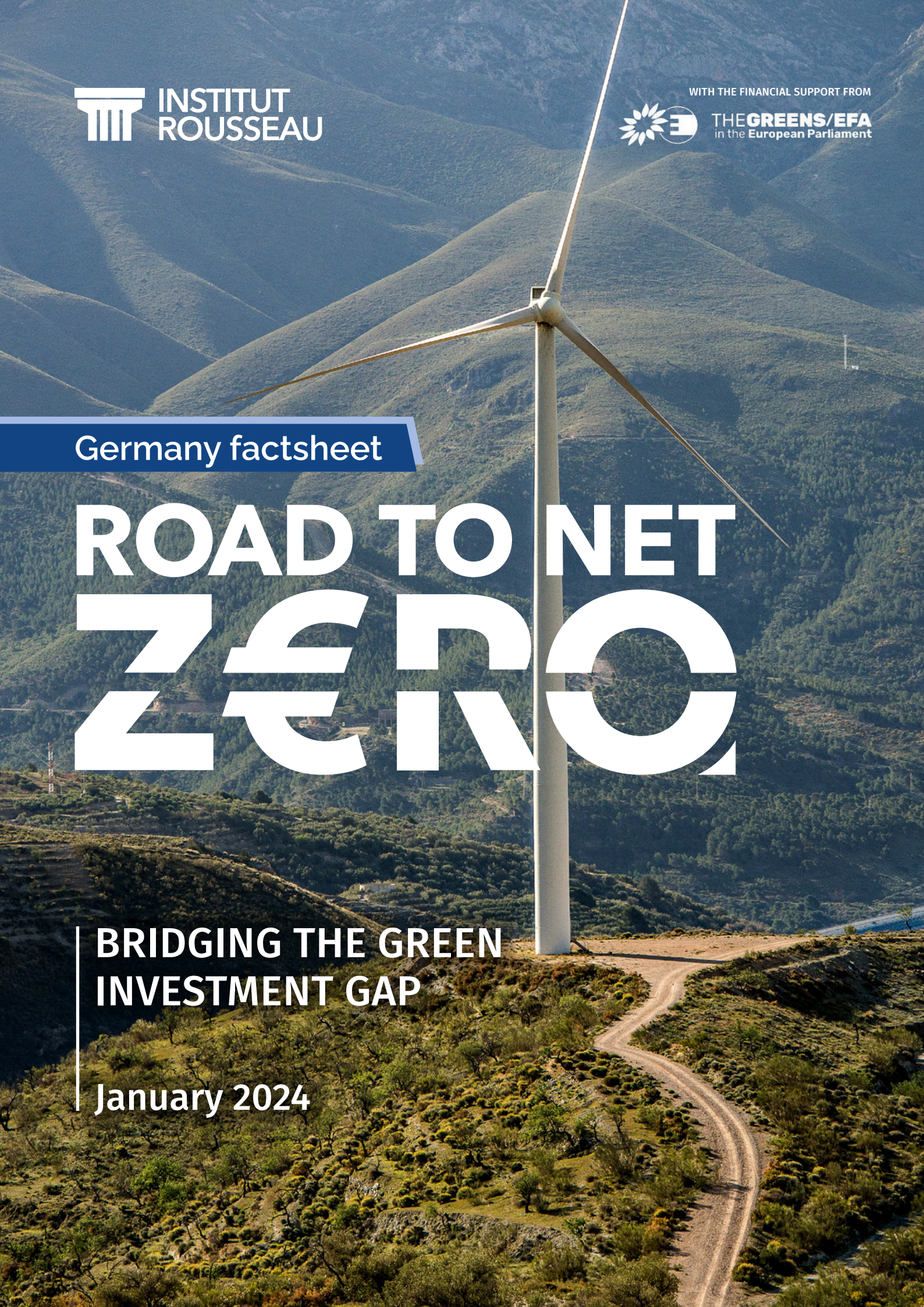
INSTITUT ROUSSEAU

WITH THE FINANCIAL SUPPORT FROM
THE GREENS/EFA in the European Parliament



Germany factsheet

ROAD TO NET ZERO

BRIDGING THE GREEN INVESTMENT GAP

January 2024

This document is an appendix of the Road to Net Zero report. For more details and EU-scale results, please refer to the full report. For more information about the methodology used, please refer to the Methodological Appendix.

