INVESTMENT REPORT
2023/2024

Transforming for competitiveness

European Investment Bank

2024

Chapter 5

Investing in green transformation

EUROPEAN INVESTMENT BANK INVESTMENT REPORT
2023/2024

Transforming for competitiveness

Part II Accelerating transformation for competitiveness

Chapter 5
Investing in green transformation

Investment Report 2023/2024: Transforming for competitiveness.

About the report
The annual EIB report on investment and investment finance is a product of the EIB Economics Department. The report provides a comprehensive overview of the developments and drivers of investment and investment finance in the European Union. It combines an analysis and understanding of key market trends and developments, with a thematic focus explored in greater depth. This year, the focus is on Europe's transition to an innovative and green future. The report draws extensively on the results of the annual EIB Investment Survey (EIBIS) and the EIB Municipality Survey, combining internal EIB analysis with contributions from leading experts in the field.

About the Economics Department of the EIB
The mission of the EIB Economics Department is to provide economic analyses and studies to support the Bank in its operations and to help define its positioning, strategy and policy. The director of Economics Department, Debora Revoltella, heads a team of 40 economists.

Main contributors to this year's report
Report director: Debora Revoltella
Report coordinators and reviewers: Laurent Maurin and Atanas Kolev

Key Findings: Debora Revoltella and Tessa Bending
Chapter 1: Andrea Brasili, Jochen Schanz (lead authors), Peter Harasztosi and Michael Stemmer.
Chapter 2: Atanas Kolev (lead author), Andrea Brasili, Jochen Schanz, Annamaria Tueske and Wouter van der Wielen.
Chapter 3: Laurent Maurin, Rozália Pál (lead authors), Frank Betz, Antonia Botsari, Chiara Fratto, Matteo Gatti, Salome Gvetadze, Peter Harasztosi, Helmut Krämer-Eis, Frank Lang, Wouter Torfs, Thi Thu Huyen Tran and Wouter van der Wielen. Miguel Gil Tertre, Viktor Hauk, Eva Hoos, Ignacio Martinez, Manuel Von Mettenheim and Andreas Zucker (European Commission, Directorate-General for Energy, Box A). Luka Klimavičiūtė and Marco Schito (Box B).
Chapter 4: Julie Delanote, Péter Harasztosi, Christoph Weiss (lead authors), Chiara Fratto and Wouter van der Wielen. Yann Ménière and Ilja Rudyk (European Patent Office, Box A). Julien Ravet, Valentina di Girolamo and Alessio Mitra (European Commission, Directorate-General for Research and Innovation, Box B). Michael Stemmer (Box C).
Chapter 5: Fotios Kalantzis (lead author), Paola Casati, Benjamin Hattemer, Bertrand Magné and Marcin Wolski.

Published by the European Investment Bank.
Printed on FSC® paper

Disclaimer
The views expressed in this publication are those of the authors and do not necessarily reflect the position of the EIB.

Acknowledgements
Centre for Research and Development Monitoring (ECOOM), KU Leuven, for its research assistance. Annalisa Ferrando for useful comments and guidance. Benjamin Freudenstein for research assistance.

Chapter 5
Investing in green transformation

Download the complete report:
https://www.eib.org/en/publications/20230323-investment-report-2023

Available as:

pdf: ISBN 978-92-861-5648-9 ISSN: 2599-8277

Table of contents

Chapter 5

Investing in green transformation

The EU energy market has been grappling with a severe crisis that has affected governments, households and businesses across Europe for the last two years. The crisis demanded urgent solutions to ensure a continuous and stable supply of energy to Europe, but it was also a chance to speed up the transition to a greener and more sustainable economy. The European Union implemented various measures to address the short-term and long-term challenges of the energy crisis, by diversifying energy supply routes, reducing demand and promoting renewable sources. These measures not only helped Europe cope, but also paved the way for the transformation of the energy landscape.

The energy shock affected EU firms more strongly than US firms, but it also motivated companies to invest and transform. In the short term, most EU firms responded to the energy shock by investing in energy efficiency. When looking at overall climate action investment, EU firms remained more committed than US firms, but uncertainty affected their investment decisions, somehow slowing their efforts. The role played by uncertainty underlined once again the relevance of clear policies on the speed and future path of the net-zero transition.

Firms in energy-intensive industries are at a crossroads. The progressive tightening of the EU Emissions Trading System (ETS) is effectively incentivising firms to transform, with decarbonisation going hand in hand with investment and innovation. Decarbonisation leaders and laggards are emerging. Firms seeing opportunities in the net-zero transition process are more likely to invest, innovate and transform. It is important to avoid the creation of a divide between firms actively pursuing net-zero and those less implicated. Decarbonisation depends on clear signals, with energy prices, regulations and uncertainty critical issues for all firms.

Beyond reducing emissions, most European firms also need to adapt to the adverse effects of climate change. However, many lack the awareness, knowledge, skills and incentives to assess and implement suitable and cost-effective adaptation solutions. Firms hurt by extreme weather events are slightly more proactive about investing in adaptation measures. But even those are dismissive of their role in climate adaptation. Finance appears to be crucial for adaptation, as it can help firms overcome barriers like high costs, long payback periods, low returns, high uncertainty and risk aversion. Public funds are crucial in supporting and catalysing firms' investment in adaptation, especially in the most vulnerable regions and sectors, and in helping them overcome barriers and create new markets and opportunities.

Introduction

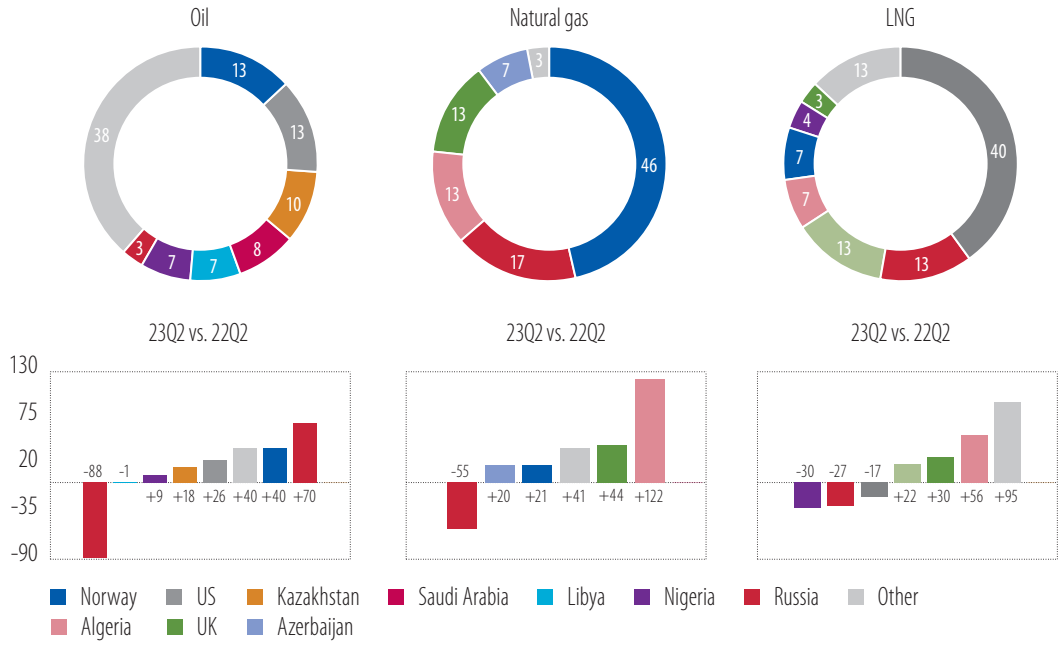
The 2022 energy shock forced a reckoning in the European economy. At first Europe had to deal with potential energy supply shortages and high costs, which it managed reasonably well. However, the shock provoked a rethinking of the EU energy landscape. The European Union revised its energy market and energy mix, and set ambitious climate goals and policies to transition to low-carbon energy in the future while ensuring the security of supply in the meantime. The shock also instigated a push for energy efficiency, for households and companies. However, uncertainty remains high as the economy adjusts to a new equilibrium that encourages energy resilience and sustainability. It will take more than a decade for renewable and alternative resources to stabilise energy prices, despite efforts to diversify the energy mix and increase the production of renewable energy and energy efficiency. In this context, the European Union faces many questions: How are the energy markets transforming? How are EU firms adapting to the new environment? How is competitiveness affected? How are energy-intensive industries adjusting? And how can the economy balance varying demand as it responds to shocks and the challenges of the transition?

This chapter aims to answer these questions. Section one examines how the energy crisis affected the EU energy market and its ongoing transformation. Section two explores the reaction of EU firms to the energy shock and the ongoing adjustments demanded by the green transition. Section three focuses on energy-intensive industries – those most exposed to the energy crisis and the green transition – and examines how they are balancing their emissions reduction and transformation. Box A presents the results of a focused survey on manufacturing firms operating in the Emissions Trading System, to shed light on their decarbonisation strategies. Section four focuses on the role of adaptation in enhancing firms' resilience to climate change and extreme weather events, while section five concludes with policy implications and recommendations for supporting firms in the green transition.

The energy shock has triggered a rethinking of EU energy markets

Russia's invasion of Ukraine, and the EU response, disrupted the supply of Russian oil and gas to the European Union, forcing Europe to diversify its fossil fuel imports. In December 2022, the European Union banned imports of Russian crude oil and refined oil products by sea. Russia had been Europe's main supplier of natural gas, accounting for 40% of total imports before the war. However, Russian gas imports were halved between 2022 and 2023 thanks to various policy measures to restrict imports and reduce consumption. By June 2023, Russia's share of EU oil imports had fallen to 3% and gas to 14% – a decline of 84% for oil and 51% for gas, compared to a year earlier (Figure 1). The European Union turned to liquefied natural gas (LNG) as an alternative to gas transported via pipelines. Although major efforts were made to diversify LNG sources, Russia held a significant (albeit declining) share of the trade, as some EU members could not secure alternate sources. The European Union also moved swifty to maximise the storage of supplies. By November 2023, EU gas storage had reached 90% of its capacity, providing a favourable outlook for the gas supply throughout the winter of 2024.

Figure 1
EU energy imports by supplier in the second quarter of 2023 (in %, top panel) **and change in market share compared to the second quarter of 2022** (in %, bottom panel)



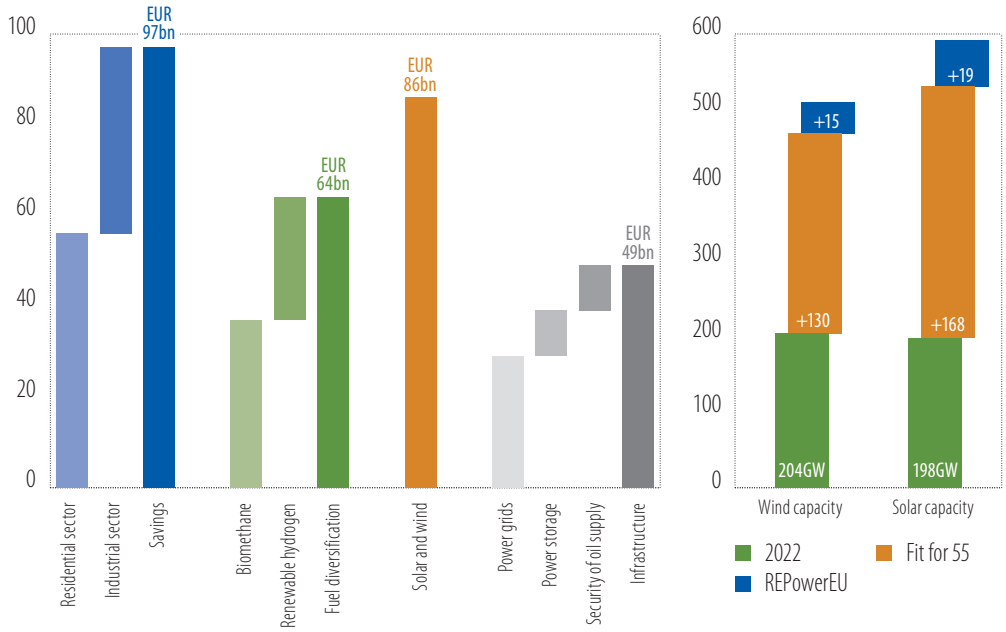
Source: *Eurostat (2023).*
Note: *Shares refer to trade in value and not volume. LNG stands for liquefied natural gas.*

To reduce its dependence on Russian gas by 2027, the European Union adopted the REPowerEU plan, which builds on the European Green Deal and uses the approximately EUR 225 billion Recovery and Resilience Facility as its main source of funding. The REPowerEU plan aims to cut gas demand by 155 billion m^3, which is equal to the amount of gas imported from Russia in 2021. The gas reduction is one-third more than the original goal of the Fit for 55 package, Europe's plan to reduce emissions 55% by 2030, compared to 1990 levels. The REPowerEU plan also sets more ambitious targets for reaching net-zero emissions and introduces various reforms, helping the EU economy to decarbonise (Figure 2). The plan includes almost EUR 100 billion of gas savings for households and industries, along with encouraging behavioural changes and other efforts to reduce demand. It also allocates nearly EUR 50 billion to improving power grid and energy storage infrastructure, emphasising their importance in the transition.

The energy shock prompted European firms and households to act quickly to save energy. Buildings and industries reduced their demand for natural gas the most (Figure 3), thanks to a combination of energy efficiency measures and other actions. Although significant nuclear and hydropower capacity was temporarily unavailable due to maintenance and exceptionally dry weather conditions, this was largely offset by increased production of electricity based primarily on coal and renewable energy.

Figure 2

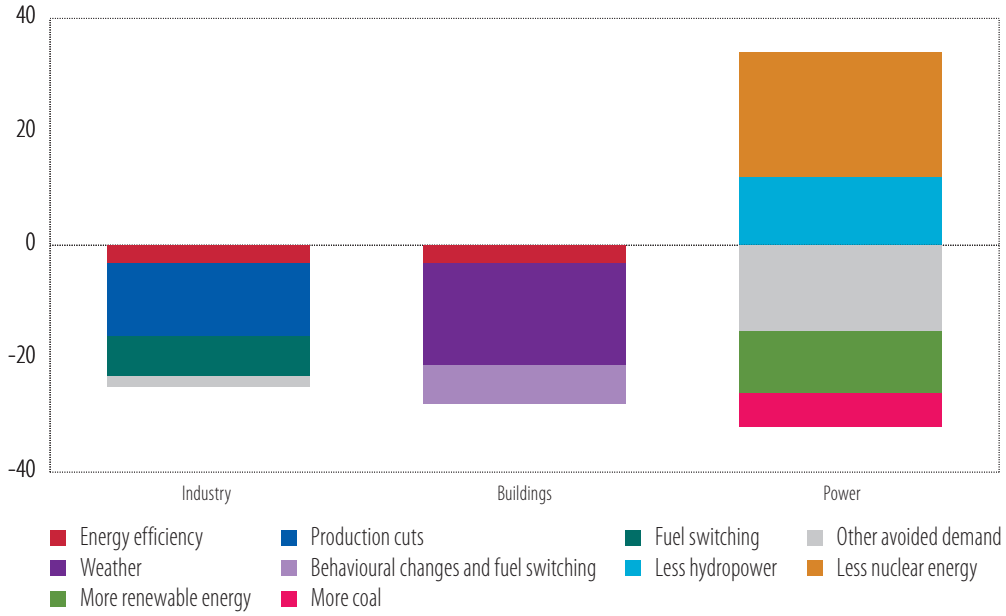
Investment needed to reach 2030 goals for Fit for 55 and REPowerEU (left panel), **and wind and solar capacity targets for 2030** (right panel)



Source: *Directorate-Generale for Energy (2023).*
Note: *Gas savings in the residential sector will be realised through with a wider adoption of energy efficiency measures and heat pumps by 2030. The industrial sector will essentially cut its gas usage with more energy efficient processes and electrification.*

Figure 3

Estimated drivers of change in EU demand for natural gas, by region 2022 vs. 2021

