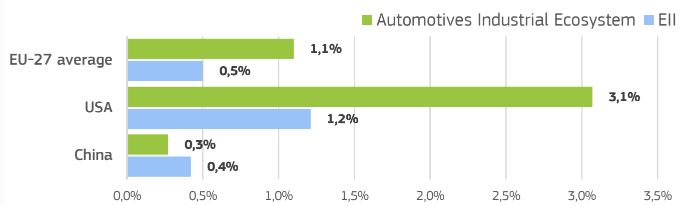

**Source:** Indicator HC22. Estimated level of skill mismatch. **Data source:** CEDEFOP European Skills and Jobs Survey data

### Share of companies that contribute to at least one UN SDG in Automotive and EII ecosystems



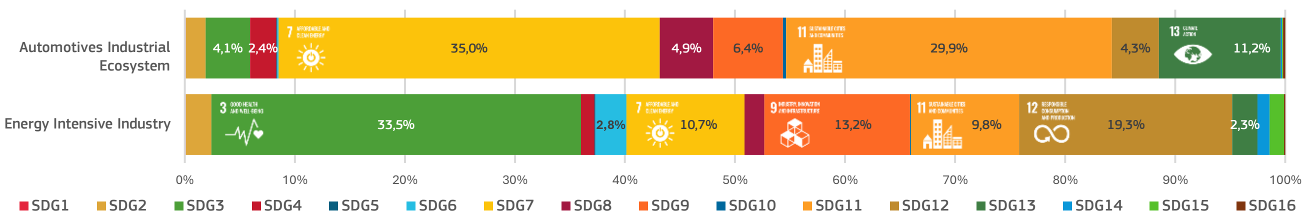

**Source:** Indicator HC24. Share of companies that contribute to UN SDGs in Automotive and EII ecosystems. **Data source**: RDI dashboard (Technote) data. **Data retrieved** in June 2024

### Share of firms active in virtual reality/augmented reality/human-robot interaction technologies, robots in automotive and EII ecosystems




**Source:** Indicator HC9. Firms active in virtual reality/augmented reality/human-robot interaction technologies, robots. **Data source**: RDI dashboard (Technote) data. **Data retrieved** in October 2023