Key takeaways

- **An additional €55 billion investment is needed by 2050 to decarbonise the German economy, averaging around 1.4% of current GDP** yearly. This is **one of the lowest among studied countries, mainly due to greater savings opportunities in the transport** sector.
- This extra-investment plan can be **partially financed by redirecting fossil fuel subsidies**, will be **offset by a sharp decrease in energy costs**, is **~50% less expensive than the EU Com plan** (thanks to more efficiency & sufficiency) and **~6 times less than the cost of inaction**.
- **Germany's public expenditure should double** from €48 to €93 billion per year. **This additional public investment of €45 billion per year amounts to around 1.2% of the current GDP**. Biggest needs for additional public support are in the **buildings sector**.

TRANSPORT

Significant investments required, yet unmatched savings potential in Europe. Germany stands to realise substantial savings in its automotive sector through the transition, more than offsetting investments in alternative modes of transportation.

BUILDINGS

German buildings renovation require a substantial increase in public support, and a shift from simple heating replacement to efficient renovation. Despite a relatively low share of the housing stock to be renovated efficiently (57%) and an already high level of public support for residential renovation, the prevalence of individual houses in the targeted stocks and relatively high costs of energy works per m².

AGRICULTURE

Despite Germany's relatively smaller agricultural surface and current substantial public support for agroecological practices, **there's a pressing need to bolster long-term public backing for agroecology, given the continued prevalence of intensive farming methods.**

ENERGY PRODUCTION AND INFRASTRUCTURE

Germany benefits from a relatively lower investment cost of decarbonising its energy sector compared to other EU Member States, mainly due to a transition strategy that highly relies on alternative fuel imports (i.e. operational expenditures not included here).

CARBON SINKS (LULUCF)

In addition to addressing ecosystem regeneration expenses, investments in adapting tree species are paramount in every country, including Germany. By 2050, and across all climate change scenarios, habitats for numerous species will become unsuitable. Proactive human intervention is thus indispensable to anticipate appropriate species distributions and enhance ecosystem resilience.

CROSS-SECTOR/R&D

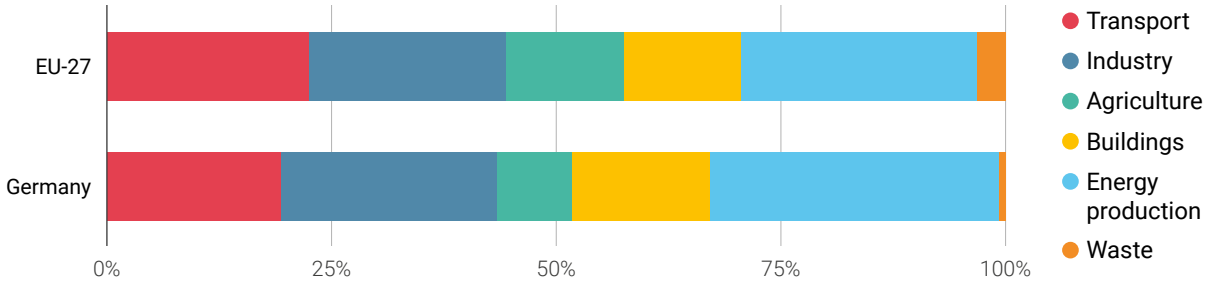
Germany's investment in energy and agriculture Research and Development (R&D) aligns closely with the EU average. **However, there's a critical need for a substantial realignment of public agricultural R&D towards supporting agroecological systems.**