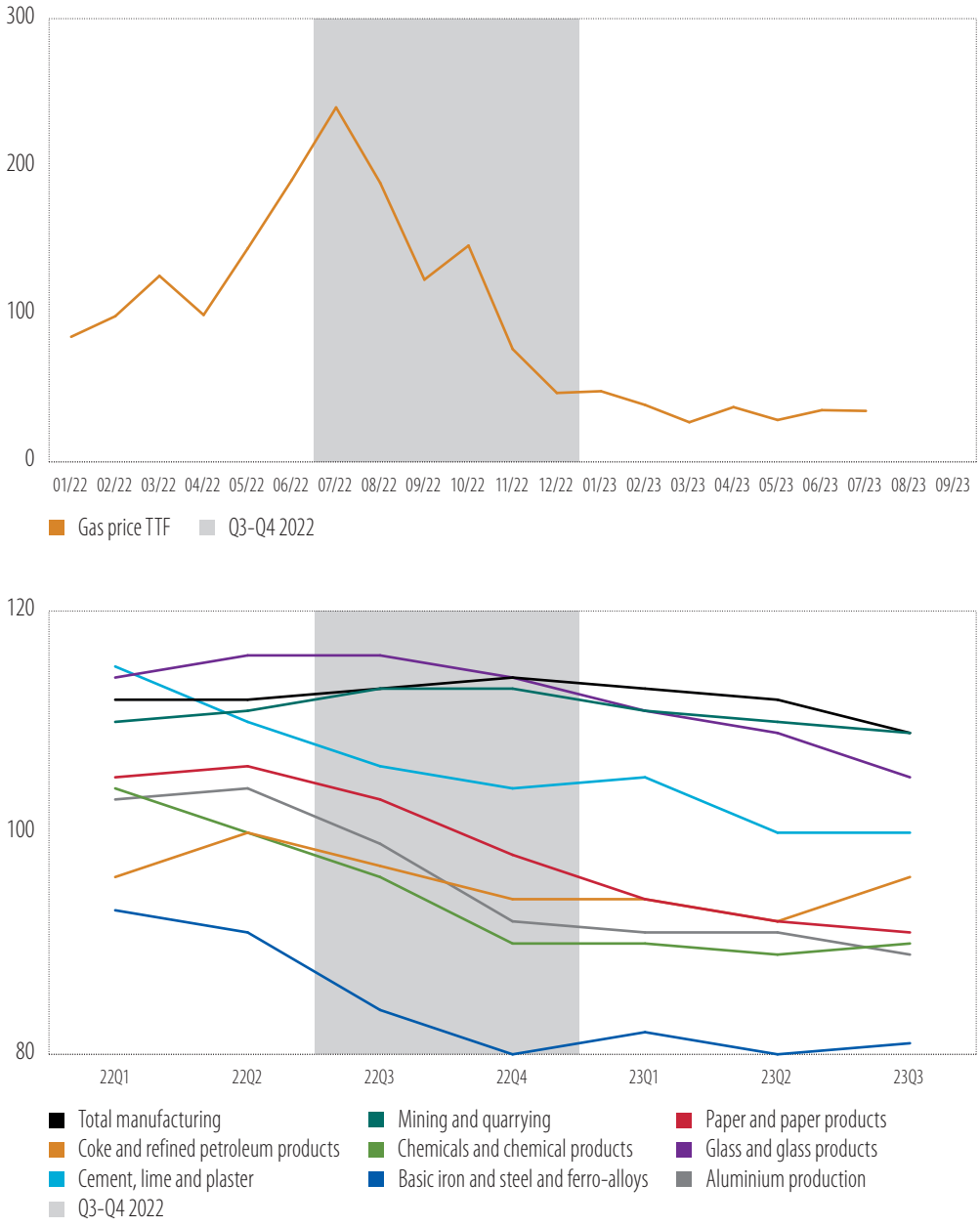


Source: *IEA online commentary (14 Mar 2023), Europe's energy crisis: What factors drove the record fall in natural gas demand in 2022?*

As the energy shock sunk in, industries reacted by rolling out emergency measures, such as scaling back production, and accelerating efforts to save energy. Under pressure from soaring gas and electricity prices – which were compounded by historically high prices for carbon credits under the Emissions Trading System – energy-intensive industries revised their production plans downwards for most of 2022 (Figure 4). By contrast, overall activity in manufacturing was only moderately affected. Primary aluminium production was cut by 12%, crude steel by 10%, paper by 6% and chemicals by 5%. The economic activity of heavy industries levelled off during the first half of 2023, but at a lower rate than before the crisis.

Figure 4

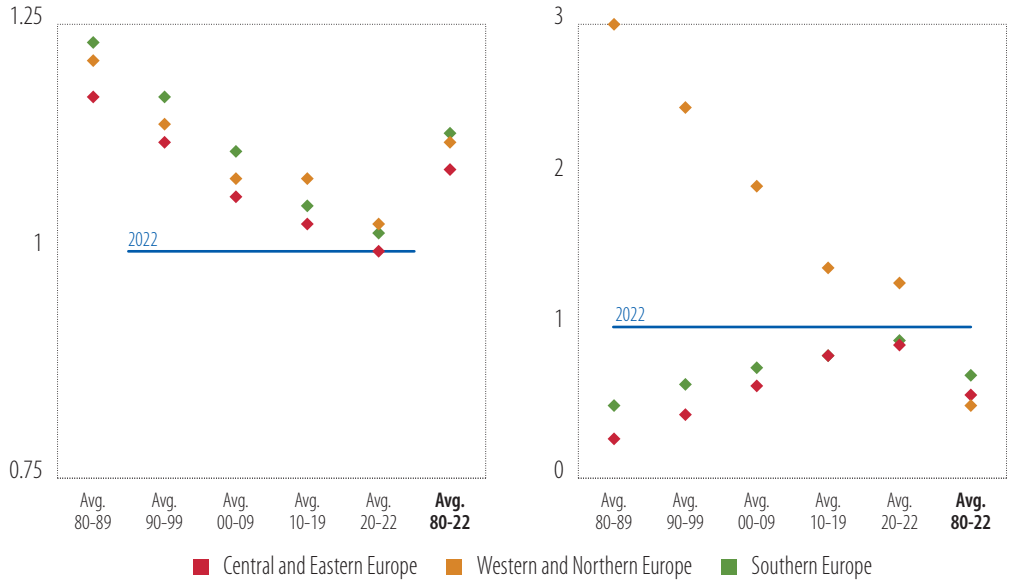
Gas price developments (€ per megawatt hour, top panel) **and activity index** (2015=100, bottom panel) **by industrial sector.**



Source: *Eurostat.*
Note: *Top panel, nautral gas prices come from the Dutch Title Transfer Facility (TTF). Bottom panel, the index of industrial production measures monthly changes in industry output.*

Exceptional weather conditions in 2022 also caused energy demand to fluctuate widely. Weather conditions can disrupt the functioning of energy systems, and they are monitored closely by energy producers, grid operators and regulators alike. In 2022, winter was warmer than usual in Europe, reducing demand for heating to historically low levels. Conversely, the summer of 2022 brought record-high temperatures, which increased cooling needs and partially offset the gas savings achieved during the winter (Figure 5).

Figure 5
Heating (left panel) **and cooling degree days** (right panel) **in EU regions, decade averages 1980-2022**

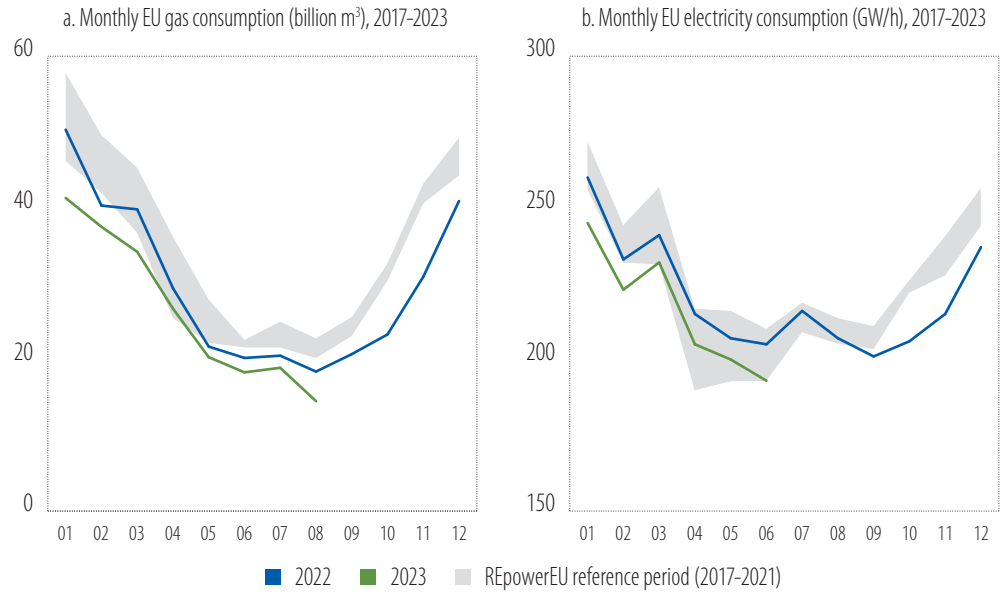


Source: *Eurostat (2023).*
Note: *Heating degree day and cooling degree indices are weather-based technical indices designed to describe the energy required to heat or cool buildings.*

In 2022, the weather was mild and the economy was sluggish, which led to record-low demand for gas, which was 14% less than in 2021. Electricity demand also decreased. Gas demand fell by 19% from August 2022 to January 2023 (Figure 6). For example, the industrial sector used much less gas (one-quarter less), as did the residential sector (one-fifth less) (International Energy Agency (IEA), 2023a). Electricity consumption fell by 3%, the second biggest drop since the global financial crisis of 2008-2009. The impact varied between countries, depending on their economic structures, energy systems and connections with other European networks (Figure 6).

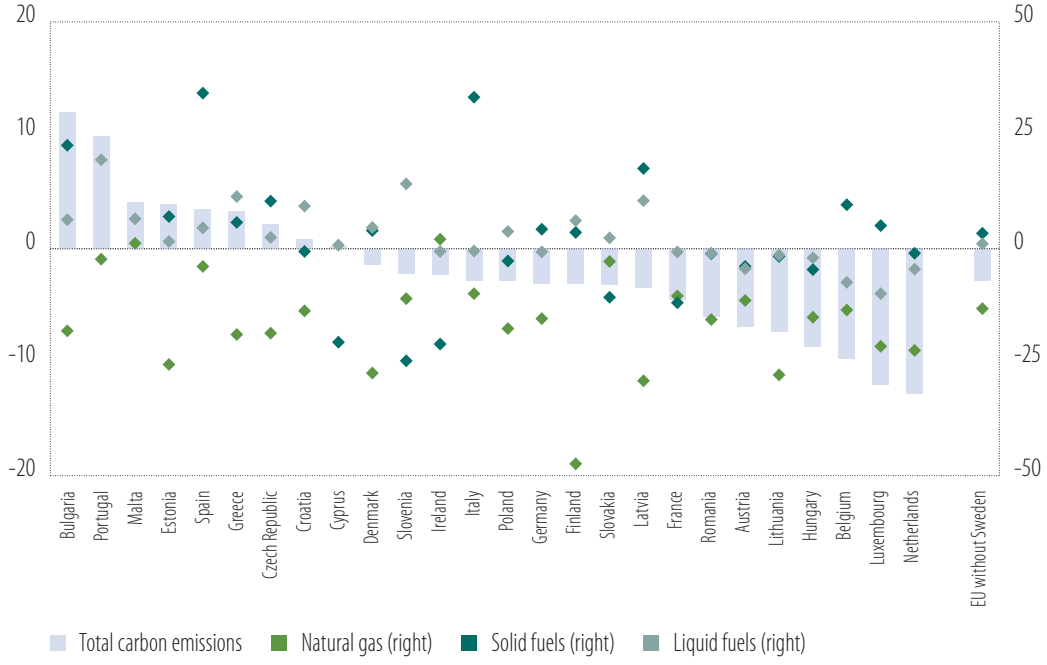
The energy transition in 2022 helped the European Union reduce carbon emissions by 2.8%, thanks mainly to lower gas consumption. This brought the European Union closer to its goal of cutting emissions by 55% by 2030. Seventeen EU countries reduced their net carbon emissions (Figure 7). Some countries, like Bulgaria or Portugal, temporarily used more coal or liquid fuels instead of gas during the first half of 2023, which increased their net emissions. The power sector saw the biggest drop in greenhouse gas emissions (-10% compared to the average of 2017-2021). The manufacturing sector – which was the largest emitter in the European Union, producing 22% of total emissions – experienced a smaller drop of 2%. Early 2023 estimates point to an historical drop in the European Union's carbon emissions, following a marked slowdown in coal-based electricity and overall gas consumption thanks to the breadth of energy saving measures implemented since the start of the energy crisis.

Figure 6
Impact of the energy shock on gas and electricity consumption



Source: *Eurostat (2023).*

Figure 7
Change in annual EU carbon emissions (in %)**, 2021-2022**

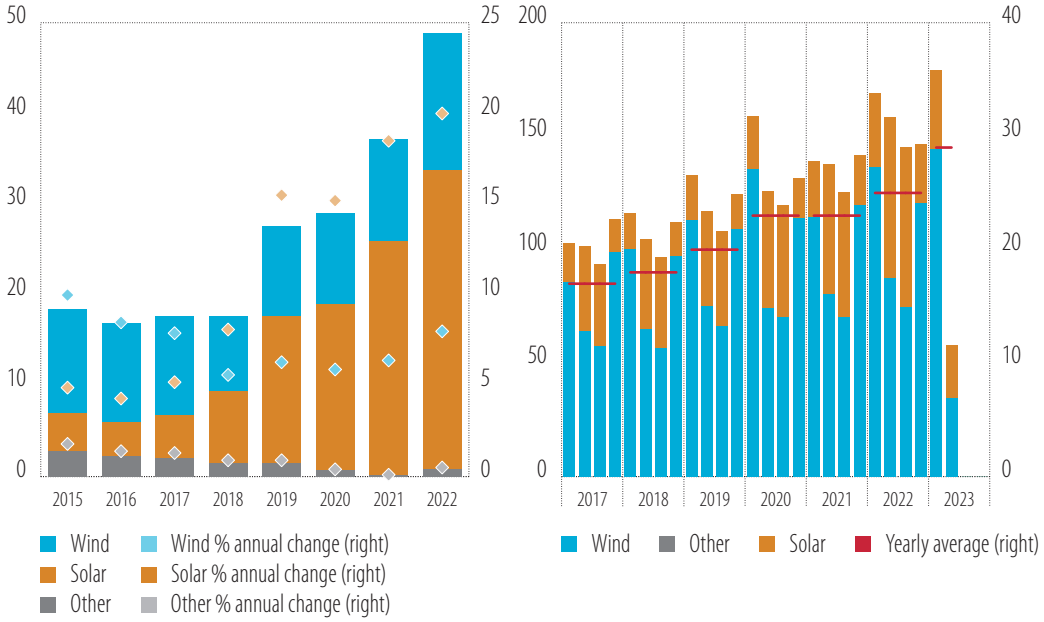


Source: *Eurostat (2023).*
Note: *Solid fuels mostly refer to coal.*

Renewable electricity is the key to decarbonisation, and it has been Europe's main response to the energy shock. It also helped replace the missing Russian fossil fuels in 2022. Solar power grew very fast in 2022, with 20% new capacity, and wind power also increased by 8% (Figure 8). This helped grid operators to manage the crisis. Almost 40% of electricity needs were met by renewable sources, with wind and solar alone accounting for 30% (and producing more electricity than gas). Renewable power also opened new markets for green hydrogen and ammonia, which can be used to decarbonise hard-to-abate sectors. The European Union has a strong supply chain for renewable energy, especially in wind manufacturing, which offers vast opportunities to create skilled jobs and add value.