### **Companies that contribute to at least one UN SDG**, distribution by industry




**Source:** Indicator R2. Company's R&D intensity. **Data source:** Orbis

### Detailed view

| | HC1. SHARE OF WORKERS THAT PARTICIPATED IN EMPLOYEE UPSKILLING OR RE-SKILLING (ON-THE-JOB) IN 2021 | HC1. SHARE OF WORKERS THAT PARTICIPATED IN EMPLOYEE UPSKILLING OR RE-SKILLING (OUTSIDE OF THE JOB) IN 2021 | HC1. SHARE OF WORKERS THAT WERE ENCOURAGED TO MAKE DECISIONS AT DIFFERENT SENIORITY LEVELS IN 2021 | HC22. ESTIMATED LEVEL OF SKILL MISMATCH (2022) | HC24. SHARE OF COMPANIES THAT CONTRIBUTE TO UN SDGS IN THE AUTOMOTIVES INDUSTRIAL ECOSYSTEM | | HC24. SHARE OF COMPANIES THAT CONTRIBUTE TO UN SDGS IN EII | | HC9. SHARE OF FIRMS ACTIVE IN VIRTUAL REALITY/ AUGMENTED REALITY/HUMAN-ROBOT INTERACTION TECHNOLOGIES, ROBOTS, AUTOMOTIVES INDUSTRIAL ECOSYSTEM | | HC9. SHARE OF FIRMS ACTIVE IN VIRTUAL REALITY/AUGMENTED REALITY/ HUMAN-ROBOT INTERACTION TECHNOLOGIES, ROBOTS, EII | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Austria | 10,1% | 2,3% | 25,8% | 12,0% | 7,6% | (421) | 12,7% | (798) | 0,6% | (14) | 0,5% | (10) |
| Belgium | 10,1% | 0,9% | 21,4% | 15,0% | 11,1% | (594) | 13,0% | (1420) | 0,5% | (20) | 0,6% | (26) |
| Bulgaria | 0,6% | 0,1% | 21,5% | 8,0% | 3,8% | (236) | 7,3% | (739) | 0,2% | (2) | 0,1% | (1) |
| Cyprus | 7,5% | 1,4% | 26,4% | 9,0% | 14,3% | (7) | 18,5% | (54) | N/A | N/A | 0,8% | (1) |
| Croatia | 3,6% | 0,6% | 23,9% | 11,0% | 12,9% | (279) | 12,6% | (666) | N/A | N/A | 0,1% | (1) |
| Czechia | 5,5% | 0,5% | 22,9% | 6,0% | 2,5% | (3352) | 8,3% | (6280) | 0,7% | (9) | 0,5% | (8) |
| Denmark | 7,4% | 11,1% | 15,8% | 10,0% | 18,1% | (298) | 13,5% | (680) | 1,7% | (35) | 0,5% | (9) |
| Estonia | 12,9% | 2,1% | 32,4% | 15,0% | 5,7% | (53) | 8,1% | (320) | 0,7% | (3) | N/A | N/A |
| Finland | 20,8% | 3,9% | 26,2% | 15,0% | 12,8% | (3168) | 18,0% | (5029) | 1,0% | (17) | 0,5% | (10) |
| France | 6,2% | 3,5% | 39,7% | 18,0% | 9,1% | (304) | 11,5% | (668) | 2,7% | (283) | 0,6% | (57) |
| Germany | 3,5% | 0,8% | 32,0% | 9,0% | 11,5% | (1547) | 10,7% | (3542) | 1,3% | (242) | 0,8% | (125) |
| Greece | 2,0% | 0,4% | 23,6% | 12,0% | 4,0% | (151) | 12,0% | (401) | 0,3% | (2) | N/A | N/A |
| Hungary | 4,0% | 1,6% | 12,7% | 10,0% | 5,6% | (31) | 10,7% | (222) | 0,3% | (6) | 0,2% | (6) |
| Ireland | 6,6% | 4,4% | 39,9% | 15,0% | 14,8% | (216) | 16,6% | (467) | 0,2% | (2) | 0,3% | (4) |
| Italy | 8,5% | 1,3% | 26,8% | 12,0% | 4,2% | (210) | 7,5% | (495) | 0,8% | (85) | 0,6% | (117) |
| Latvia | 7,2% | 1,1% | 11,2% | 6,0% | 21,9% | (4878) | 16,1% | (10786) | 0,5% | (2) | 0,1% | (1) |
| Lithuania | 7,6% | 1,3% | 10,4% | 19,0% | 37,1% | (62) | 19,2% | (224) | 0,5% | (4) | 0,1% | (1) |
| Luxembourg | 14,9% | 1,7% | 32,9% | 18,0% | 0,0% | (12) | 9,5% | (63) | N/A | N/A | N/A | N/A |
| Malta | 10,4% | 3,5% | 47,6% | 16,0% | 9,1% | (32) | 6,3% | (199) | N/A | N/A | N/A | N/A |
| Netherlands | 13,0% | 5,3% | 18,1% | 7,0% | 13,6% | (11) | 15,2% | (16) | 1,5% | (64) | 0,5% | (36) |
| Poland | 4,4% | 1,2% | 22,2% | 22,0% | 3,0% | (566) | 7,6% | (2233) | 0,8% | (20) | 0,6% | (34) |
| Portugal | 9,1% | 1,5% | 39,8% | 11,0% | 2,9% | (1058) | 4,6% | (3109) | 0,2% | (6) | 0,1% | (2) |
| Romania | 5,9% | 0,4% | 21,7% | 7,0% | 1,5% | (1078) | 8,1% | (1520) | 0,3% | (6) | 0,1% | (2) |
| Slovakia | 4,5% | 0,2% | 11,8% | 5,0% | 7,1% | (267) | 7,0% | (395) | 0,3% | (3) | 0,6% | (7) |
| Slovenia | 14,5% | 4,1% | 25,7% | 14,0% | 1,8% | (500) | 6,3% | (1112) | 0,2% | (1) | 0,6% | (5) |
| Spain | 11,3% | 1,2% | 28,0% | 10,0% | 3,4% | (164) | 8,9% | (447) | 0,9% | (76) | 0,2% | (21) |
| Sweden | 18,1% | 11,2% | 31,0% | 16,0% | 7,4% | (308) | 13,4% | (473) | 0,3% | (12) | 0,7% | (24) |
| **EU-27 average** | **7,1%** | **2,1%** | **28,4%** | N/A | **6,8%** | **(19803)** | **9,8%** | **(42358)** | **1,1%** | **(914)** | **0,5%** | **(508)** |