1 Current GHG emissions, decarbonisation potential and action levers available

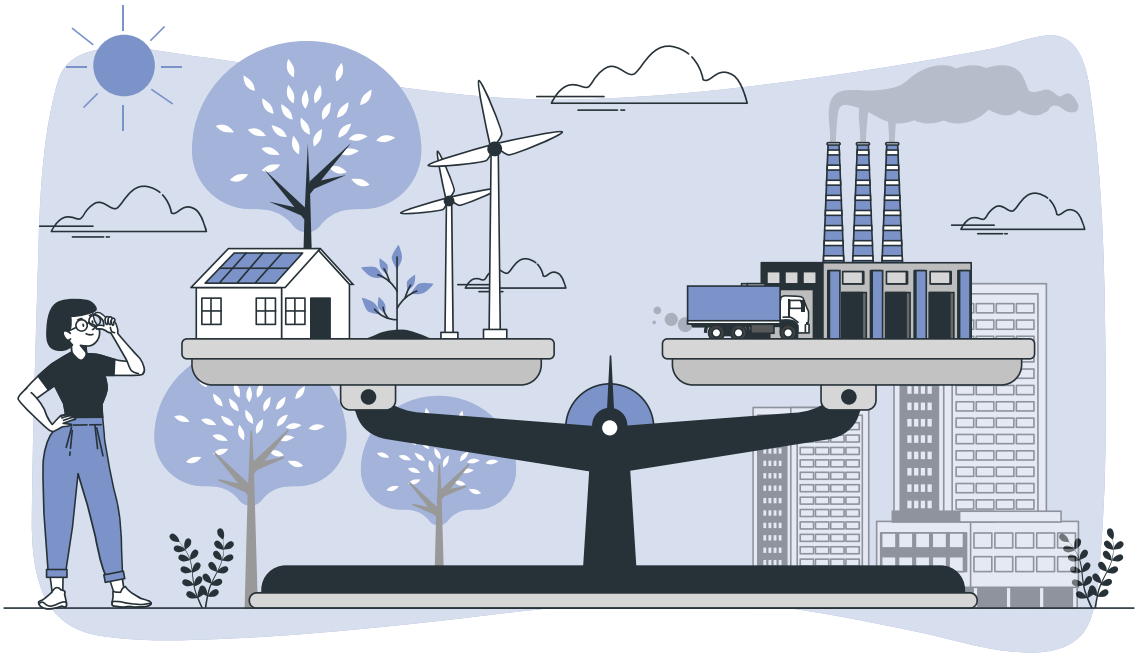
1.1 Current GHG emissions profile

Germany's territorial emissions are primarily due to energy production (32%) and industry (24%). The transport of goods and people and buildings (which consume energy for heating, lighting, cooking, ventilation, etc.) follow with 19% and 15% respectively, before agriculture (8%). Waste management constitutes the remaining <1%, primarily attributed to methane emissions resulting from the natural decomposition of organic waste in landfills.

Fig. 1 **Sectoral breakdown of Germany and EU-27 current domestic emissions (2021), in %**



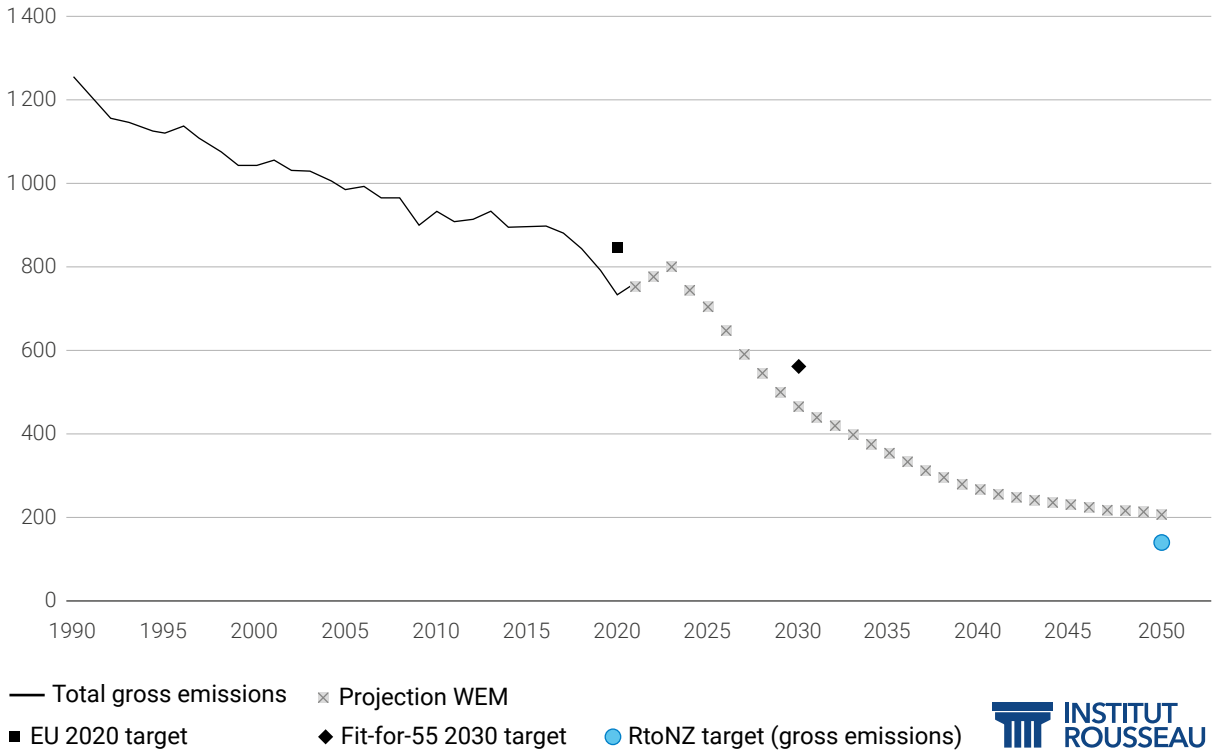
Compared to the rest of the EU, Germany stands out with a more carbon-intensive energy mix, a more developed industry, and a proportionally smaller agriculture sector.