Figure 8

Installed capacity of renewable electricity (GW, left panel)**, 2015-22, and electricity production from solar and wind power** (TW/h, right panel)**, 2017-2023**

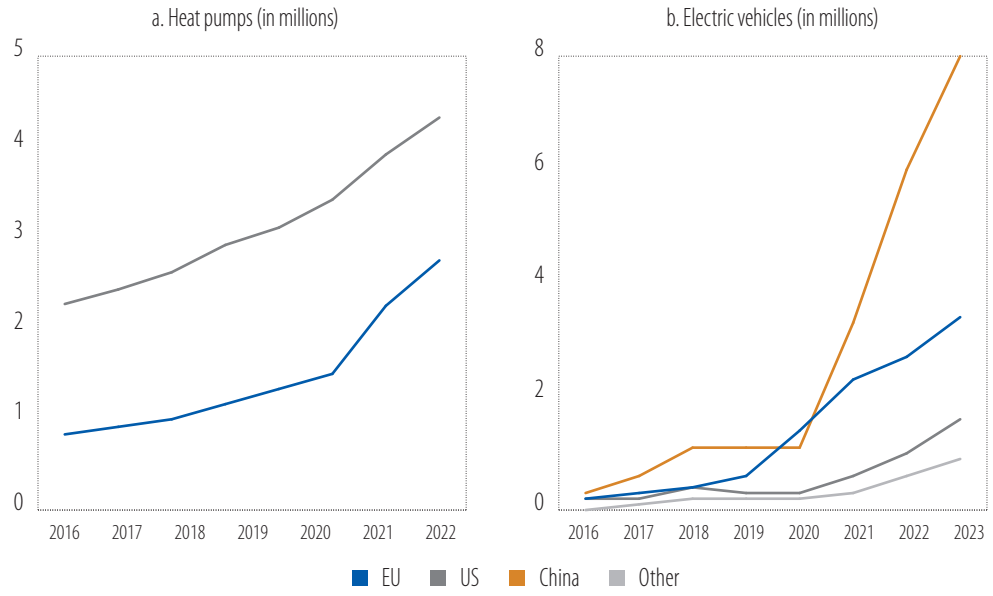


Source: IRENA (2023), Eurostat energy statistics, latest trends from monthly data (2023). The diamonds represent the annual change in renewable energy generation.

Heat pumps, which have a booming manufacturing base in Europe, are among the priority technologies in the REPowerEU plan with the potential to deliver large gas savings. In the residential sector, around 80% of final energy consumption is for space and water heating. Average residential gas prices in 2022 were 80% higher than in the previous five years, and heat pumps – three to four times more efficient than traditional boilers – have become a prime option for residential and industrial end users to reduce energy bills (Figure 9). Thanks to generous public support, the heat pump market is experiencing double-digit growth in Europe, approaching sales of 3 million units per year. REPowerEU targets will prompt a further 10 million hydronic heat pumps to be installed in the next five years, on top of the 20 million units currently in use in Europe.

Electric mobility is also gaining momentum. Electric mobility is now flourishing globally thanks to various support schemes. 20 EU members have incentives in place to stimulate the purchase of electric cars (European Automobile Manufacturers' Association (ACEA), 2023), while others grant tax reductions or exemptions. According to Bruegel and the European Automobile Manufacturers' Association, average support for electric mobility in Europe is equivalent to EUR 6 200 per vehicle (the US Inflation Reduction Act grants a tax credit of EUR 7 100 per vehicle). One-quarter of electric vehicles worldwide, about 3.4 million cars, are sold in the European Union (Figure 9) – far behind China, which captures almost 60% of global sales. The electrification of transport beyond personal mobility is also being supported, through targeted measures like the REPowerEU provisions to strengthen power grids and build up charging networks for electric vehicles.

Figure 9
EU heat pump sales (left panel), **and electric vehicles sales by country** (right panel), **2016-2022**

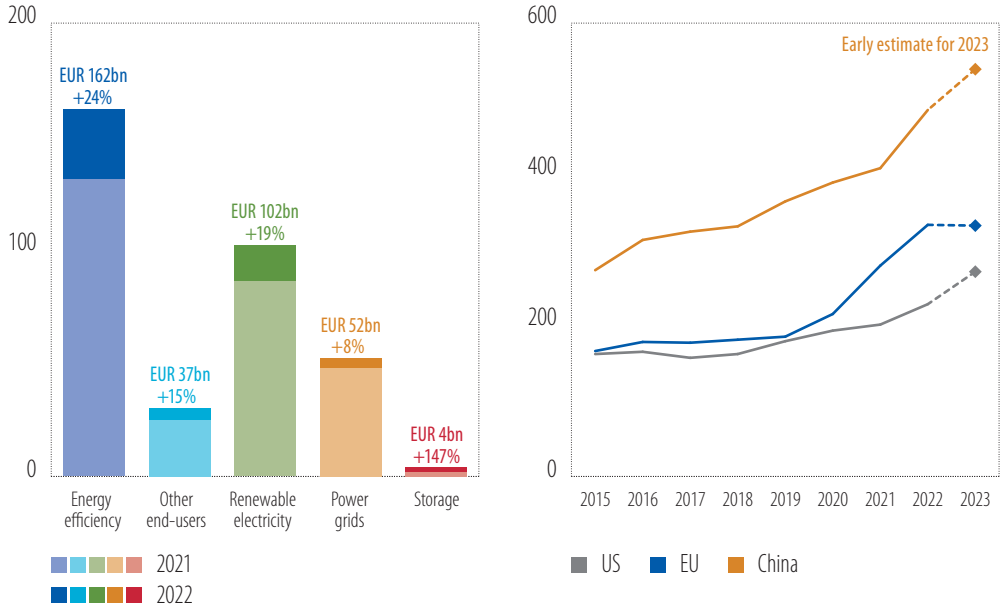


Source: *EIB staff calculations on heat pumps are based on market data from European Heat Pump Association, New York State Energy Research and Development Authority (2023), Bloomberg New Energy Finance (2023) and Eurostat (2023). Electric car sales are based on IEA (2023b) and the European Automobile Manufacturers' Association (2023).*

The Net-Zero Industry Act could provide further impetus to the clean tech manufacturing sector, directing investments towards technologies and know-how that are indispensable to reaching carbon neutrality. This initiative was originally proposed in response to the US Inflation Reduction Act, but it will also reduce EU dependence on imported commodities. The plan includes creating an enabling framework for these technologies, with simplified regulatory and licensing procedures, easier access to markets for green technology developers (including long-term contracts), and measures to align skills with the needs of the green transition. This regulatory toolbox will foster innovative net-zero technologies like heat pumps, solar panels, electrolysers, fuel cells and wind turbines. The proposal also calls for establishing a European financial facility to stimulate the green hydrogen market, the Green Hydrogen Bank, and the creation of more environmentally and socially responsible battery supply chains, in line with the European Critical Raw Materials Act.

Clean energy investments in the European Union kept growing during the energy crisis, despite challenges and uncertainty. As defined by the International Energy Agency, clean energy investments are all energy investments except those directed to unabated fossil fuels. EU clean energy investments reached almost EUR 360 billion in 2022 – twice as much as in 2015 and 20% more than in 2021 (Figure 10). High energy prices motivated people to invest more in energy saving measures (+24%), such as heat pumps, electric vehicles and other efficient equipment. Renewable electricity investments also increased to more than EUR 100 billion and boosted energy storage capacities (+147%). China invested EUR 540 billion in 2022, growing at roughly the same rate as the European Union (+19%). The United States invested just over EUR 250 billion in clean energy (13%), helped by the US Inflation Reduction Act, which was signed in August 2022. Preliminary estimates for 2023 indicate that clean energy investments will rise to more than EUR 1.6 billion globally, roughly two-thirds higher than fossil fuel investments, with investment accelerating in the United States and China. EU investments in clean energy are expected to plateau somewhat as high interest rates put pressure on financing costs and supply chain constraints persist.

Figure 10
EU clean energy investments (EUR billion, left panel)**, by sector 2021-2022, and regional comparison** (EUR billion, right panel)**, 2015-2023**



Source: *EIB staff calculations based on IEA (2023c).*
Note: *Other end-users refers to renewable energy and electrification used in the buildings, transport and industrial sectors. Investments in nuclear energy and clean fuels are included in country totals (right panel).*

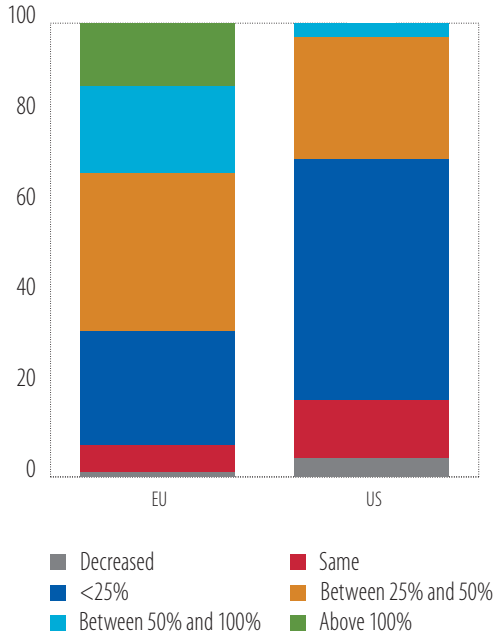
The investment required to meet the objectives of the European Green Deal and REPowerEU is estimated to be about EUR 620 billion per year. The green deal and REPowerEU policies gave a clear signal to investors to speed up the transition and phase out fossil fuels faster. While the data in Figure 10 referred to investment in clean energy technologies alone, the estimated EUR 620 billion needed for investment includes initiatives for the green transition and for addressing climate change, the environment, energy, transport, industry, agriculture and sustainable finance, all of which are closely interlinked (European Commission, 2023).

The energy shock and EU climate policy are pushing firms to transform

Europe felt the reverberations of the energy shock strongly. In the EIB Investment Survey (EIBIS) for 2023, nearly 70% of European firms reported a rise of more than 25% in their energy spending since early 2022, with 20% saying bills rose 50-100% and 14% saying their spending at least doubled (Figure 11). The shock hit Europe particularly hard, since it was heavily dependent on Russian gas imports at the beginning of the crisis and needed to quickly reshuffle its energy mix. By contrast, only 30% of firms in the United States saw their energy bill rise more than 25%.

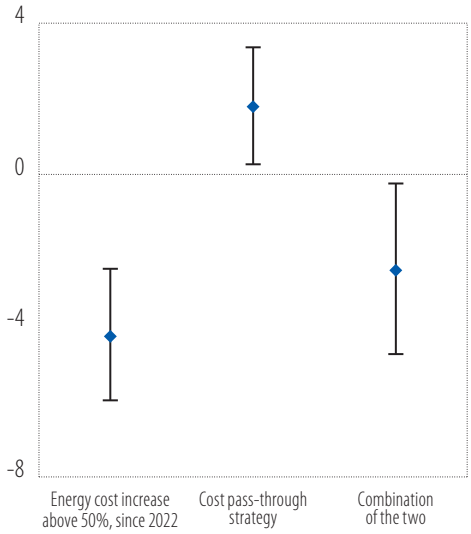
These energy cost hikes clearly affected the competitiveness of European companies. A regression analysis of EIBIS 2023 data shows that a firm's probability of being profitable decreases by more than 4 percentage points if its energy spending increases by at least 50% (Figure 12). However, this effect is reduced by half if the firm had a strategy to pass on the extra cost to its customers. In contrast, firms with a strategy to pass on costs were more likely to be profitable if their energy spending had not increased by more than 50% since 2022.

Figure 11
Spending on energy since the beginning of 2022 (% of firms)



Source: *EIBIS 2023.*
Question: *Since the beginning of 2022, by how much has your company's spending on energy (including gas, electricity, oil) changed on average?*

Figure 12
Marginal effects of energy spending increases on the likelihood of a firm being profitable (in percentage points)

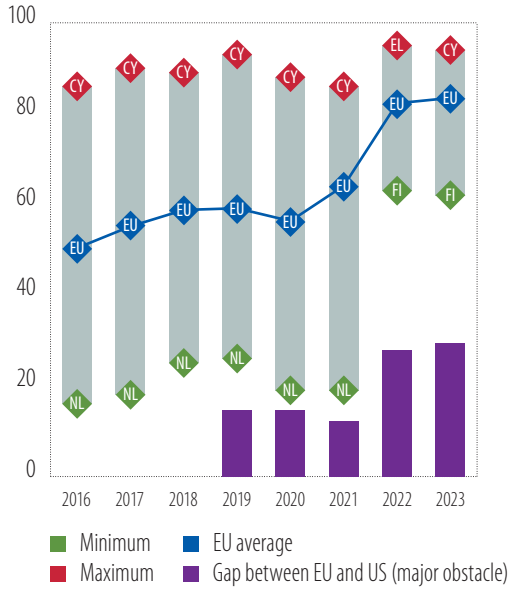


Source: *EIB staff calculations based on the EIBIS 2023.*
Note: *Marginal effects of increased spending on energy vs. no change or a decrease in the probability of being profitable, with and without a strategy to pass on costs to clients, after accounting for country, sector and size effects. The black lines represent 95% confidence intervals.*

The rise in energy spending meant a large share of firms once again cited energy costs as an obstacle to investment. EIBIS 2023 shows that energy costs are a serious hurdle to investment in Europe, with 83% of firms saying it is a barrier, and 53% describing it as a major one. This is 30 percentage points higher than US firms, which illustrates the difference in the impact of the energy crisis across the Atlantic. Concerns about energy costs dampening investment are widespread across European countries and sectors, but they vary in intensity. Nevertheless, the variation among countries and sectors decreased significantly in 2022 and 2023, showing the universal nature of the energy shock for European firms (Figure 13).

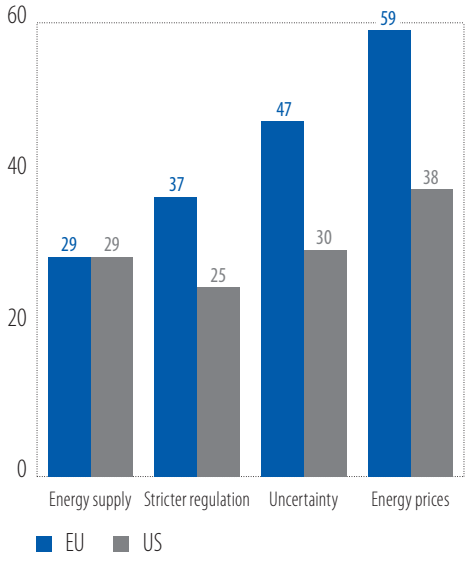
The ongoing energy crisis poses different challenges for firms in the European Union than in the United States, depending on the factors affecting their energy concerns. EIBIS 2023 shows that EU firms are generally more concerned than US firms about various aspects of the energy crisis, including stricter regulation, uncertainty and energy prices (Figure 14). The only exception was concern about energy supply, which was similar in both regions.

Figure 13
Impact of energy cost concerns on investment (% of firms)



Source: *EIBIS 2016-2023.*
Question: *Thinking about your investment activities, to what extent is energy cost a major, minor or not an obstacle?*

Figure 14
Major concerns related to the energy shock (% of firms)



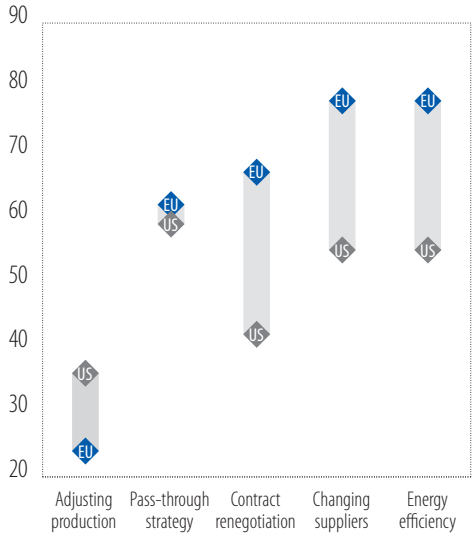
Source: *EIBIS 2023.*
Question: *Thinking about the energy shock, to what extent is your company concerned about …?*

To cope with the energy crisis, EU and US firms have different strategies, with EU firms being generally more reactive. EU firms are more likely to invest in energy savings, change their supplier or contract, and adjust their fuel mix than US firms. According to EIBIS 2023, 78% of EU firms prioritise investment in energy savings, compared with 55% in the United States (Figure 15). Similarly, 67% of EU firms would seek to change their supplier or renegotiate their contract, compared with only 42% of US firms. Moreover, 47% of EU firms would change their fuel mix, whereas only 20% of US firms would consider this option. This suggests that EU firms are more proactive and adaptive in reducing their energy cost and consumption, and in diversifying their energy sources.