# **Industry 5.0 sustainability pillar:** Examples of indicators tested in the Automotives Industrial Ecosystem

**11,3%**
of companies find the increasing customer demand for products that help mitigate or adapt to climate change (e.g. low- carbon products) highly important

**Source:** Indicator S16. Extent to which there is increasing customer demand for products that help mitigate or adapt to climate change (e.g. low- carbon products). **Data source:** Community Innovation survey (2020)

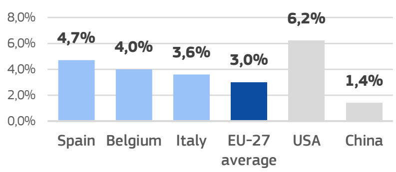
**3%**
of companies are linked to low carbon and circular technologies (LCT, CEI, CREI)

**Source:** Indicator S4. Number/share of companies linked to low carbon and circular technologies. **Data source:** RDI dashboard (Technote, Orbis and Dealroom)

**5,2%**
of companies have at least one of the sustainability/ environment ISO standards

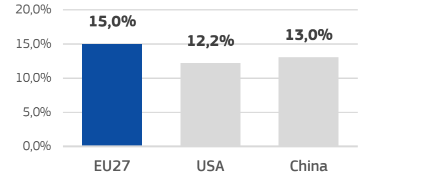
**Source:** S8. Share of companies having at least one of the following sustainability/ environment ISO standards (ISO 14000 group); also ISO 50001, ISO 9553, ISO 10217, ISO 17743, ISO 20619, ISO 13065). **Data source:** Technote. Data retrieved in October 2023

### Companies linked to low carbon and circular technologies (LCT, CEI, CREI)



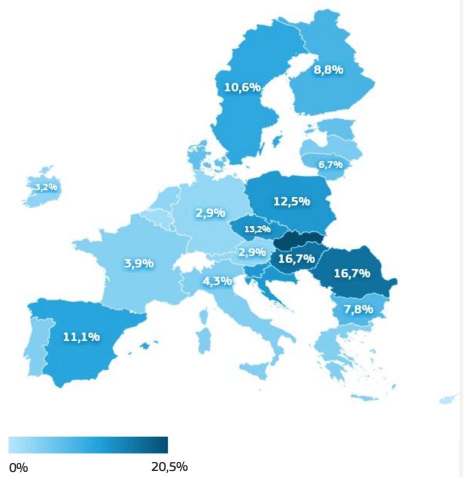

**Source:** Indicator S4. Number/share of companies linked to low carbon and circular technologies. **Data source:** RDI dashboard (Technote, Orbis and Dealroom). **Data retrieved** in October 2023

### Share of investing firms that are active in low carbon or circular technologies



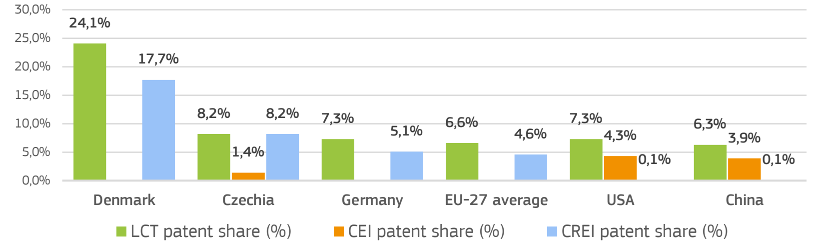

**Source:** Indicator S1. Number/share of investing firms that are active in low-carbon or circular technologies. **Data source**: RDI dashboard (Technote, Orbis and Dealroom). **Data retrieved** in October 2023

### Share of companies having at least one sustainability/environment ISO standards




**Source:** S8. Share of companies having at least one of the following sustainability/ environment ISO standards (ISO 14000 group); also ISO 50001, ISO 9553, ISO 10217, ISO 17743, ISO 20619, ISO 13065). **Data source:** Technote. **Data retrieved** in October 2023