1.2 GHG emissions trend

Germany is the main greenhouse gas emitter in Europe. It contributed 760 million tons of CO_2-eq in 2021, nearly a quarter of the European Union's emissions. Since 1990, the country's emissions have decreased by 39% or 16 million tons per year on average (compared to -29% for EU-27), as shown on Figure 2.

Fig. 2 **Germany's past domestic emissions and progress towards achieving 2030 and 2050 targets, in million tons of CO_2 equivalent ($MtCO_2e$).**



WEM: With Existing Measures. European Environment Agency, 'Total net greenhouse gas emission trends and projections in Europe', 2023.

1.3 Decarbonisation levers

To meet these targets, it is necessary to activate multiple levers. There are 37 decarbonisation levers in total, outlined in Figure 3. Key decarbonisation levers with significant emission reduction potential involve energy (power production), transport (cars, trucks) and building renovations. But there is no single solution for instantly decarbonising the German economy. All listed levers, regardless of their scale or economical efficiency, must be engaged to reach the goal of carbon neutrality.

Fig. 3 **Decarbonisation levers proposed and modelled in this study, by sector**

TRANSPORT

1. Reduce the number of vehicles and convert them to low-carbon technologies
2. Develop public transportation
3. Develop soft mobility
4. Reduce air traffic and switch to Sustainable Aviation Fuels
5. Transition to zero carbon navigation

INDUSTRY

1. Reduce industrial production through end-use sufficiency
2. Increase material efficiency
3. Increase energy efficiency
4. Decarbonize industrial energy mix
5. Develop low-carbon innovative processes
6. On-site Carbon Capture, Utilisation and Storage
7. Develop EU strategic industrial sectors for the transition

AGRICULTURE

1. Reduce herd size and adapt breeding practices
2. Convert crop systems to agroecology
3. Convert tractors to low-carbon technologies

BUILDINGS

1. Efficient renovation of housing
2. Efficient renovation of public tertiary buildings
3. Efficient renovation of private tertiary buildings

INSTITUT ROUSSEAU

ENERGY PRODUCTION AND INFRASTRUCTURE

1. Decarbonize and adapt the power system
2. Switch from fossil gas to biogas and other 'green' gases
3. Phase coal and oil out, end conventional refining activities
4. Decarbonize heat production for district heating

WASTE MANAGEMENT

1. Separately collect and recover biowaste
2. Reduce plastic use, increase plastic recycling and substitution with other materials
3. Reduce wastewater treatment emissions through process adaptation
4. Produce biogas from waste and sludge

CARBON SINKS (LULUCF)

1. Improve forest management
2. Revitalise degraded ecosystems
3. Support wood industry adaptation
4. Increase forest area
5. Turn grasslands back to net sinks
6. Plant hedgerows and field trees
7. Protect wetlands and peatlands
8. Reach net zero artificialisation