However, EU and US firms are equally likely to pass on the additional energy cost to their customers. EIBIS 2023 shows that 62% of EU firms and 59% of US firms plan to pass additional energy costs on to their customers, which increases the probability that they will remain profitable (Figure 15). This is especially true for EU firms in sectors that are most affected by the transition to a low-carbon economy, as 80% are willing to pass on higher energy costs. EIBIS 2023 indicates, however, that only 24% of EU firms and 36% of US firms are thinking of stopping or reducing the production of certain goods and services because high energy costs have made them less profitable. This indicates that most firms are trying to maintain their output and market share despite high costs.

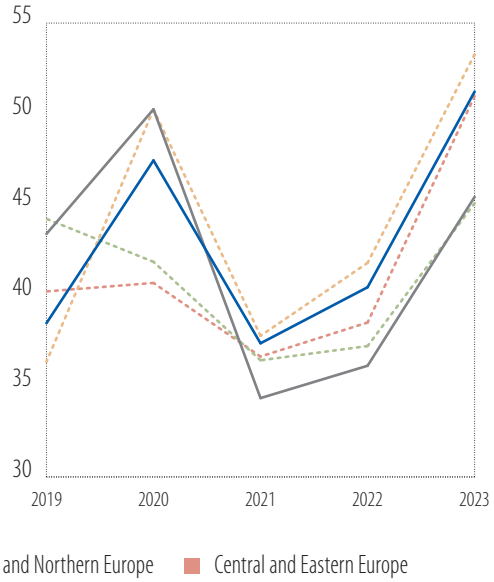
Energy efficiency investment made a strong comeback as the energy crisis pushed firms to look for ways to reduce costs and improve competitiveness. The share of firms that invested in energy efficiency in the European Union rose to 51% in 2022 from 40% in 2021 (Figure 16), surpassing the United States (45%). This trend played out across sectors and firm sizes, but varied by country. In 2023 the share of EU corporate investment budget devoted to energy efficiency was 12% on average, which matched the EIBIS 2022. It was higher than in the United States (8%).

Figure 15
Strategies for dealing with the energy shock
(% of firms)



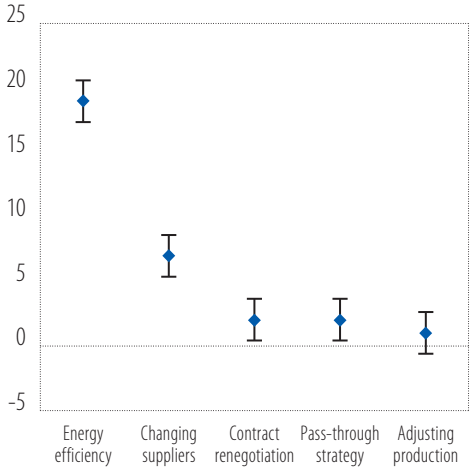
Source: *EIBIS 2023.*
Question: *Which, if any of the following, are your priorities/strategies to deal with the recent developments in the energy market?*

Figure 16
Investing in energy efficiency
(% of firms)



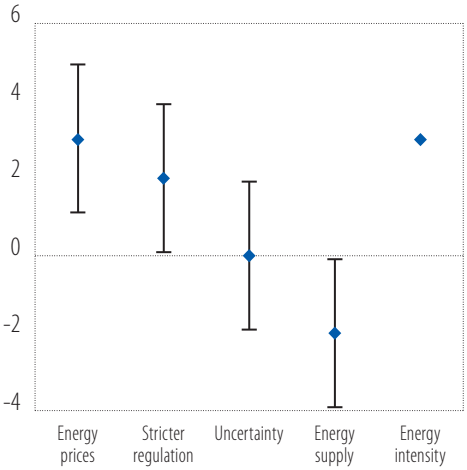
Source: *EIBIS 2019-2023 .*
Question: *What proportion of the total investment in the last financial year was primarily for measures to improve energy efficiency in your organisation?*

Figure 17
Likelihood of firms investing in energy efficiency (in percentage points), **based on the strategies they adopted to deal with the energy crisis**



Source: *EIB staff calculations based on the EIBIS 2023.*
Note: *Marginal effects of various strategies on the probability of investing in energy efficiency, after accounting for country, sector and size effects. The black lines represent 95% confidence intervals.*

Figure 18
Likelihood of firms investing in energy efficiency (in percentage points), **based on their concerns about the energy crisis**

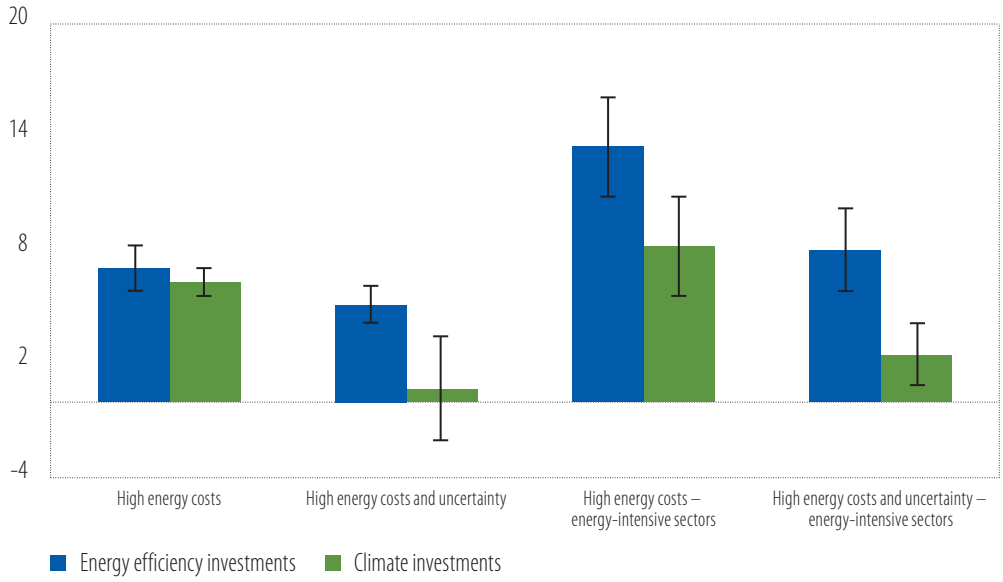


Source: *EIB staff calculations based on the EIBIS 2023.*
Note: *Marginal effects of various concerns related to the energy shock on the probability of investing in energy efficiency, after accounting for country, sector and size effects. The black lines represent 95% confidence intervals.*

Firms that were willing to transform invested more in energy efficiency, as did companies with a longer-term outlook. Among European firms, those that had a long-term vision and wanted to reduce their energy costs and environmental impact were more likely to invest than those that had a short-term focus and tried to cope with the energy crisis by passing the costs onto consumers or by reducing production (Figure 17). Similarly, firms concerned about energy prices, tightening regulation or their own energy intensity were more proactive in investing in energy efficiency, while firms concerned about uncertainty or energy supply were less proactive (Figure 18).

Figure 19

Effects of higher energy costs and uncertainty on the likelihood of investing in climate action and energy efficiency (in percentage points)**, by energy intensity**



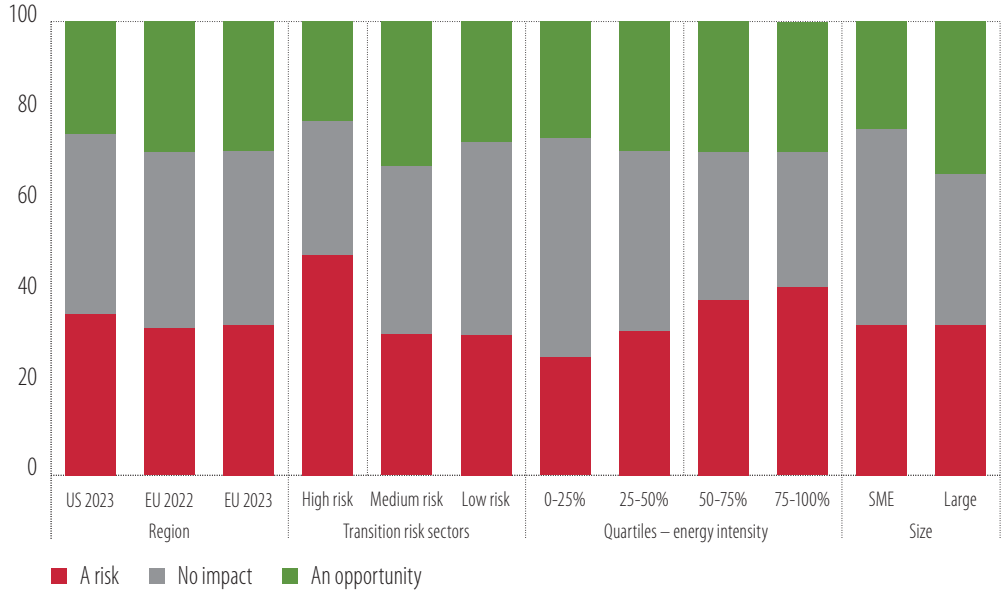
Source: *EIB staff calculations.*
Note: *Marginal effects of major energy cost concerns and uncertainty on the probability of investing in energy efficiency or in climate action, by energy intensity, after accounting for country, sector and size effects. The black lines represent 95% confidence intervals. For more information see Kalantzis et al. (2024).*

Firms chose to invest more in energy efficiency than other types of climate measures when they faced sudden increases in energy prices. The empirical analysis (Figure 19) reveals how energy costs and uncertainty affect firms' decisions to invest in energy efficiency and climate action. Higher energy costs stimulate investment in energy efficiency and climate action. But when energy cost concerns are combined with concerns about uncertainty, firms prioritise investment in energy efficiency. Remarkably, however, this result does not hold for firms in energy-intensive industries. Those firms continue to invest in energy efficiency and climate measures when uncertainty is paired with high energy costs.

The energy shock and the climate emergency are two interrelated issues that firms must tackle simultaneously. The energy crisis, caused by rising demand for fossil fuels and a limited supply of renewable sources, is a hurdle for companies trying to deal with climate change. However, it is not the only difficulty they face. Companies also must deal with the risks and opportunities arising from the transition to a green economy, such as changing consumer preferences, regulatory pressures, technological innovations and competitive pressures.

Figure 20

Impact of the energy transition on firms (in %) **by region, sectors, energy intensity and size**

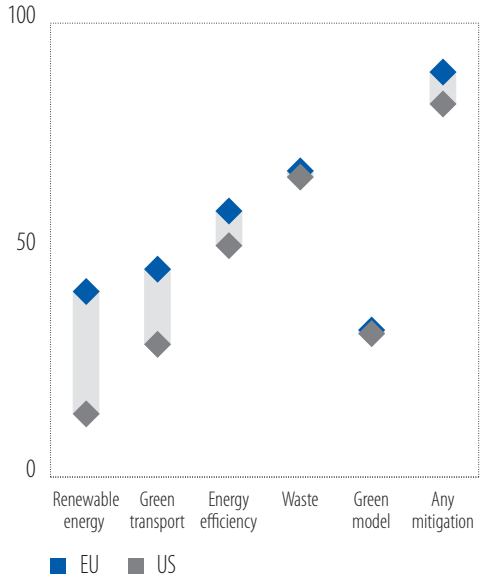


Source: *EIBIS 2023.*
Note: *Sectors with transition risks were determined using codes from the Nomenclature of Economic Activities (NACE), the European statistical classification of economic activities. The quartiles are based on energy spending per employee.*
Question: *What impact do you expect this transition to stricter climate standards and regulations will have on your company over the next five years?*

The transition to a low-carbon economy is not only a challenge, but also an opportunity for firms to gain a competitive edge in their industry. However, not all firms see it that way. EU firms are less concerned about the transition's negative impact (25%) than US firms (36%), and they are slightly more prone to see opportunities related to it (33% for EU firms vs. 29% for US firms). Differences also exist across Europe. Firms in industries that are highly exposed to the energy transition tend to see it as a threat (Figure 20), while firms in low-risk sectors think the transition will not affect them. Firms in sectors with mid-size risks have mixed views. Energy-intensive firms are more likely to see the transition as a risk than an opportunity, and fewer of them expect to come through the transition unaffected. Small and medium firms tend to be equally as concerned as large firms, but they are less likely to see the transition as an opportunity.

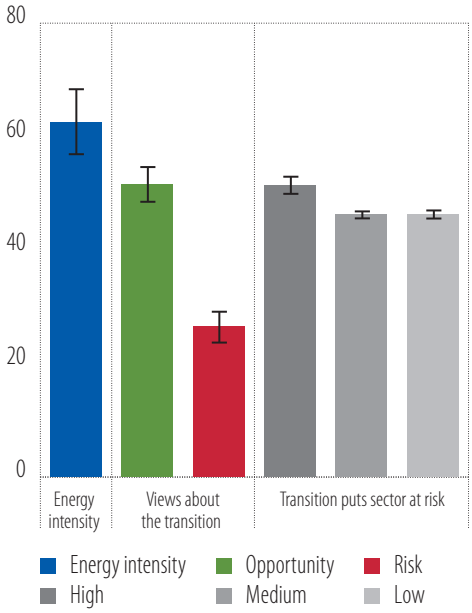
EU firms are ahead of US firms in reducing their carbon footprint, but there is room for improvement. The EIBIS shows that almost 90% of EU firms have taken action to reduce their greenhouse gas emissions, compared with 82% of US firms (Figure 21). EU firms invest mainly in energy efficiency (59% vs. 51% of US firms), and waste minimisation and recycling (67% vs. 66%). EU firms are well ahead of their US counterparts in investing in renewable energy (41% vs. 14%) and green transport (46% vs. 29%). These figures suggest that EU firms are aware of the urgency and importance of addressing climate change and are taking concrete steps to reduce their environmental impact. The results also imply that EU firms are more proactive than US firms in pursuing green investments and strategies.

Figure 21
Acting to reduce greenhouse gas emissions (% of firms)



Source: *EIBIS 2023.*
Question: *Which of the following applies to your company regarding investments to tackle the impacts of weather events and to help reduce carbon emissions?*

Figure 22
Probability of investing in new green products and services (in %), **by transition risks**



Source: *EIB staff calculations.*
Note: *Marginal effects of the probability of investing in green products and services by transition risk sector classification (EIB's risk classification), energy intensity, and views on the energy transition impacts, after taking into account country, sector and size effects. The black lines represent 95% confidence intervals.*

Many EU firms are changing their business model in response to climate change risks. Diving deeper into the data, regression analysis (Figure 22) shows that energy-intensive firms are more likely to consider changing their production and business models to favour less polluting activities. Similarly, firms that operate in sectors that are highly exposed to the transition have more incentives to invest in green products and services to mitigate these risks and seize new opportunities.

A key factor that influences firms' willingness to invest in green products and services is whether they perceive the green transition as a risk or an opportunity. Firms that expect to benefit from the transition (meaning that they expect higher demand, lower costs, an improving reputation or better innovation) are more likely to invest in green products and services. By contrast, firms that view the transition negatively (expecting to suffer from lower profitability, more cumbersome regulation, a worsening reputation or disruption to their innovation) are less likely to invest in transformation. Remarkably, both groups are more likely to invest than firms that expect no impact.