### Patents by companies active in low carbon, circular and clean and renewable energy technologies




**Source:** Indicator S5. Patents by companies active in low carbon, circular and clean and renewable energy technologies. **Data source**: RDI dashboard (Technote, Orbis and Dealroom). **Data retrieved** in October 2023

## Detailed view

| | **S1. NUMBER OF INVESTING FIRMS THAT ARE ACTIVE IN LOW-CARBON OR CIRCULAR TECHNOLOGIES** | **S4. NUMBER/SHARE OF COMPANIES LINKED TO LOW CARBON AND CIRCULAR TECHNOLOGIES** | | **S5. NUMBER/SHARE OF LOW-CARBON/CIRCULAR TECH PATENTS OWNED BY EU COMPANIES AND NUMBER/SHARE OF MANUFACTURING AND PATENTING FIRMS ACTIVE IN LOW-CARBON/CIRCULAR TECH.** | | | | | | | | | **S8. SHARE OF COMPANIES HAVING AT LEAST ONE OF THE FOLLOWING SUSTAINABILITY/ ENVIRONMENT ISO STANDARDS** (ISO 14000 GROUP); ALSO ISO 50001, ISO 9553, ISO 10217, ISO 17743, ISO 20619, ISO 13065, ISO 14064) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Number active in LCT/CEI/ CREI | Share active in LCT/CEI/ CREI | Number/share of manufacturing and patenting firms active in LCT/CEI/CREI | | Total number of patents by firms active in LCT/CEI/CREI | LCT | | CEI | | CREI | | |
| Austria | 8 | 86 | 3,6% | 21 | 18,3% | 585 | 37 | 6,3% | 0 | 0,0% | 27 | 4,6% | 2,9% |
| Belgium | 22 | 169 | 4,0% | 11 | 7,4% | 9 628 | 507 | 5,3% | 0 | 0,0% | 161 | 1,7% | 2,0% |
| Bulgaria | 1 | 8 | 0,7% | 4 | 10,3% | 20 | 4 | 20,0% | 1 | 5,0% | 0 | 0,0% | 7,8% |
| Croatia | N/A | 3 | 0,6% | 2 | 9,1% | 0 | 0 | 0,0% | 0 | 0,0% | 0 | 0,0% | 12,7% |
| Cyprus | 1 | N/A | N/A | 0 | 0,0% | 4 | 2 | 50,0% | 0 | 0,0% | 1 | 25,0% | N/A |
| Czechia | 3 | 30 | 2,2% | 22 | 12,8% | 146 | 12 | 8,2% | 2 | 1,4% | 12 | 8,2% | 13,2% |
| Denmark | 7 | 52 | 2,6% | 9 | 20,5% | 79 | 19 | 24,1% | 0 | 0,0% | 14 | 17,7% | 6,7% |
| Estonia | 3 | 2 | 0,4% | 0 | 0,0% | 0 | 0 | 0,0% | 0 | 0,0% | 0 | 0,0% | 6,7% |
| Finland | 15 | 42 | 2,5% | 9 | 14,1% | 455 | 30 | 6,6% | 0 | 0,0% | 9 | 2,0% | 8,8% |
| France | 58 | 305 | 2,9% | 110 | 16,3% | 25 790 | 1081 | 4,2% | 7 | 0,0% | 1114 | 4,3% | 3,9% |
| Germany | 51 | 590 | 3,2% | 131 | 12,0% | 112 615 | 8223 | 7,3% | 5 | 0,0% | 5760 | 5,1% | 2,9% |
| Greece | N/A | 4 | 0,6% | 0 | 0,0% | 0 | 0 | 0,0% | 0 | 0,0% | 0 | 0,0% | 4,2% |
| Hungary | 3 | 24 | 1,3% | 14 | 10,4% | 10 | 1 | 10,0% | 0 | 0,0% | 0 | 0,0% | 16,7% |
| Ireland | 13 | 26 | 2,7% | 4 | 16,0% | 8 | 0 | 0,0% | 0 | 0,0% | 0 | 0,0% | 3,2% |
| Italy | 20 | 399 | 3,6% | 81 | 11,1% | 1 673 | 119 | 7,1% | 4 | 0,2% | 63 | 3,8% | 4,3% |
| Latvia | 3 | 3 | 0,7% | 0 | 0,0% | 0 | 0 | 0,0% | 0 | 0,0% | 0 | 0,0% | 4,7% |
| Lithuania | 1 | 11 | 1,3% | 0 | 0,0% | 0 | 0 | 0,0% | 0 | 0,0% | 0 | 0,0% | 6,7% |
| Luxembourg | 2 | 7 | 5,5% | 1 | 16,7% | 1 | 1 | 100,0% | 0 | 0,0% | 1 | 100,0% | 3,8% |
| Malta | N/A | 2 | 4,1% | 1 | 16,7% | 0 | 0 | 0,0% | 0 | 0,0% | 0 | 0,0% | 6,5% |
| Netherlands | 21 | 97 | 2,3% | 12 | 10,3% | 28 | 9 | 32,1% | 1 | 3,6% | 8 | 28,6% | 3,1% |
| Poland | 21 | 92 | 3,6% | 37 | 9,3% | 13 | 3 | 23,1% | 1 | 7,7% | 2 | 15,4% | 12,5% |
| Portugal | 3 | 41 | 1,5% | 10 | 8,6% | 6 | 3 | 50,0% | 0 | 0,0% | 1 | 16,7% | 4,3% |
| Romania | 2 | 26 | 1,1% | 15 | 11,2% | 33 | 3 | 9,1% | 0 | 0,0% | 2 | 6,1% | 16,7% |
| Slovakia | 1 | 12 | 1,4% | 9 | 6,7% | 1 | 0 | 0,0% | 0 | 0,0% | 1 | 100,0% | 20,5% |
| Slovenia | 1 | 5 | 0,8% | 1 | 2,8% | 6 | 4 | 66,7% | 0 | 0,0% | 3 | 50,0% | 12,5% |
| Spain | 39 | 414 | 4,7% | 98 | 18,0% | 3 953 | 206 | 5,2% | 1 | <0,1% | 17 | 0,4% | 11,1% |
| Sweden | 21 | 65 | 1,6% | 18 | 13,1% | 1 262 | 50 | 4,0% | 0 | 0,0% | 4 | 0,3% | 10,6% |
| **EU-27 total/average** | **320** | **2 515** | **3,0%** | **620** | **12,5%** | **156 316** | **10314** | **6,6%** | **2** | **0,0%** | **7200** | **4,6%** | **5,2%** |