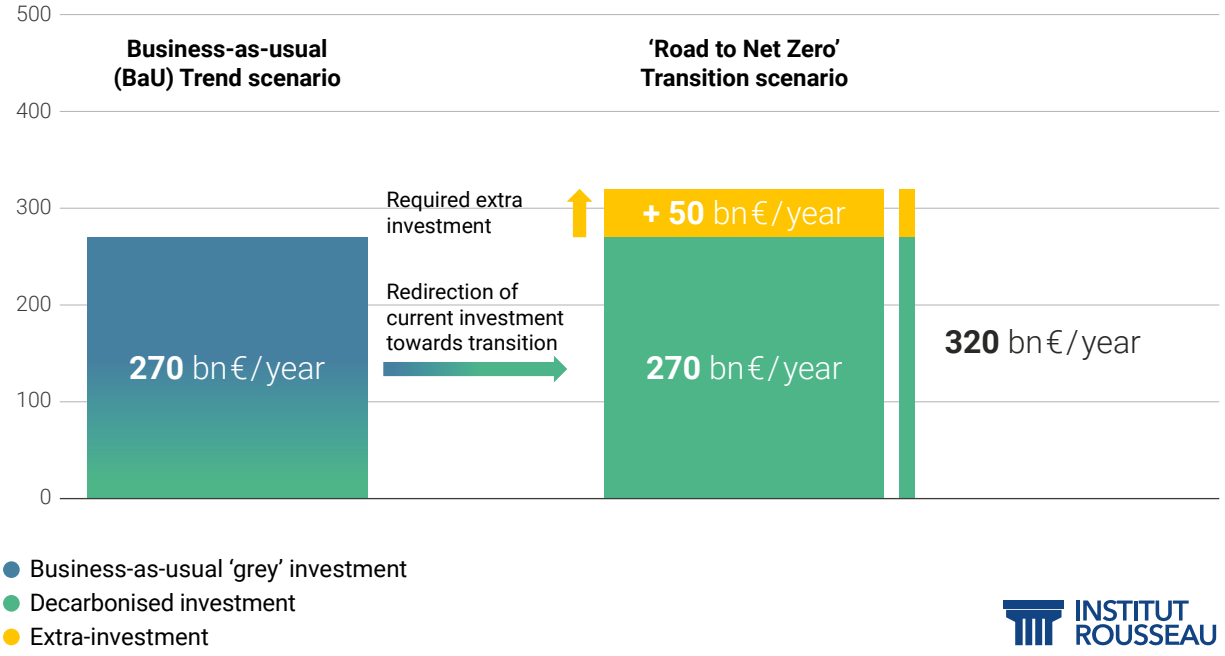
CROSS-SECTOR LEVERS

1. Enhance Research & Development in transition solutions
2. Foster public awareness of environmental issues
3. Boost the Fair Transition Fund to support professional transitions

2 Global investment required

The collective investment required to activate all decarbonisation measures is estimated at €8.7 trillion by 2050, averaging €320 billion yearly (Figure 4). This equals almost 8.3% of current GDP. This contrasts with the ongoing business-as-usual (BaU) scenario, estimated at around €7.2 trillion between now and 2050, averaging €270 billion per year (6.9% of current GDP). **The difference, about €1.5 trillion or an average of €50 billion per year, represents the 'extra investment' needed for carbon neutrality. This extra investment represents a 20% increase compared to the baseline scenario and around 1,4% of current GDP.**

Fig. 4 **Concepts and amounts of total EU-27 investment required for the transition and extra investment compared with a business-as-usual scenario (in billions of euros per year)**



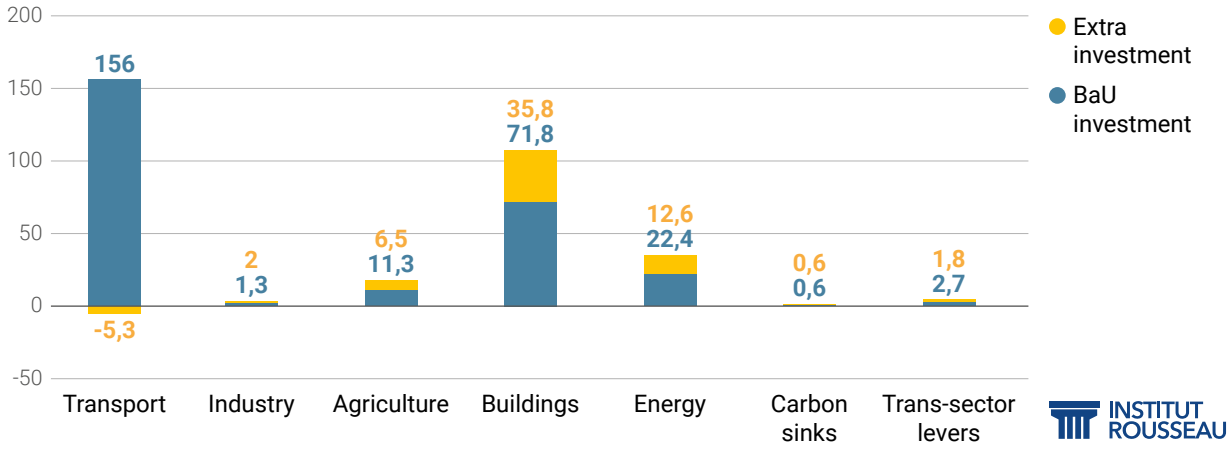
These estimates are correct only under the express condition that all BaU investments are actively redirected towards the transition by 2050. This implies a massive divestment from sectors that have become partially to completely obsolete. Without this active shift, not only will carbon neutrality not be achieved, the above-mentioned extra cost will also be higher.

In terms of total investment (Figure 5), approximately 81% is focused on two sectors: transport (**47%** of overall investment, €151 billion annually) **and buildings** (**34%**, €108 billion annually). This is due to the large-scale nature of these sectors, which invest in tens of millions of vehicles and buildings. These sectors are followed by energy production and infrastructure (11%, €35 billion annually) and agriculture (6%, €18 billion annually). Industry (€3.3 billion annually), cross-sector measures (€4.6 billion annually), carbon sinks (€1.2 billion annually) and waste management require only 3% of total investment.