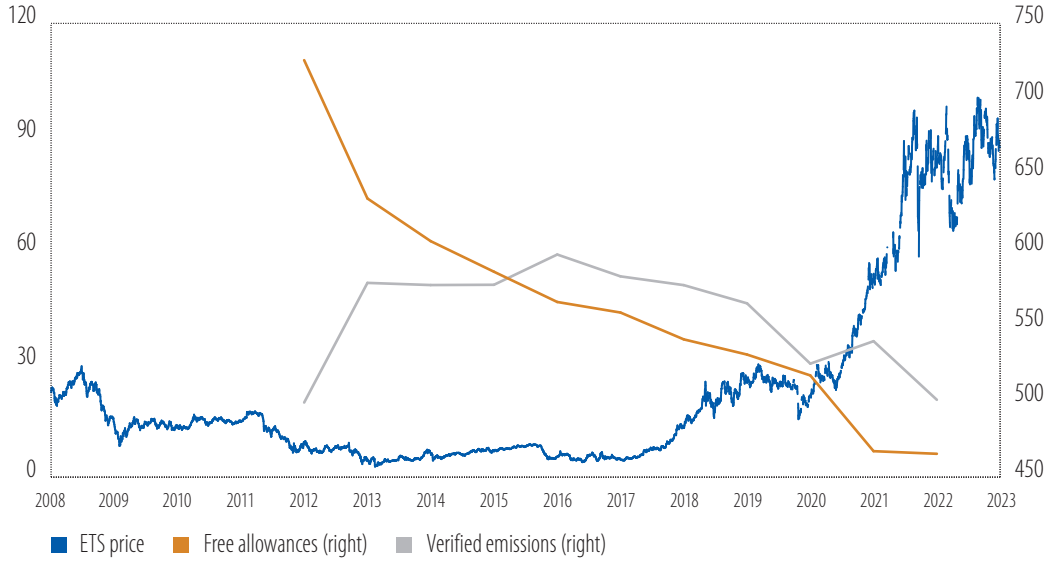
Energy-intensive industries are forging a greener path, but challenges persist

At the EU level, recent evolutions in the energy market and in climate policies have led emission-intensive industries to a crossroads. On one hand, they must adapt to the changing climate and energy landscape, as the European Union aims to become the first climate-neutral continent by 2050, which requires cutting its emissions by more than half by 2030. On the other hand, businesses must cope with rising costs and competition, as the energy crisis and stricter climate regulations put pressure on their profit margins and market share. Firms' ability to adjust to the green transition is neither straightforward nor uniform, as the transition is creating difficulties and opportunities for EU manufacturing.

The European Union is implementing a raft of policies and instruments to decarbonise its economy. One of these is the EU Emissions Trading System (ETS), which is the world's largest carbon market. The trading system includes more than 14 500 installations in the power sector and energy-intensive industries that cover almost 40% of the European Union's total greenhouse gas emissions. The system sets a cap on total emissions allowed by the regulated industries and installations, and it allows market players to trade emission allowances within the cap. The cap is reduced every year, creating a scarcity of allowances. That scarcity determines the price for emissions and outlines the future environment in which manufacturing firms must thrive (Figure 23).

Figure 23

ETS emission prices (left axis: €/tCO_2) **and verified emissions and free emission allowances** (right axis: tCO_2)

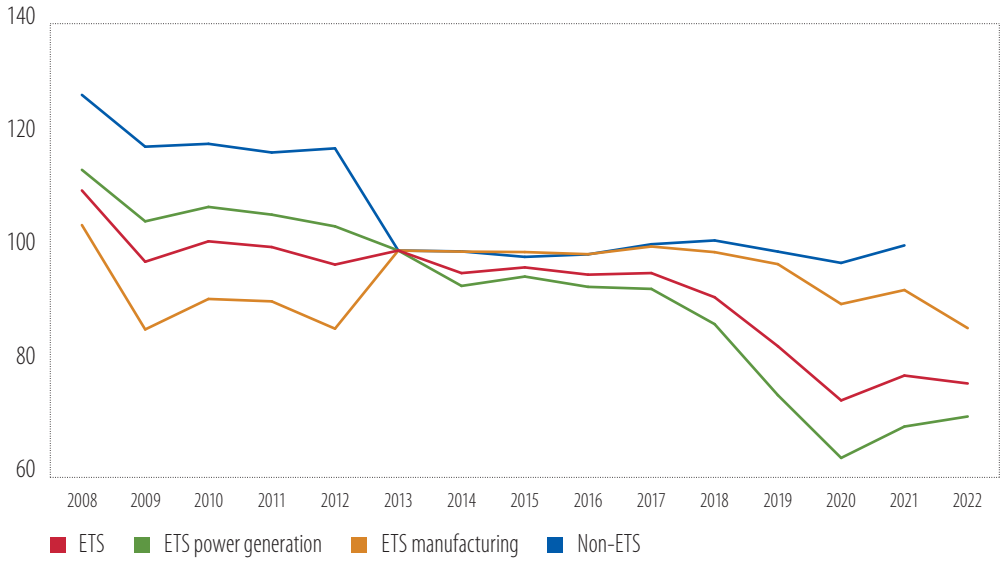


Source: *EU Transaction Log, Bloomberg and Eurostat.*

In operation since 2005, the Emissions Trading System has gone through four phases of development, with changes in scope, emission caps and allocation rules.[1] Since the system was first set up, the regulated sectors have reduced emissions significantly (Figure 24). The power generation sector has mainly driven the reductions, cutting greenhouse gas emissions 30% from 2013 to 2022, thanks to the increasing use of renewable energy and less carbon-intensive fossil fuels. But the manufacturing sector has made less progress (15% reduction for the same period), with many firms still highly reliant on carbon-emitting fossil fuels.

1 In the first phase (2005-2008), allowances were given for free and covered only power generators and energy-intensive industries. In the second phase (2008-2012), allowances were reduced by 6.5% compared to 2005 and Iceland, Liechtenstein and Norway joined the scheme. In phase three (2013-2020) and four (2020-2030), the cap on allowances become even stricter (annual reduction of 1.74% in phase three and 2.2% in phase four), and more sectors and gases were covered (including aviation, petrochemicals and aluminium), while the allocation of free credits was adjusted, based on actual production levels.

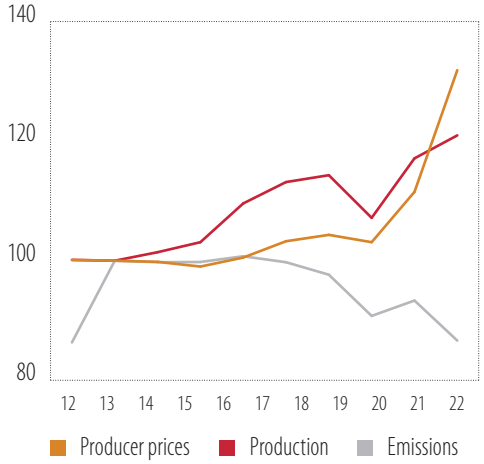
Figure 24
Emissions (an index, 2013=100)**, by sector**



Source: *EU Transaction Log, Bloomberg, Eurostat.*

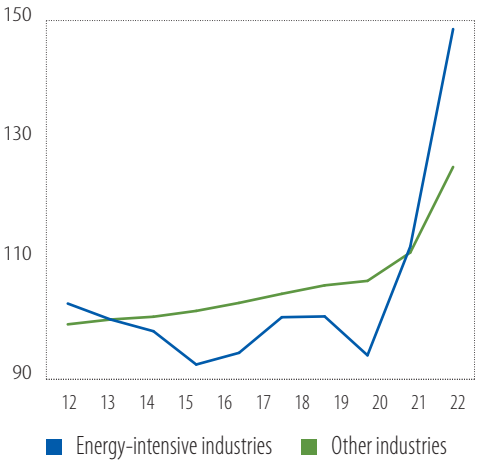
Climate regulation is getting stricter, and the Emissions Trading System is undergoing a major reform to align with the European Union's 2030 climate target. As part of the Fit for 55 package – which aims to align the EU climate and energy policies with the 2030 target of reducing emissions 55% compared to 1990 levels – the European Commission presented a legislative proposal to review the trading system in July 2021. The proposal includes several measures to strengthen the system, such as faster reduction the emission cap from 2.2% to 4.2%, extending the scope of the system to include new sectors like maritime transport and buildings, creating a separate trading system for road transport and heating fuels, and phasing out the allocation of free allowances for most sectors by 2030.

Figure 25
Producer prices, production and emissions in EU manufacturing (an index, 2013=100)



Source: *Eurostat.*

Figure 26
Production prices in energy-intensive manufacturing sectors (an index, 2013=100)



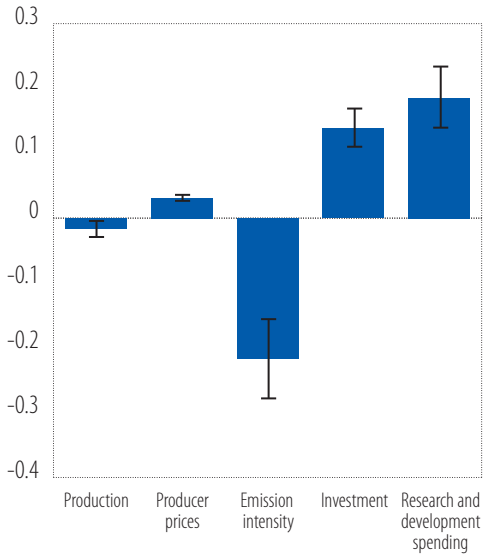
Source: *Eurostat.*
Note: *Energy-intensive industries cover the following sectors: Food, pulp and paper, basic chemicals, refining, iron and steel, non-ferrous metals, nonmetallic minerals.*

On top of the tightening of the market for emission allowances, the energy crisis has intensified the cost pressures faced by EU firms. In 2022, the producer price index jumped nearly 30% annually, but production increased by a meagre 3% (Figure 25). While inflation has fuelled costs, the 54% increase in carbon prices from 2021 to 2022 and an 83% rise in energy costs in the same period also contributed significantly. Cost pressures are exemplified by energy-intensive industries, where production prices surged nearly two times more than in other industries (Figure 26). These developments have raised concerns about the competitiveness and profitability of EU manufacturing firms, especially those highly exposed to international trade and those more likely to shift production or consumption to regions with less strict climate policies (known as carbon leakage).

Tighter carbon markets bring benefits and challenges for industries that are highly dependent on energy or are high emitting. On the positive side, tighter carbon markets help reduce emissions and prod the European Union to meet its climate goals (Figure 27). However, these gains come with economic costs, and steepness of those costs depend on how well the regulated sectors can adapt and innovate. By placing a cap on carbon emissions and limiting the trading of allowances, the Emissions Trading System influences markets through price and supply. Its impact is explored below with a panel regression model that explores developments from 2012 to 2022, after controlling for factors like labour, energy costs and value added.

Figure 27

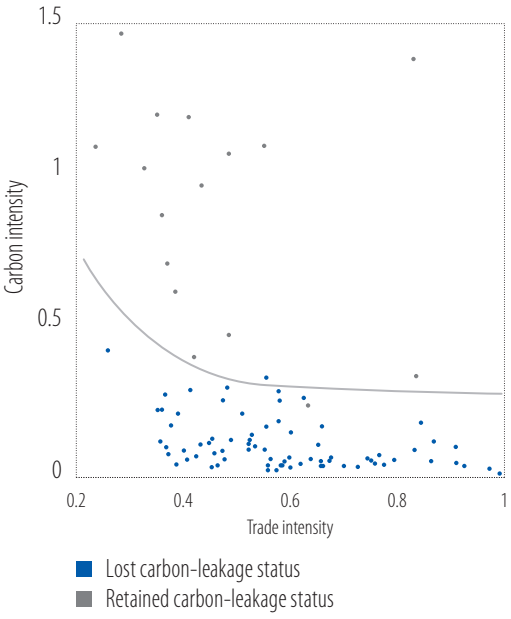
Impact of ETS prices on firms' strategies (a coefficient)



Source: *EIB staff calculations.*
Note: *The coefficients have been estimated based on panel regressions (2012-2022), taking into account sectorial and country effects, as well as control variables such as value added at factor cost, share of labour and energy prices. The black lines represent 95% confidence intervals. For more details see Hattemer and Kalantzis (2024).*

Figure 28

Changes in the allocation of free allowances (indexes)



Source: *EIB staff calculations.*
Note: *The figure below shows the changes in the allocation of free allowances for different sectors under the EU Emissions Trading System from Phase III (2013-2020) to Phase IV (2021-2030). The free allowances are granted to sectors that are exposed to a significant risk of carbon leakage, which means that they may relocate their production to countries with less stringent climate policies. The blue dots represent sectors that lost their eligibility for free allowances in Phase IV, while the grey dots represent sectors that retained their eligibility for free allowances in Phase IV. For more details see Hattemer and Kalantzis (2024).*

Higher prices for emission allowances have a small impact on producer prices and production, but a larger impact on emission intensity. A 1% increase in the ETS price is associated with less than a 0.03% increase in producer prices, and a similarly small decrease in production. This means that only a small fraction of emission costs is passed through to consumers, and that firms slightly reduce output (Figure 27). By contrast, the same price increase results in a decrease of over 0.2% in emission intensity, which is robust and statistically significant. This implies that the ETS price effectively encourages the manufacturing sector to reduce greenhouse gas emissions per unit of output.

Higher ETS prices create an incentive for firms to invest in low-carbon or carbon-neutral technologies, which can lower their production costs and enhance their long-term competitiveness. However, the relationship between carbon price and investment is not simple, as it depends on many other factors, such as market structure, technological advancements, regulatory interventions and external shocks. Despite this complexity, a clear trend emerges from the panel data analysis. A 1% increase in the price of carbon allowances corresponds to a 0.14% increase in net investments or 0.18% increase in research and development (R&D) spending. These findings confirm that investment and R&D are key ways in which the system influences the environmental performance of the manufacturing sector.

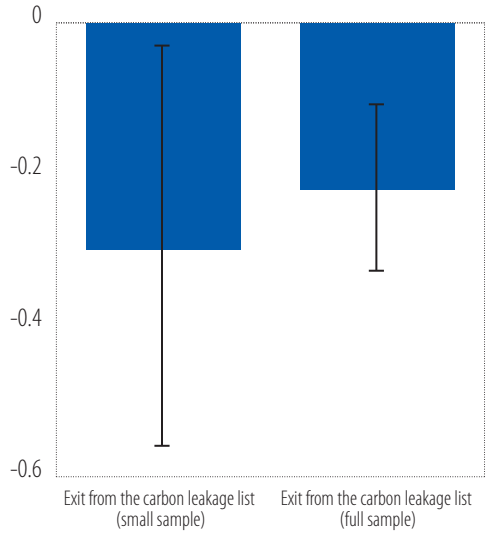
Figure 29

Effects of losing the carbon-leakage status on emission intensity

Source: *EIB staff calculations.*
Note: *The red line represents the moment at which some sectors lost their free emissions allowances.*

Figure 30

Change in the emissions intensity of firms that lost their carbon-leakage status vs. those that retained it (in %)



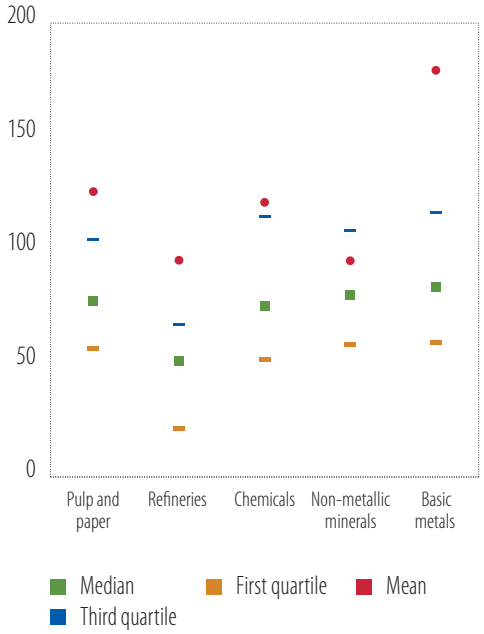
Source: *EIB staff calculations.*
Note: *The small sample excludes sectors with very high carbon intensity in Figure 28. For more details see Hattemer and Kalantzis (2024). The black lines represent 95% confidence intervals.*

Cutting the quantity of emission allowances provided for free also encourages firms to lower their emission intensity. Sectors at risk of carbon leakage used to receive free emission allowances to offset the risk of firms' relocating production to countries or regions with less stringent climate regulations. This practice was reduced in Phase IV of the system (Figure 28) as the allocation criteria became stricter. As a result, sectors that exported more but had lower carbon intensity were excluded from the list (blue dots). The impact of this change is measured by comparing the average emission intensity of sectors that lost their carbon leakage status (and received fewer free allowances) and sectors that remained on the list (and continued to receive free allowances), taking into account sector-specific factors like labour share, energy prices and value added (Figure 29). The results indicate that firms stripped of their carbon leakage status decreased their emission intensity by 20% more than firms that retained their status (Figure 30).

Nevertheless, high emissions remain a source of concern for many firms in energy-intensive industries. With the exception of refineries, more than 25% of firms in each of the other product categories increased their emission intensity from 2013 to 2020 (Figure 31). A few firms even saw their emission intensity increase substantially – such that average changes in intensity exceeded the median and even the third quartile of the distribution. These firms constitute potential pockets of vulnerability, as they will be particularly exposed to more ambitious climate objectives and further competitiveness pressures resulting from higher carbon prices.