European Commission

PPMi IDEA CONSULT thinking ahead

# Industry 5.0 sustainability pillar: Examples of indicators tested in Energy Intensive Industries

**9,4%**

of companies find the increasing customer demand for products that help mitigate or adapt to climate change (e.g. low- carbon products) highly important

**Source:** Indicator S16. Extent to which there is increasing customer demand for products that help mitigate or adapt to climate change (e.g. low- carbon products). **Data source:** Community Innovation survey (2020)

**5,5%**

of companies are linked to low carbon and circular technologies (LCT, CEI, CREI)

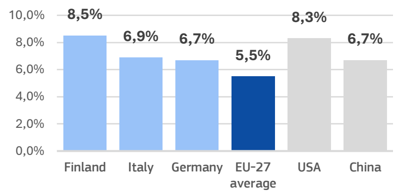
**Source:** Indicator S4. Number/share of companies linked to low carbon and circular technologies. **Data source**: RDI dashboard (Technote, Orbis and Dealroom)

**12,9%**

of companies have at least one of the sustainability/ environment ISO standards

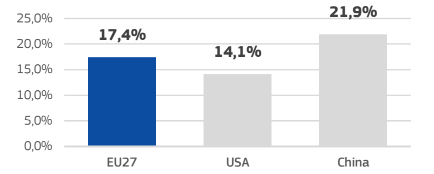
**Source:** S8. Share of companies having at least one of the following sustainability/ environment ISO standards (ISO 14000 group); also ISO 50001, ISO 9553, ISO 10217, ISO 17743, ISO 20619, ISO 13065. **Data source:** Technote. **Data retrieved** in October 2023