When considering extra investment compared to the business-as-usual trend, the buildings sector requires by far the most substantial extra effort, with two thirds (66% or €142 billion per year) of the

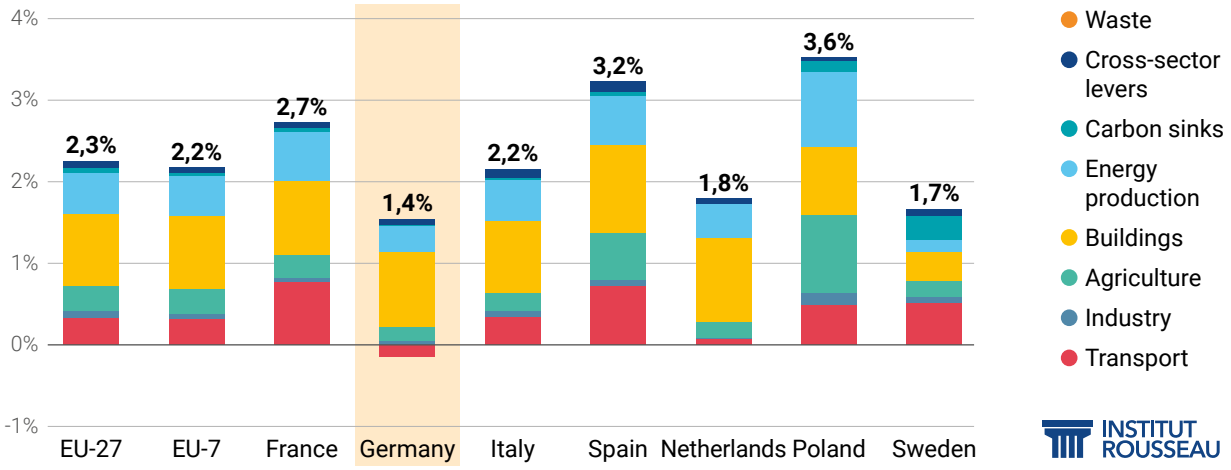
total extra investment required. Energy production and infrastructures follows with 22% (€79 billion per year). In the building sector, this is attributed to the need for an accelerated renovation pace and a shift towards comprehensive renovations, which are individually more expensive. On the energy side, the assumption of strong electrification in the transition scenario leads to a doubling in electricity consumption compared to the trend scenario. The transport sector's decrease in extra investment ranking is mainly due to reducing the private car fleet. In Germany, there is a greater potential for reducing both the size of individual cars and the overall size of vehicle fleets compared to other countries. This results in a significant reduction in investment needed for transitioning to a decarbonised transportation system, in contrast to the business-as-usual scenario. The savings generated by downsizing fleets outweigh the investments required for other transport modes like trains and bikes. Essentially, transitioning to a decarbonised transportation system in Germany requires less investment than maintaining the status quo, and when considering operational costs, the overall savings would be even greater.

Fig. 5 **German trend investment, extra-investment and total investment per sector, in billion euros per year, on average, by 2050.**



All sectors considered, **Germany requires one of the lowest additional investments among the studied countries**, as depicted in Figure 6.

Fig. 6 **Yearly extra investment needed by sector per country (in % of GDP 2022)**



This is primarily due to:

- **Significant transition savings in the transportation sector**. The country stands to make substantial savings in its automotive industry through fleet reduction and downsizing, surpassing investments in alternative transportation modes. Nevertheless, considerable investment is still necessary for new tracks and lines, especially to bolster the modest passenger modal share.

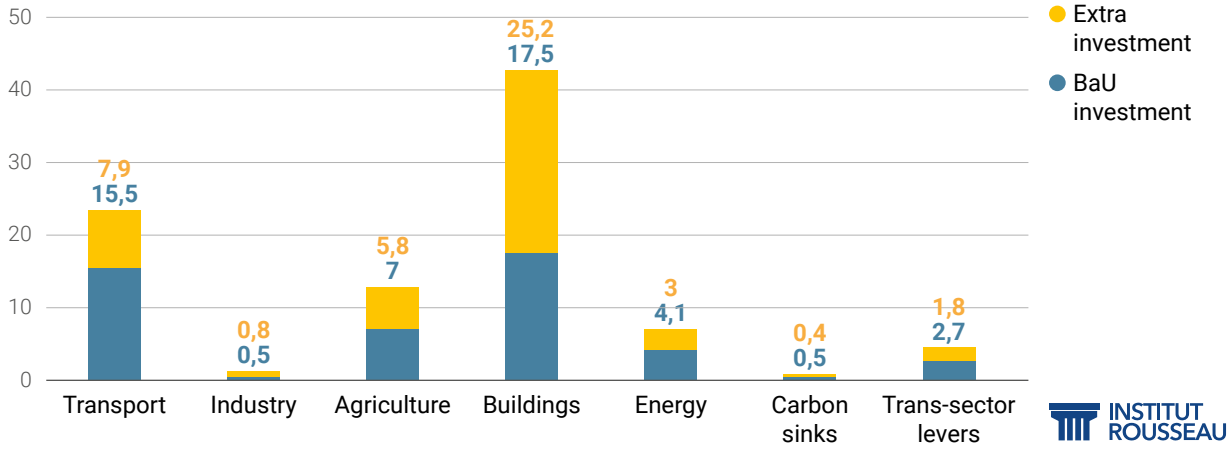
- **Proportionally lower investments needed to decarbonize Germany's power system**, mainly due to a strong reliance on energy imports in the scenarios used (i.e. operational expenditures not included here), assuming that e-fuels will be available on the international markets at a low cost. Extra-investment is also low due to an already high level of investment in the business-as-usual average scenario.