Figure 31

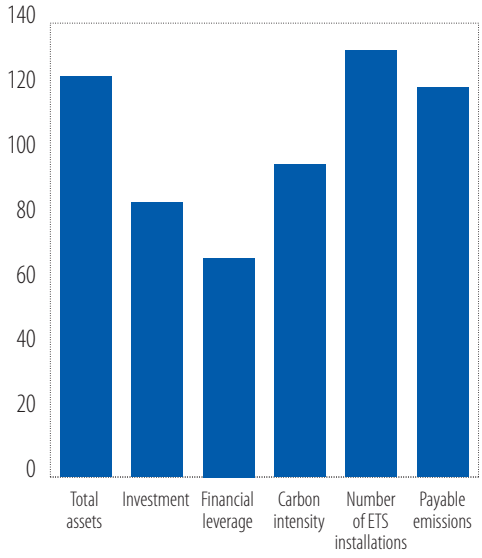
Distribution of changes in firms' carbon intensity (carbon intensity index, 2013=100), **by sector**



Source: *EIB staff calculations.*
Note: *The squares represent the median for each sector, the bars the first and third quartiles of the distribution and the dots the mean. Investment is represented in relation to the index. Product sectors are based on EU ETS installation-level sectors and are assigned to firms based on the installations which constitute the majority emissions.*

Figure 32

Differences in the characteristics of firms lagging in decarbonisation vs. the sector average (average=100)



Source: *EIB staff calculations.*
Note: *Average statistics calculated on a sample of EU ETS manufacturing firms from 2013 to 2020. Decarbonisation laggards are defined as 25% of firms with the lowest reduction in carbon intensity from 2020 to 2013 in each of the product sectors. Financial leverage is defined as the sum of short-term loans and long-term debt compared to total assets. Payable emissions describe the share of verified emissions for which a firm has to buy credit. Numbers are standardised such that 100 describes the average for all manufacturing firms in the period.*

Firms that have made the least progress in reducing their emission intensity appear to be structurally different than the average manufacturing firm. Decarbonisation laggards are defined as the bottom 25% of firms in each sector based on the reduction in their emission intensity from 2013 to 2020. Descriptive statistics show that decarbonisation laggards are typically larger, invest less and rely less on external finance than the average manufacturing firm covered by the Emissions Trading System (Figure 32).

Access to long-term financing is correlated with a reduction in a firm's emission intensity. We examine the relationship between external finance and emission intensity, controlling for firm financial characteristics and the exposure to the Emissions Trading System, as well as fixed effects for firms, countries, sectors and years. While financial leverage is only weakly correlated with emission intensity, the relationship becomes negative and significant for external debt with a maturity of more than 12 months (Figure 33). At the firm level, a 1 percentage point increase in the long-term debt-to-asset ratio is associated with 0.2% lower emission intensity over time. This means that emission-intensive firms use long-term finance to decarbonise.

Figure 33

Relationship between firms' leverage and carbon intensity (a coefficient)

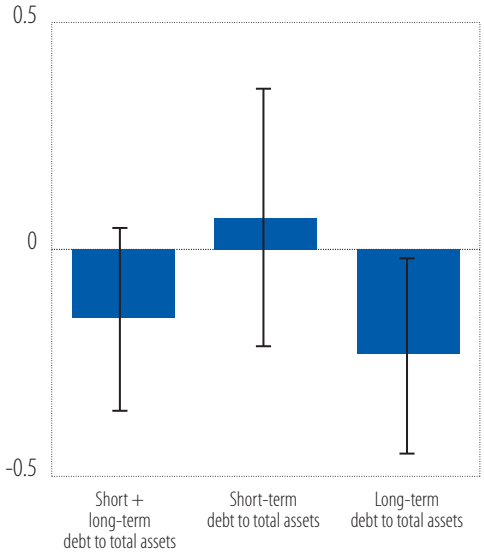
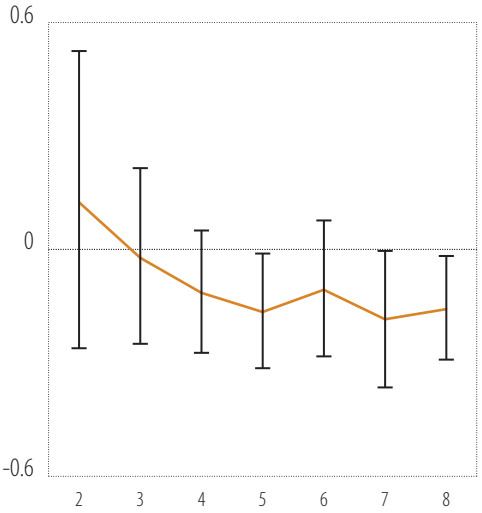


Figure 34

Relationship between firms' leverage and carbon intensity (a coefficient)**, by deciles of the carbon intensity of firms covered by the ETS**



Source: *EIB staff calculations.*

Note: *The right panel looks at the relationship between firms' financial leverage and their carbon intensity, depending on where the they fall in the distribution of the carbon intensity of firms covered by the Emissions Trading System. Regression results use the firm-level fixed effects panel model, regressing real carbon intensity (in log) on financial leverage and its components (loans and long-term debt scaled by total assets). The model controls for the changes in tangible fixed assets, returns on assets, taxes paid, cash ratio, total assets (in log), firm's age, and number of installations reported under the EU ETS and the amount of free allowances granted under the regulation. All explanatory variables are lagged by one year. The model takes into account firm-level and country-sector-year fixed effects, and clusters the standard errors at the firm level. The estimation sample covers 2008-2020. The black lines represent 95% confidence intervals. For more details see Wolski (2024).*

The time to accelerate decarbonisation for emission intensive industries is now. Emission-intensive firms are more dependent on long-term finance. After controlling for fixed effects for country, sector and year, regression results show that the negative relationship between long-term debt and emission intensity is significant only for companies located in the highest emission intensity deciles (Figure 34). This suggests that high-emitting firms depend on long-term finance to decarbonise. Long-term finance might become scarce for high-emitting industries, however. Financial institutions are progressively starting to price in the cost of climate risk, which means that financing costs will increase substantially for these firms.

Box A

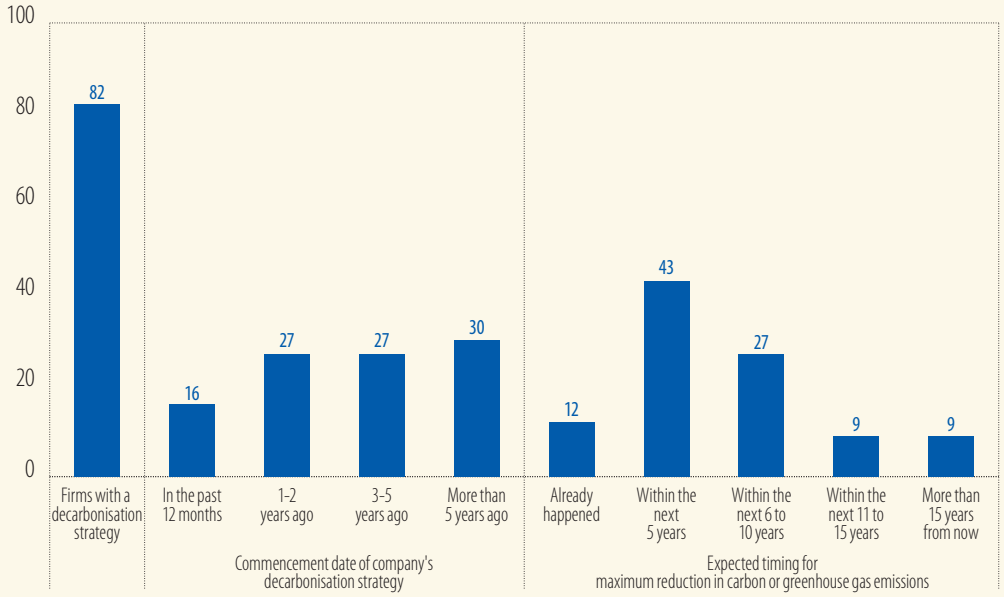
Manufacturing firms in the EU Emissions Trading System – what makes the leaders stand out from the rest?

This box explores how EU firms in manufacturing sectors subject to the Emissions Trading System (ETS) approach decarbonisation. It investigates what sets emissions reduction leaders apart from those that lag behind, and what motivates or hinders them. The analysis leverages data derived from a 2023 EIB special survey of 373 EU manufacturing firms[2] that had at least one installation, namely a stationary technical unit subject to the trading system in 2022.[3] These firms are, by nature, energy-intensive and face the greatest transition challenges, but are also more aware of those challenges.

Responses show that 82% of ETS manufacturing firms in the survey had a decarbonisation strategy in place in 2023. The majority of firms began their decarbonisation strategy before 2020 but the rest have been catching up quickly (Figure A.1). Looking at firms' decarbonisation plans, only 12% say they have already reached their decarbonisation peak. Most are focusing on the 2030 targets and on aligning their activities with the Paris Agreement. Some 18% report that they do not expect their decarbonisation efforts to have the most impact within the next ten years.

Figure A.1

Presence and impact of a decarbonisation strategy for firms covered by the Emissions Trading System (% of firms)



Source: *EIBIS 2023 add-on module on manufacturing firms covered by the Emissions Trading System (ETS).*
Question: *1. Does your company have a decarbonisation strategy? 2. If yes, when did you first implement a decarbonisation strategy for your company? 3. When thinking about the decarbonisation strategy of your company, when do you expect to achieve the biggest reduction in your carbon or greenhouse gas emissions?*

2 The questionnaire was designed in cooperation with the European University Institute. The European University Institute input is part of the LIFE COASE project, co-financed by the EU Life Programme.

3 For more information on the ETS survey, see the Data Annex.

Manufacturing firms operating in the system were asked to assess their decarbonisation efforts compared to their peers. About 30% described themselves as ahead of their peers (firms that are "ahead," or leaders), 10% as behind ("laggards" or behind) and 60% as in line with other firms (Figure A.2). Figure A.2 also presents the leaders and laggards by sector. Pulp and paper and refineries tend to have a slightly higher incidence of laggards. The chemical sector has a higher share of firms considering themselves ahead.

Cross-checking this self-assessment with hard data on emissions, firms appear to have a relatively strong awareness and ability to measure their decarbonisation progress. The self-reported status tends to match the real carbon intensity trends for each group, measured by the ratio of emissions to value added in the last decade (Figure A.3). Specifically, the median carbon intensity has steadily dropped by nearly 20% from 2013 to 2019 among the leaders, and by only 5% among the laggards.

Figure A.2
Firms' reported decarbonisation status (in %)

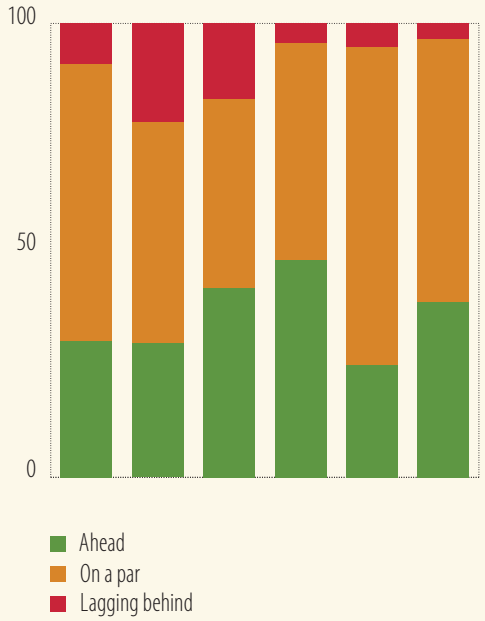
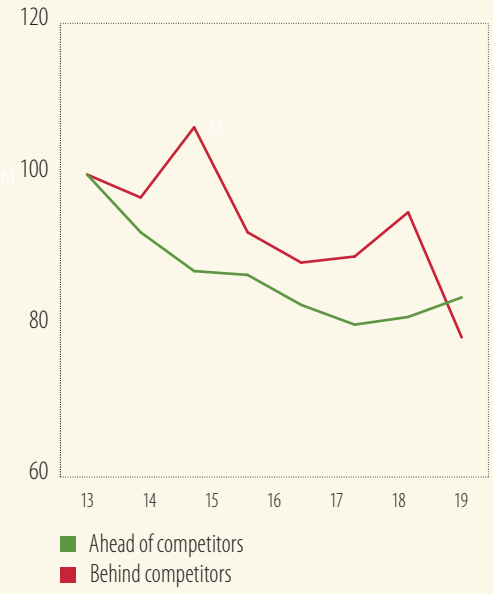


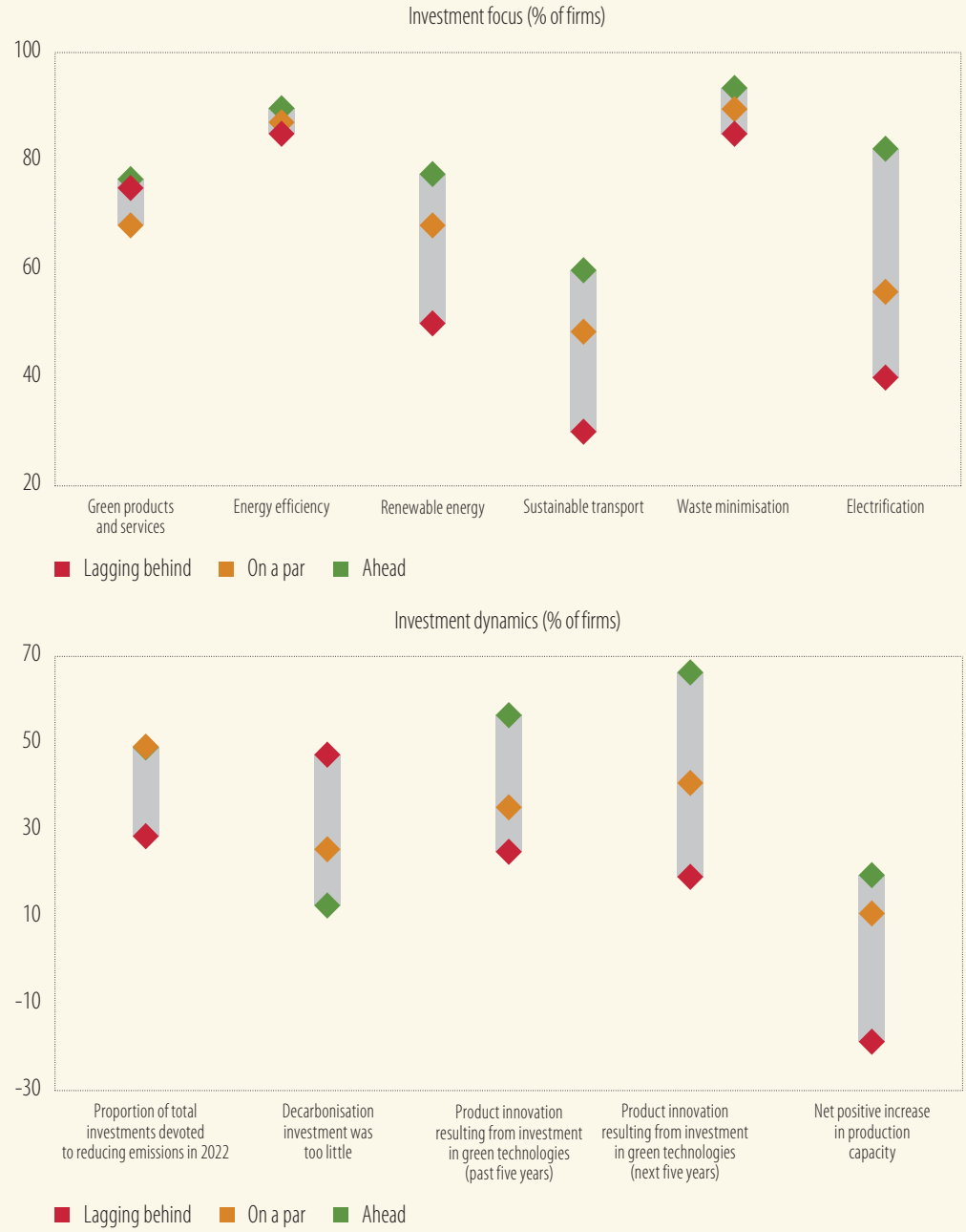
Figure A.3
Carbon intensity of firms that say they are ahead or behind on decarbonisation (an index, 2013=100)



Source: *EIBIS 2023 add-on module on manufacturing firms covered by the ETS.*
Note: *In Figure A.3, the two groups of firms are based on 2023 ETS survey, and they are fixed across the years. The median is calculated using the firm-level decarbonisation index (2013=100) for specific years. Data constraints make it impossible to control for the business cycle, therefore 2020 was left out to avoid anomalies caused by the COVID-19 pandemic.*

Having a decarbonisation strategy is a basic but essential step for any firm that wants to be ahead in decarbonisation. All leaders have a decarbonisation strategy in place, unlike 38% of laggards and 22% of those on a par with their peers. A decarbonisation strategy can help a firm to set clear goals, identify opportunities, allocate resources, monitor progress, and communicate visions and actions to shareholders and others. Leaders also embarked on their strategies earlier (41% started more than five years ago) and, for almost 20% of them, the peak in emissions reduction has already been achieved.