## Companies linked to low carbon and circular technologies (LCT, CEI, CREI)



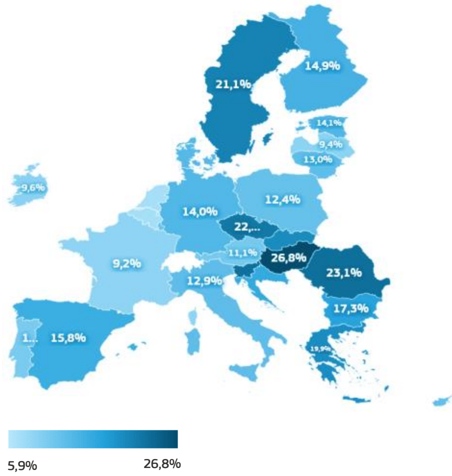

**Source:** Indicator S4. Number/share of companies linked to low carbon and circular technologies. **Data source:** RDI dashboard (Technote, Orbis and Dealroom). **Data retrieved** in October 2023

## Share of investing firms that are active in low carbon or circular technologies



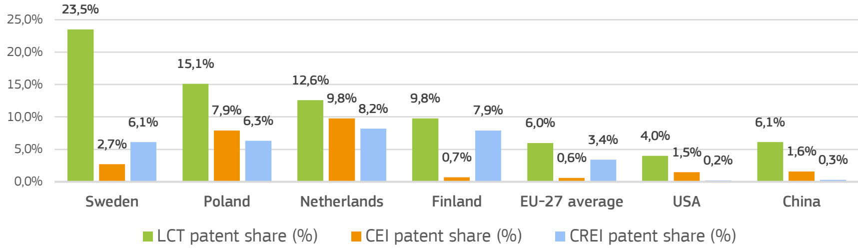

**Source:** Indicator S1. Number/share of investing firms that are active in low-carbon or circular technologies. **Data source:** RDI dashboard (Technote, Orbis and Dealroom). **Data retrieved** in October 2023

## Share of companies having at least one sustainability/ environment ISO standards




**Source:** S8. Share of companies having at least one of the following sustainability/ environment ISO standards (ISO 14000 group); also ISO 50001, ISO 9553, ISO 10217, ISO 17743, ISO 20619, ISO 13065). **Data source**: Technote. **Data retrieved** in October 2023

## Patents by companies active in low carbon, circular and clean and renewable energy technologies




**Source:** Indicator S5. Patents by companies active in low carbon, circular and clean and renewable energy technologies. **Data source**: RDI dashboard (Technote, Orbis and Dealroom). **Data retrieved** in October 2023