- **Lower investments in agriculture attributed to a smaller agricultural surface area per unit of GDP**, in comparison to other countries.

3 Public investment required

This study also outlines 73 public policy proposals to catalyse these investments, categorised for each of the 37 decarbonisation levers. The total public cost of these measures for Germany is estimated at €93 billion annually, with €45 billion exceeding the trend scenario. This is equivalent to doubling average annual public investment.

Fig. 7 **German public trend investment, extra-investment and total investment per sector, in billion euros per year, on average, by 2050.**

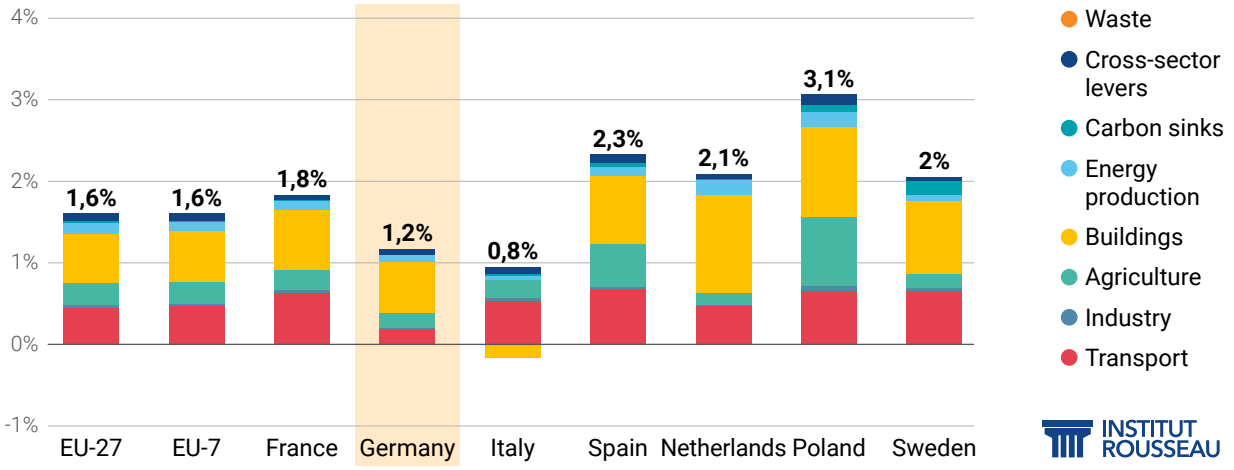


The sectoral breakdown of the €93 billion investments shows that the buildings sector (46%) and the transport sector (25%), together account for 71% of the required public investment. Agriculture stands for 14%, which brings these three sectors to a total of 85% of the essential public investments.

When considering extra public investments, the same two sectors alone account for almost three-quarters (73%) of the extra public investment needs: construction (56%) and transport (18%). Agriculture (13%), energy production and infrastructure (7%) and cross-sector measures (4%) come next. The ranking remains consistent with total public investment needs, since public support allocations are generally calculated within the same scope between the transition and reference scenarios.

These €45 billion per year of extra public investment equal approximately 1,2% of current German GDP. This is less than most of the other countries studied and the EU average, as shown on Figure 8. This is notably driven by its already substantial current public expenditures on public transport infrastructure and a relatively low ratio of agricultural area to GDP.