Figure A.4
Firms' investment focus and dynamics



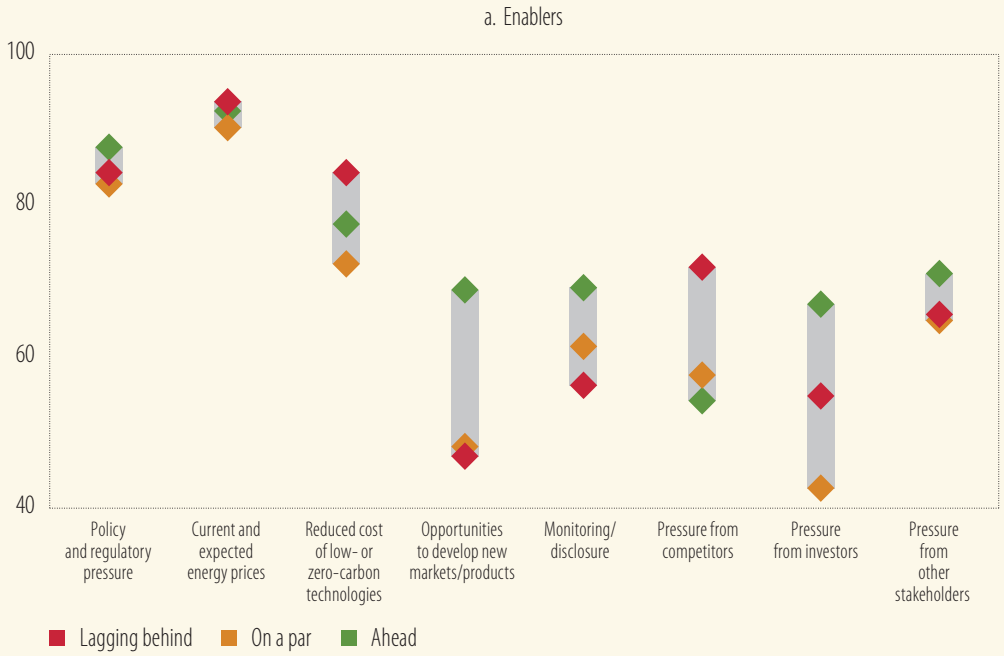
Source: *EIBIS 2023 add-on module on manufacturing firms covered by the ETS.*
Question: *Question: 1. Is your company investing in or implementing any of the following to reduce carbon or greenhouse gas emissions? 2. Thinking about the total investment of your company in 2022, what proportion of your total investment was devoted to reducing greenhouse gas emissions? 3. Looking back at your decarbonisation investment over the last five years, was it too much, too little, or about the right amount to ensure the success of your decarbonisation strategy? 4. And thinking about your company's decarbonisation strategy, compared to five years ago, has your company's total production capacity significantly changed as a result of the construction, shutdown, purchase or sale of production plants? 5. You mentioned investment in technologies to reduce greenhouse gas emissions in the EU. Did this involve any product innovation?*

Firms that invest more in decarbonisation tend to perform better in reducing their carbon footprint and their emission intensity. Leaders invested 50% of their total investment budget in decarbonisation, outperforming laggards, which invested only 30%. Nearly half of laggards admitted that they underinvested in decarbonisation, while only 13% of leaders said so (Figure A.4).

Firms that are frontrunners in decarbonisation are very active in product innovation. Among the firms that invested in technologies to reduce greenhouse gas emissions in the last five years, 75% of the laggards did not focus on product innovation, while almost 60% of the leaders did. Similarly, 66% of leaders plan to innovate in decarbonisation in the next five years, while only 19% of laggards have such plans. Product innovation helps firms stand out from the competition and meet changing customer needs and preferences. It also helps them to access new markets and opportunities and stay competitive in the long run.

Firms' decarbonisation efforts are closely linked to the prospects they see in the future. Leaders, the ones cutting emissions the most, are more likely to have seen an increase in production than a contraction (24% vs. 5%) (Figure A.4). Laggards, the ones cutting emissions intensity the least, are much more likely to have seen production capacity contract rather than increase (34% vs. 16%). In parallel, all firms show little appetite for shifting production to new plants outside the European Union, to regions with less strict environmental regulations. Less than 5% consider shifting production to be a major or minor part of their strategy. This suggests that carbon leakage, or moving production offshore, is not a widespread practice among ETS firms.

Figure A.5
Enabling factors and obstacles to climate investments (% of firms)



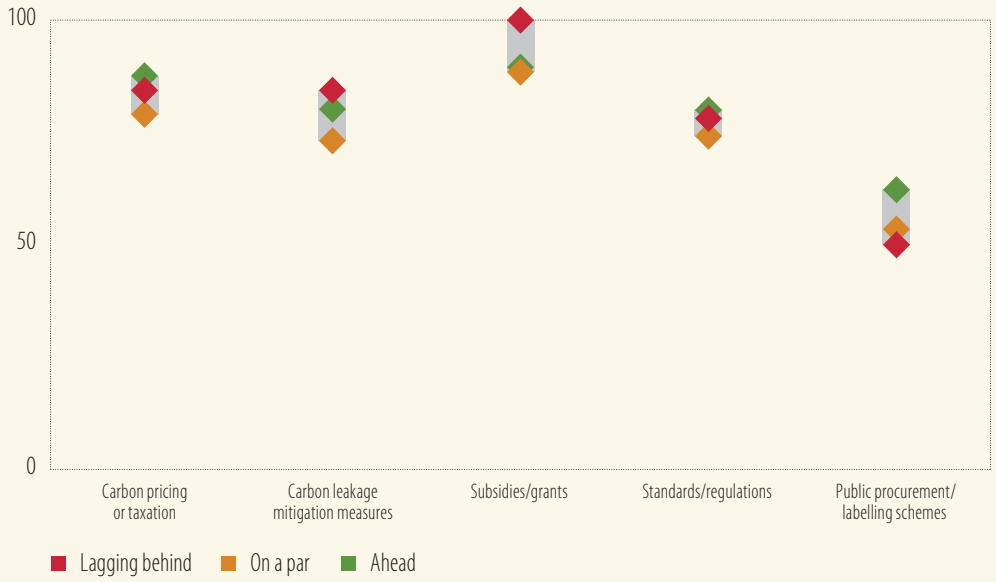
Source: *EIBIS 2023 add-on module on manufacturing firms covered by the ETS.*
Question: *1. When thinking about decarbonisation, how important, if at all, are each of the following to encourage you to undertake or accelerate action to tackle climate change? 2. To what extent, if at all, is each of the following an obstacle to investing in green technologies and processes?*

All firms see the political and regulatory framework, along with energy prices, as key drivers of their decarbonisation efforts (Figure A.5). Laggards cite high costs for low-carbon technologies as an obstacle and pressure from competitors as a stimulus for transformation. They also show lower sensitivity to monitoring and disclosure requirements and to pressure from investors. Combining these findings suggests that laggards' delay could be motivated by a gap in technological advancement. Leaders are more sensitive to reporting and disclosure rules (69%), and to pressure from investors (67%) and stakeholders (71%). They are also much more likely to be motivated by business opportunities from creating new markets or products (69%).

For all groups, the major barriers to decarbonisation are uncertainty about future energy and carbon costs, and uncertainty about regulation and taxation. These concerns affect the incentive to decarbonise for frontrunners (who might anticipate investment, expecting more stringent net-zero conditions and requirements) and laggards (who might hope for delays in such requirements). Thus, uncertainty reduces incentives to invest for both groups of firms (Figure A.5). The majority (around 90%) are likely to see high financing costs as constraints. Firms that are slower to decarbonise tend to cite long payback periods (88%) and technology-related challenges (88%) as obstacles, whereas those that feel they are ahead tend to be more concerned about the lack of skilled labour (80%).

Finally, the survey asked ETS manufacturing firms about policy initiatives that could support their decarbonisation efforts and general decarbonisation investment (Figure A.6). Leaders preferred market and legal incentives, such as carbon pricing (88%), green public procurement (62%) and standards (80%). Laggards, who are behind in the green transition, preferred subsidies (100%) and measures to prevent carbon leakage (84%). This suggests that leaders favour of policies that reward their efforts and create new business opportunities in the net-zero economy, whereas laggards are in favour of policies that reduce the costs of adjusting to net zero and protect them from international competition.

Figure A.6
Policy initiatives that would encourage investment (% of firms)



Source: *EIBIS 2023 add-on module on manufacturing firms covered by the ETS.*
Question: *How likely or unlikely are each of the following policies to encourage your company to invest in green technologies and processes?*

To sum up, the decarbonisation challenges of manufacturing firms covered by the Emissions Trading System vary depending on the sector and the availability of suitable technologies. However, some common features can be identified. Decarbonisation leaders are firms that see the net-zero transition as a business opportunity and invest more in it. They are more innovative, more responsive to investor pressure and more transparent about their decarbonisation efforts. They are also more likely to expand or maintain their production capacity. Decarbonisation laggards are firms that face technological constraints and invest less in the transition. They are more likely to believe they are not doing enough and to anticipate a decline in production. Measures that could accelerate decarbonisation differ for the two groups of firms. Leaders are in favour of more market opportunities and clear policy guidance for the net-zero economy. Laggards, however, seem to delay their transformation and to make it conditional on direct support.

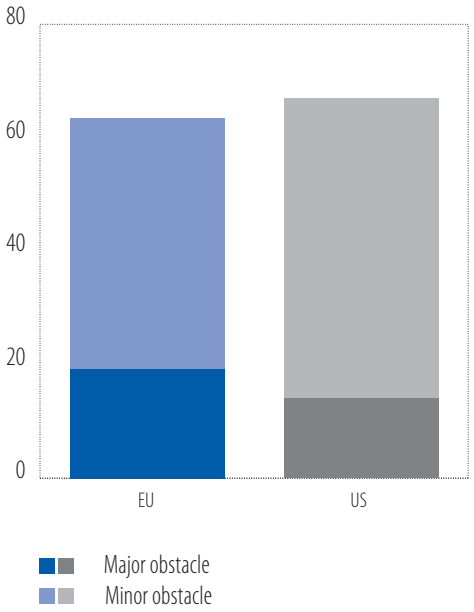
Firms favour mitigation over adaptation measures, creating a gap in climate resilience

Climate change is not just a global environmental issue, but also a business challenge. EU firms must adapt to the fallout of climate change, on top of reducing their emissions. Many companies are facing extreme weather events, such as droughts, heat stress and floods, which affect their operations and profitability. These events can disrupt the supply chain, reduce the productivity of labour and resources, and damage business infrastructure and assets. They also increase the need for external finance (Benincasa et al., 2023). This section explores how European companies are responding to these physical climate risks and the strategies they are adopting to enhance their resilience and competitiveness.

While climate change poses serious risks to EU firms, few of them are taking sufficient measures to adapt. According to EIBIS 2023 data, 63% of firms in the European Union and 67% in the United States

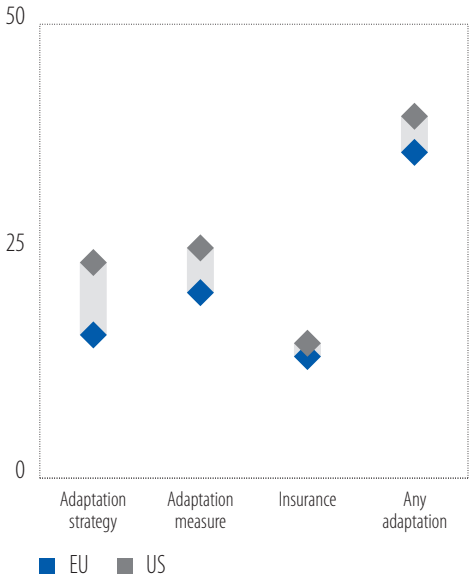
say they are at risk from climate change (Figure 35), up by at least 6 percentage points compared to the previous survey wave. However, only 36% of EU firms have taken any action (strategy, investment or buying insurance) to deal with physical risks (Figure 36). Moreover, there is a large gap in insurance coverage, as only 13% of firms in Europe have bought an insurance policy against climate risks. Only 17% of firms already facing climate risks are insured.

Figure 35
Firms (in %) **affected by physical climate risks**



Source: *EIBIS 2023.*
Question: *Thinking about climate change and the related changes in weather patterns, would you say these weather events currently have an impact on your business?*

Figure 36
Firms (in %) **investing in specific adaptation measures**

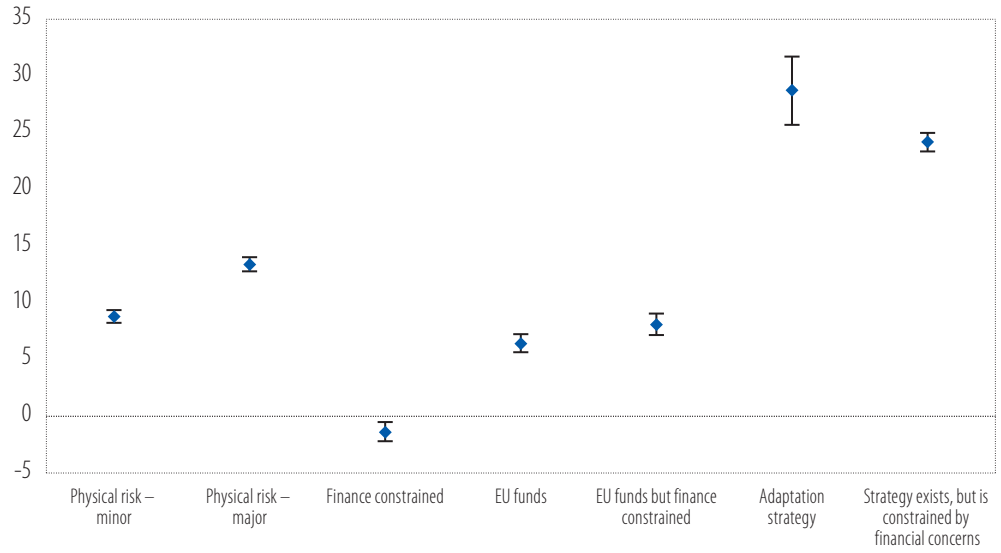


Source: *EIBIS 2023.*
Question: *Has your company developed or invested in any of the following measures to build resilience to the physical risks to your company caused by climate change?*

Adapting to physical climate risks is not an easy task for companies. They face several challenges that may hinder their efforts (Li, 2022). These include the difficulty of estimating the long-term impacts of climate change, which are not well captured by historical data; the complexity and costliness of adapting to multiple and diverse climate risk drivers; the tendency to prioritise short-term goals over the long-term benefits of adaptation; and the attempt to shift the burden of adaptation to other players, such as governments. There is also the chance firms will not take the necessary steps to protect themselves against climate risks, as they expect government to intervene.

Firms are implementing different types of adaptation measures to cope with climate change risks. Some of those measures are active and include changing operational or business strategies, while others are passive, such as insurance or relocation. According to EIBIS 2023 data, EU firms tend to prefer active adaptation measures (especially operational ones) over passive measures. Several factors may explain this. First, operational measures, such as improving water efficiency or installing cooling systems, are easier and faster to implement than business strategies, such as changing product lines or entering new markets. Second, operational measures are less costly and risky than business strategies, which may require significant investments and changes in the business model. Third, operational measures can be more easily justified to stakeholders, such as customers, employees or investors, as they demonstrate the firm's commitment to sustainability and resilience. Therefore, firms may opt for active adaptation measures that are more feasible and beneficial than passive ones.