## Detailed view

| | S1. NUMBER OF INVESTING FIRMS THAT ARE ACTIVE IN LOW-CARBON OR CIRCULAR TECHNOLOGIES | S4. NUMBER/SHARE OF COMPANIES LINKED TO LOW CARBON AND CIRCULAR TECHNOLOGIES | | S5. NUMBER/SHARE OF LOW-CARBON/CIRCULAR TECH PATENTS OWNED BY EU COMPANIES AND NUMBER/SHARE OF MANUFACTURING AND PATENTING FIRMS ACTIVE IN LOW-CARBON/CIRCULAR TECH. | | | | | | | | | S8. SHARE OF COMPANIES HAVING AT LEAST ONE OF THE FOLLOWING SUSTAINABILITY/ ENVIRONMENT ISO STANDARDS (ISO 14000 GROUP); ALSO ISO 50001, ISO 9553, ISO 10217, ISO 17743, ISO 20619, ISO 13065, ISO 14064) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Number active in LCT/CEI/ CREI | Share active in LCT/CEI/ CREI | Number/share of manufacturing and patenting firms active in LCT/CEI/CREI | | Total number of patents by firms active in LCT/CEI/CREI | LCT | | CEI | | CREI | | |
| Austria | 38 | 135 | 6,2% | 75 | 11,3% | 962 | 70 | 7,3% | 7 | 0,7% | 16 | 1,7% | 11,1% |
| Belgium | 53 | 272 | 5,8% | 153 | 12,6% | 2 891 | 148 | 5,1% | 20 | 0,7% | 178 | 6,2% | 7,4% |
| Bulgaria | 12 | 42 | 2,1% | 22 | 6,3% | 4 | 1 | 25,0% | 1 | 25,0% | 0 | 0,0% | 17,3% |
| Croatia | - | 19 | 1,7% | 13 | 5,2% | 0 | 0 | 0,0% | 0 | 0,0% | 0 | 0,0% | 16,4% |
| Cyprus | 5 | 6 | 5,0% | 0 | 0,0% | 4 | 1 | 25,0% | 0 | 0,0% | 0 | 0,0% | 12,7% |
| Czechia | 12 | 84 | 5,1% | 62 | 9,6% | 298 | 18 | 6,0% | 23 | 7,7% | 7 | 2,3% | 22,2% |
| Denmark | 19 | 82 | 4,7% | 28 | 7,0% | 545 | 41 | 7,5% | 1 | 0,2% | 9 | 1,7% | 13,7% |
| Estonia | 12 | 19 | 3,3% | 17 | 4,3% | 4 | 0 | 0,0% | 1 | 25,0% | 0 | 0,0% | 14,1% |
| Finland | 67 | 176 | 8,5% | 103 | 18,8% | 2 583 | 254 | 9,8% | 18 | 0,7% | 203 | 7,9% | 14,9% |
| France | 140 | 613 | 6,2% | 340 | 11,5% | 19 817 | 1547 | 7,8% | 70 | 0,4% | 751 | 3,8% | 9,2% |
| Germany | 186 | 1 038 | 6,7% | 540 | 12,3% | 39 109 | 1696 | 4,3% | 116 | 0,3% | 1000 | 2,6% | 14,0% |
| Greece | 10 | 47 | 5,6% | 15 | 5,8% | 10 | 2 | 20,0% | 1 | 10,0% | 1 | 10,0% | 19,9% |
| Hungary | 10 | 52 | 2,0% | 41 | 9,8% | 436 | 10 | 2,3% | 4 | 0,9% | 3 | 0,7% | 26,8% |
| Ireland | 27 | 49 | 4,0% | 17 | 7,8% | 13 | 7 | 53,8% | 4 | 30,8% | 1 | 7,7% | 9,6% |
| Italy | 82 | 1 370 | 6,9% | 461 | 7,3% | 3 895 | 268 | 6,9% | 72 | 1,8% | 206 | 5,3% | 12,9% |
| Latvia | 6 | 29 | 3,5% | 12 | 8,3% | 15 | 0 | 0,0% | 4 | 26,7% | 1 | 6,7% | 9,4% |
| Lithuania | 14 | 21 | 2,3% | 8 | 5,5% | 2 | 0 | 0,0% | 1 | 50,0% | 0 | 0,0% | 13,0% |
| Luxembourg | 5 | 98 | 35,8% | 14 | 20,3% | 797 | 78 | 9,8% | 0 | 0,0% | 7 | 0,9% | 12,1% |
| Malta | 1 | 4 | 7,1% | 0 | 0,0% | 0 | 0 | 0,0% | 0 | 0,0% | 0 | 0,0% | 5,9% |
| Netherlands | 58 | 322 | 4,6% | 107 | 12,4% | 366 | 46 | 12,6% | 36 | 9,8% | 30 | 8,2% | 7,3% |
| Poland | 54 | 308 | 5,1% | 182 | 8,6% | 331 | 50 | 15,1% | 26 | 7,9% | 21 | 6,3% | 12,4% |
| Portugal | 28 | 103 | 3,2% | 56 | 8,1% | 120 | 8 | 6,7% | 7 | 5,8% | 2 | 1,7% | 10,8% |
| Romania | 16 | 48 | 1,6% | 33 | 7,2% | 27 | 5 | 18,5% | 1 | 3,7% | 4 | 14,8% | 23,1% |
| Slovakia | 5 | 26 | 2,1% | 18 | 5,8% | 36 | 8 | 22,2% | 9 | 25,0% | 3 | 8,3% | 20,2% |
| Slovenia | 2 | 29 | 3,3% | 15 | 6,4% | 108 | 11 | 10,2% | 1 | 0,9% | 1 | 0,9% | 22,9% |
| Spain | 97 | 511 | 4,7% | 256 | 10,4% | 728 | 55 | 7,6% | 23 | 3,2% | 9 | 1,2% | 15,8% |
| Sweden | 69 | 214 | 6,3% | 107 | 14,7% | 524 | 123 | 23,5% | 14 | 2,7% | 32 | 6,1% | 21,1% |
| **EU-27 total/average** | **1028** | **5 717** | **5,5%** | **2695** | **9,9%** | **73 625** | **4447** | **6,0%** | **460** | **0,6%** | **2485** | **3,4%** | **12,9%** |

## Acknowledgements

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