Fig. 8 **Yearly public extra investment needed by sector per country (in % of GDP 2022)**



Despite this moderate additional public investment requirement, the absolute public expenditure remains considerable, necessitating a reorientation of most public support:

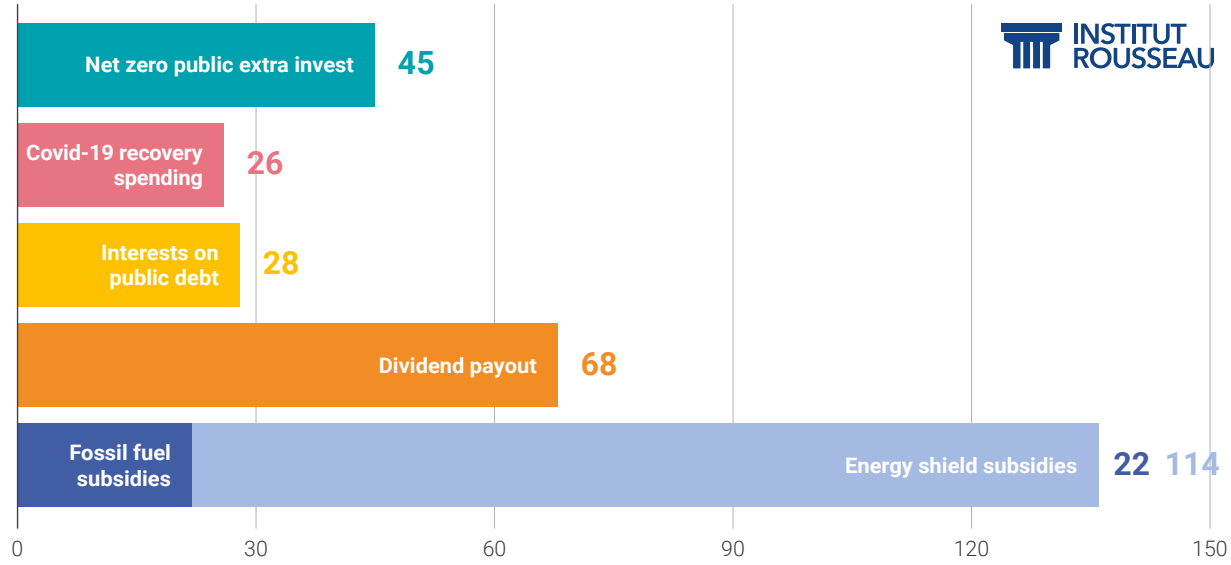
- **Germany's building renovation sector requires a significant boost in public support and a transition from simple heating replacements to comprehensive and efficient renovations**. Despite only 57% of the housing stock requiring efficient renovation and existing high levels of public support, the predominance of individual houses in the targeted stocks and the high costs of energy-related works per square metre imply substantial investment needs.

- **Although Germany possesses smaller agricultural areas and currently benefits from significant public support for agroecological systems, long-term public backing for such systems must be bolstered**, given the persistent prevalence of intensive practices.

- **Additionally, Germany requires a substantial reorientation of its public agricultural research and development (R&D) toward agroecological systems**.

Contextualising the proposed €45 billion per year is crucial. This amount, allocated to empower public authorities in stimulating, encouraging, and overseeing all stakeholders while setting the necessary pace to meet the European Union's climate objectives, must be viewed in perspective (cf. Figure 9). **€45 billion per year is three times less that what Germany spent in 2022 on fossil fuel subsidies, including price caps. It is also 50% less than dividend payout.**

Fig. 9 **Contrasting extra public investment with known yearly budget (2022 values)**



This additional investment plan :

- Can be partially financed by redirecting existing fossil fuel subsidies.
- Will be offset in the short term by a significant decrease in energy costs for households, businesses, and public authorities.
- Is approximately six times less expensive than the potential cost of inaction[1][2].
- Will generate numerous local jobs, amounting to several million net positions at the European scale. All conventional sectors affected by the transition to net zero will require social support through a dedicated Just Transition Fund, included in the investment plan.
- Will yield returns by reducing the need for future public expenditure, such as unemployment insurance, energy bills, and costs related to climate change adaptation.
- Is nearly 50% less expensive than the investment plan proposed by the European Commission[3] (on a similar scope of sectors), thanks to a reduction in final energy consumption achieved through both efficiency and sufficiency measures.

If sufficiency and local production options are prioritized, it will also enhance the EU's energy security, economic sovereignty, competitiveness, and trade balance.

Images: Storyset.com/Freepik.com, Unsplash.com

Notes

1. Kotz & al., The economic commitment of climate change, published in the journal Nature in April 2024.
2. Additionally, ADEME estimates adaptation costs for France alone at €260 billion per year; 'Climate risks and their costs for France: to preserve the economy, the urgency to act now', December 2023. To be compared to a + €70 billion per year of global (public + private) net zero extra investment in our scenario, i.e. a × 4 ratio.
3. European Commission 2040 climate target, feb 2024.