Figure 37
Factors influencing the probability of investing in adaptation measures (in percentage points)



Source: *EIB staff calculations.*
Note: *Marginal effects of the probability of investing in adaptation measures, after taking into account country, sector and size effects. The black lines represent 95% confidence intervals.*

Firms' investment in adaptation measures depends on how they perceive and respond to the physical climate risks they face, and on access to finance. EIBIS data show that companies invest more in adaptation when they are exposed to higher climate risks that affect their own business (Figure 37). Finance is also crucial for this investment – but it is often scarce, uneven and insufficient to meet the growing needs and costs of adaptation. The European Investment Bank (2021) estimates that annual adaptation needs in Europe range from EUR 35 billion to EUR 500 billion, while only EUR 70 billion was allocated to adaptation through EU structural and investment funds from 2014 to 2021. In addition, EIBIS analysis shows that finance-constrained firms are less likely to adopt an adaptation strategy or take measures (passive or active) to protect themselves from climate change. Furthermore, even if they have an adaptation strategy, the likelihood that they will invest in adaptation measures decreases when they face finance constraints.

Public funds play a vital role in catalysing investment in adaptation by companies, especially in the most vulnerable regions and sectors. EIBIS analysis confirms that European firms are more likely to invest in adaptation when a higher share of EU funds within the country is earmarked for adaptation purposes (Figure 37). These funds help companies adapt either by providing direct financial incentives or by creating a framework for adaptation. Such a framework ultimately sets standards and guidelines, integrates climate risks and adaptation solutions into economic and development policies, and supports capacity-building, knowledge-sharing and research.

Geographical characteristics also shape firms' climate investments. EIBIS 2023 shows clear regional clusters of firms that are investing in adaptation and mitigation. In some regions firms are less active, while in others clusters of active firms exist. Interestingly some spillover effects, such as firms exposed to demonstrations of climate projects and presented with opportunities to learn from their peers, could help to encourage climate investments. To this end, the geographical dimension of firms' climate investments should be considered when designing EU policies and programmes. Box B gives more detail on how regional spillover effects influence firms' decisions to invest in climate adaptation and mitigation measures.

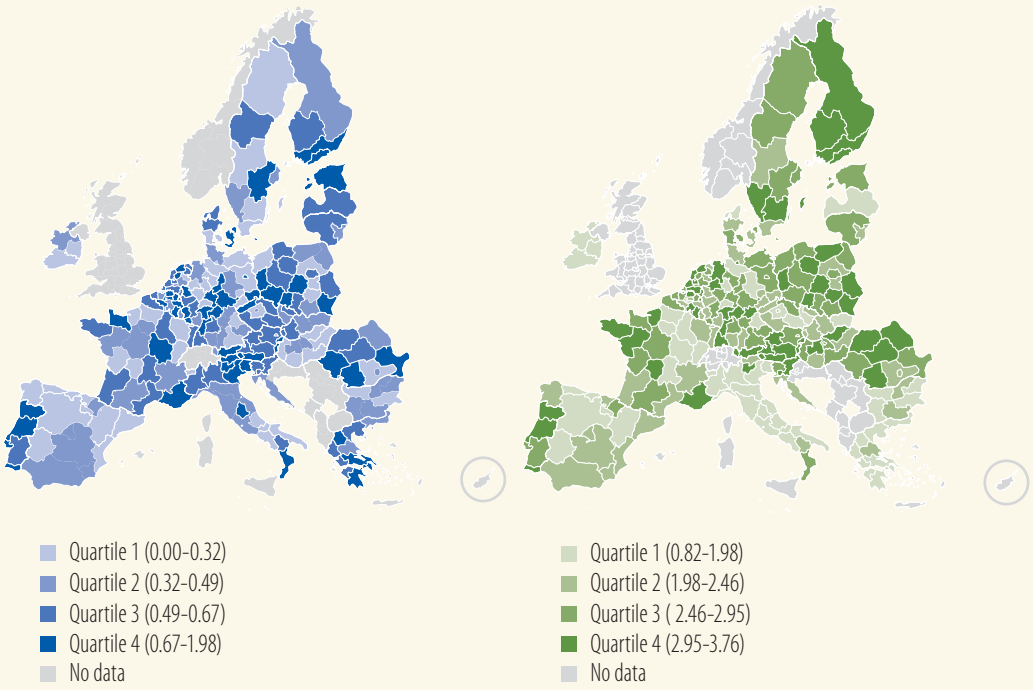
Box B

How regional spillovers shape firms' climate investments in Europe

Climate action depends in part on awareness and local conditions. This box explores how spillover effects from firms' climate actions in one specific region can influence firms in neighbouring regions. Spillover effects can create a positive or negative environment for investment, depending on whether they benefit or harm other firms. They can also generate network effects, where the impact of a specific climate action increases with the number of adopters. For example, if more firms invest in renewable energy, they may create economies of scale and reduce costs for others. Furthermore, regional spillover effects can foster learning and innovation as firms share knowledge and best practices with each other. Because they can amplify or hinder firms' adoption of climate-friendly practices, policymakers should take regional spillover effects into account when drafting climate laws or regulations.

Figure B.1

Average number of adaptation (left) **and mitigation** (right) **measures adopted by firms, by NUTS 2 region and distribution quartile**



Source: *EIBIS 2023.*

Question: *1) Has your company developed or invested in any of the following measures to build resilience to the physical risks to your company caused by climate change? 2) Is your company investing or implementing any of the following to reduce greenhouse gas emissions?*

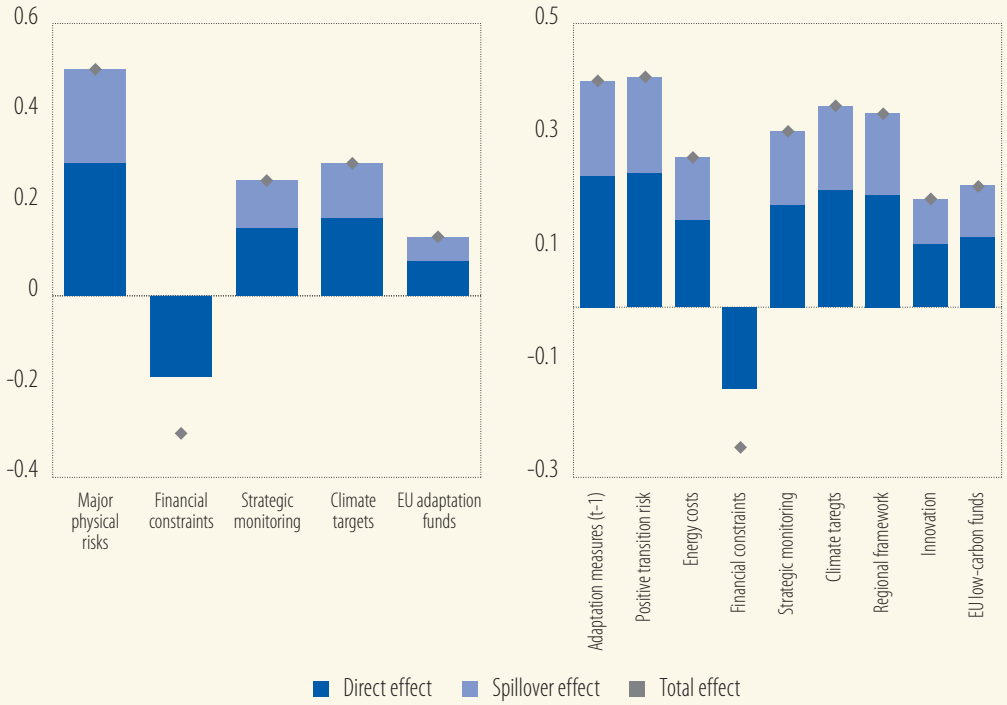
Figure B.1 shows clusters of firms that are more or less active in addressing climate change. These spillover effects are the focus of this study, which investigates whether adopting more climate change measures in one region translates to a higher rate of adoption of similar measures in neighbouring regions. Our analysis based on spatial techniques confirmed the existence of spatial dependence in the adoption of climate measures among EU regions at the NUTS 2 level,[4] underscoring that firms in

4 NUTS refers to the Nomenclature of Territorial Units for Statistics, or La nomenclature des unités territoriales statistiques (NUTS) in French. It is used to reference the administrative divisions of countries for statistical purposes.

one region affect climate action in another region. Furthermore, the magnitude of these spillover effects depends on the type of measure, with mitigation measures influencing firms slightly more than adaptation measures.

Figure B.2

Direct, indirect and total effects of various factors on the number of adaptation (left) **and mitigation** (right) **measures adopted** (a coefficient)



Source: *EIB staff calculations.*

Note: *The graphs show the direct, indirect and total effects of different factors on firms' climate investments, based on spatial autoregressive (SAR) models. The left chart shows the impact on the average number of adaptation measures per region (NUTS 2), and the right chart on the average number of mitigation measures. The charts only show the factors that are significant at 90% or more. The models account for the spatial dependence in the data, as indicated by the Morans' I and Lagrange Multiplier tests. For more details see Casati and Kalantzis (2024).*

In particular, the spatial analysis (Figure B.2) reveals some other interesting patterns and insights.

- Firms' own strategies (strategic monitoring or setting climate targets) affect neighbours' decisions to invest in climate adaptation and mitigation. A decision to set and monitor greenhouse gas targets influences local investment in adaptation and mitigation, but also generates positive spillover effects, amplifying environmental investment across regions. This is particularly true in interconnected regional markets where firms keenly observe their peers' strategies. On the other hand, financial constraints negatively influence local investment, but their spillover effect is negligible in neighbouring regions.
- Regional characteristics also shape climate investment and spill over to neighbouring regions. For instance, improved local conditions (measured by the Basic Sub-Index of the Regional Competitiveness Index, which aggregates information on macroeconomic status, institutions, infrastructure, health conditions and basic education) and a higher level of innovation (captured by R&D expenditures in the business sector) can create a conducive environment for regional climate investments, with positive effects for neighbouring regions.

- Deploying EU funds at the regional level for adaptation or mitigation encourages firms to adopt more climate measures. This trend also spreads beyond the immediate recipients, with firms in neighbouring regions prompted to keep pace and align themselves with emerging climate standards.
- Importantly, the results revealed an interesting interplay between adaptation and mitigation when promoting climate action among firms. Firms that have adaptation strategies in place are more likely to implement mitigation measures (although not vice versa). This synergy also extends to neighbouring regions, amplifying the collective response to climate change. These findings have important implications for public policies. The synergies and benefits that exist between adaptation and mitigation measures should be maximised, keeping in mind the trade-offs and conflicts that may arise between them.

Conclusion and policy implications

The global energy crisis was a wake-up call for Europe to rethink its energy system and accelerate the green transition. The crisis required urgent solutions to ensure security of supply and stability, but it also increased pressure on the European Union to achieve its climate goals and transition to a low-carbon economy. In addition, the crisis exposed the significant challenges and uncertainty plaguing EU firms, especially in energy-intensive industries, which had to cope with higher energy and borrowing costs and decreased competitiveness.

The energy crisis has increased the urgency and the opportunity for EU firms to invest in energy efficiency. However, energy efficiency alone is not enough to achieve the ambitious climate goals of the European Union and the world. Firms must adopt a holistic approach that integrates mitigation and adaptation measures, as well as innovation and the transformation of business models. There is a clear divergence among EU firms in their readiness and willingness to change, depending on their perception of the risks and opportunities associated with the green transition. Firms that see opportunities in the net-zero transition invest more to achieve it, while those concerned about the risk invest less. A large group of firms is still unaware of the consequences, and they are not investing for the transition.

Energy-intensive firms covered by the Emissions Trading System play a key role in the green transition. The analysis shows how the trading system influences businesses' efforts to decarbonise. It finds that stricter emissions requirements and a reduction in the number of free emission allowances is pushing firms to decarbonise faster. At the same time, energy-intensive firms seem to rely heavily on long-term finance to decarbonise. Funds for the green transition may become harder to find for energy intensive industries and more costly as financial markets progressively price in climate risks.

There is a wide variation in the performance of firms covered by the Emissions Trading System in reducing their carbon footprint, resulting in a clear distinction between leaders and laggards. Firms that see opportunity in the net-zero transition are more likely to invest and innovate, and they are transforming faster. This difference in perception might create a divide between decarbonisation leaders and the laggards – a divide that risks becoming entrenched. Overall, decarbonisation relies on clear market signals. Uncertainty over energy prices or regulation are a drag on the decarbonisation efforts of all firms. Interestingly, when looking at what motivates firms to transform, decarbonisation leaders are seizing market opportunities, while laggards are calling for more protection, subsidies or grants.

The European Union has a leading role in climate action, and it has set high standards and policies for firms to follow. However, there is still a gap between policy objectives and actions taken by firms, especially for adaptation. Therefore, EU firms continue to focus more on climate mitigation than on adaptation, implying that they are relying on government to ensure that infrastructure can resist the impact of climate change.

References

Benincasa, E., Betz, F., & Gattini, L. (2023). How do firms cope with losses from extreme weather events? (September 27, 2023). *Journal of Corporate Finance* (forthcoming). http://dx.doi.org/10.2139/ssrn.4171196

Bloomberg New Energy Finance (BNEF) (2023). *Skyrocketing European Heat Pump Market Attracts Carrier.*

Carradori, O., Giuzio, M., Kapadia, S., Salakhova, D., & Vozian, K. (2023). Financing the low-carbon transition in Europe. *Social Science Research Network*. https://doi.org/10.2139/ssrn.4510461

Casati, P., & Kalantzis, F. (2024). How regional spillovers shape firms' climate investment in Europe? Evidence from EIBIS. EIB Working Paper series (forthcoming).

Directorate-Generale for Energy (2023). Joint Statement by the Director-General of the International Renewable Energy Agency La Camera and EU Commissioner Simson: "The time for speeding up renewables is now", 30 March 2023, European Commission, Brussels.

European Automobile Manufacturers' Association (ACEA) 2023, Electric cars, Tax benefits, Purchase incentives 2023.

European Commission (2022). Commission Staff Working Document, SWD (2022) 230 final and Annexes, Implementing the REPowerEU, Action Plan: Investment needs, hydrogen accelerator, and achieving the bio-methane targets, European Commission, Brussels.

European Commission (2023). Strategic Foresight Report 2023, European Commission, Brussels.

European Investment Bank (2021). The EIB Climate Adaptation Plan. European Investment Bank.

European Investment Bank (2022). What drives firms' investment in climate change? – Evidence from the 2021-2022 EIB Investment Survey, European Investment Bank, 2022. https://data.europa.eu/doi/10.2867/321629

Hattemer, B., & Kalantzis, F. (2024). The Manufacturing Sector in the New Era of the EU ETS. EIB Working Paper series (forthcoming).

International Energy Agency (2023a). *Electricity Market Report* - Update 2023 - Outlook for 2023 and 2024, International Energy Agency, Paris.

International Energy Agency (2023b). *Global EV Outlook 2023: Trends in light duty vehicles*, International Energy Agency, Paris.

International Energy Agency (2023c). *World Energy Investment 2023*, International Energy Agency, Paris.

IRENA (2023). *Renewable Energy Statistics 2023*, International Renewable Energy Agency, Abu Dhabi.

Kalantzis, F., Revoltella, D., & Gatti, M. (2024). How do EU firms cope with the energy transition in times of uncertainty and high energy prices? Evidence from EIBIS. EIB Working Paper series (forthcoming).

Li, X. (2022). How do companies adapt to climate change exposure? Principle for Responsible Investment, 28 September 2022. https://www.unpri.org/pri-blog/how-do-companies-adapt-to-climate-change-exposure/10576.article

New York State Energy Research and Development Authority (NYSERDA) (2023). *U.S. Heat Pump Sales Surpass Gas Furnaces*. https://www.nyserda.ny.gov/Featured-Stories/US-Heat-Pump-Sales

Wolski, M. (2024). External finance and corporate emissions: Distributional perspective. EIB Working Paper (forthcoming).