# OECD Environmental Performance Reviews: Sweden 2025

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# Foreword

The principal aim of the OECD Environmental Performance Review (EPR) programme is to help member and selected partner countries improve their individual and collective performance in environmental management by:

- helping countries assess progress in achieving their environmental goals
- promoting continuous policy dialogue and peer learning
- stimulating greater accountability from governments towards each other and public opinion.

This is the fourth EPR of Sweden. It examines the country's environmental performance since the previous review in 2014. Progress in achieving domestic objectives and international commitments provides the basis for assessing Sweden's environmental performance. Such objectives and commitments may be broad aims, qualitative goals or quantitative targets. A distinction is made between intentions, actions and results. Assessment of environmental performance is also placed within the context of Sweden's historical environmental record, present state of the environment, physical endowment in natural resources, economic conditions and demographic trends.

The OECD is grateful to the Ministry of Climate and Enterprise for providing information and comments, organising the review mission (13-17 May 2024) and virtual policy mission (18 October 2024), as well as for facilitating contacts inside and outside government institutions.

Thanks are also due to the representative of the examining country, Thomas Pedersen (Denmark), for participating in the review.

The authors of this report are Nicolina Lamhauge, Frédérique Zegel, Kathleen Dominique and Maria Adelaida Rojas Lleras of the OECD Environment Directorate, under the co-ordination of Frédérique Zegel. Nathalie Girouard and Frédérique Zegel provided oversight and guidance. Maria Adelaida Rojas Lleras provided statistical support, while Lydia Servant provided administrative support. Fiorella Cianchi provided communications support. Mark Foss copy-edited the report. Preparation of this report also benefited from inputs and comments from Olof Bystrom, Katherine Hassett, Hyunjeong Hwang, Katia Karousakis, Anita King, Frithjof Laubinger, Jon Pareliussen, Mikaela Rambali, Katarina Svatikova, Tuva Werner Torgersen and Klas Wetterberg of the OECD Secretariat as well as Mathilde Fajardy, Carl Greenfield, Oskar Kvarnstrom and Divya Reddy of the International Energy Agency.

The OECD Working Party on Environmental Performance discussed the Environmental Performance Review of Sweden at its meeting on 11 December 2024 and reviewed and expressed support for the Assessment and Recommendations.

# Table of contents



## Tables

## Figures



## Boxes

# Reader's guide

### Signs

The following signs are used in figures and tables:

.. : not available

– : nil or negligible

. : decimal point

### Country aggregates

OECD Europe: This zone includes all European member countries of the OECD, i.e. Austria, Belgium, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

OECD: This zone includes all member countries of the OECD, i.e. the countries of OECD Europe plus Australia, Canada, Chile, Colombia, Costa Rica, Israel*, Japan, Korea, Mexico, New Zealand and the United States.

Country aggregates may include Secretariat estimates.

### Currency

Monetary unit: Swedish Krona (SEK) equals 100 öre.

In 2024, USD 1 = SEK 10.58; EUR 1 = SEK 11.41
In 2023, USD 1 = SEK 10.60; EUR 1 = SEK 11.48
In 2022, USD 1 = SEK 10.11; EUR 1 = SEK 10.63

### Cut-off date

This report is based on information and data available up to November 2024.

### Indicators

Internationally-comparable indicators presented in the OECD Environment at a Glance online platform support the analysis. They should be read in conjunction with this report.

### Disclaimer

* The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

# Basic statistics of Sweden

## 2023 or latest available year (OECD values in parentheses)[a]

| | | | | | |
|---|---|---|---|---|---|
| **PEOPLE AND SOCIETY** | | | | | |
| Population (million) | 10.5 | | Population density per km$^2$ | 20 | (37) |
| Share of population by type of region: | | | Population compound annual growth rate, latest 5 years | 0.7 | (0.6) |
| Predominantly urban (%) | 40 | (49) | Income inequality (Gini coefficient) | 0.29 | (0.32) |
| Intermediate (%) | 51 | (28) | Poverty rate (% of pop. with less than 50% median income) | 8 | (12) |
| Rural (%) | 9 | (23) | Life expectancy | 83 | (81) |
| **ECONOMY AND EXTERNAL ACCOUNTS** | | | | | |
| Total GDP (National currency, billion) | 6 208 | | Imports of goods and services (% of GDP) | 51 | (31) |
| Total GDP (USD, billion, current prices and PPPs) | 729 | | Main exports (% of total merchandise exports) | | |
| GDP compound annual real growth rate, latest 5 years | 1.5 | (1.6) | Nuclear reactors, boilers, machinery and mechanical appliances | 15 | |
| GDP per capita (1 000 USD current PPPs) | 69 | (59) | Vehicles other than railway or tramway rolling stock, and parts and accessories | 14 | |
| Value added shares (%) | | | Electrical machinery and equipment | 9 | |
| Agriculture | 1 | (3) | Main imports (% of total merchandise imports) | | |
| Industry including construction | 26 | (27) | Electrical machinery and equipment | 13 | |
| Services | 73 | (70) | Nuclear reactors, boilers, machinery and mechanical appliances | 12 | |
| Exports of goods and services (% of GDP) | 55 | (31) | Vehicles other than railway or tramway rolling stock, and parts and accessories | 11 | |
| **GENERAL GOVERNMENT** Percentage of GDP | | | | | |
| Expenditure | 48 | (43) | Education expenditure | 7 | (5) |
| Revenue | 47 | (34) | Health expenditure | 7 | (7) |
| Gross financial debt | 41 | (109) | Environment protection expenditure | 0.6 | (0.7) |
| Fiscal balance | -0.6 | (-3.4) | Environmental taxes: (% of GDP) | 1.6 | (1.3) |
| | | | (% of total tax revenue) | 3.8 | (3.9) |
| **LABOUR MARKET, SKILLS AND INNOVATION** | | | | | |
| Unemployment rate (% of civilian labour force) | 7.6 | (4.8) | Patent applications in environment-related technologies (% of all technologies, average of latest 3 years [b] | 14 | (11) |
| Tertiary educational attainment of 25-64 year-olds (%) | 49 | (40) | Environmental management | 4 | (3) |
| Gross expenditure on R&D, % of GDP | 3.4 | (2.7) | Climate change mitigation technologies | 13 | (11) |
| | | | Climate change adaptation technologies | 2 | (1) |
| **ENVIRONMENT** | | | | | |
| Energy intensity: TES per capita (toe/cap.) | 4.3 | (3.7) | Passenger cars stock (vehicles/100 inhabitants) | 48 | (49) |
| TES per GDP (toe/1 000 USD, 2015 PPPs) | 0.08 | (0.08) | Water stress (abstraction as % of available sources) | 1 | (9) |
| Renewables (% of TES) | 49 | (13) | Water abstraction per capita (m3/cap./year) | 240 | (690) |
| Carbon intensity (energy-related $CO_2$): | | | Municipal waste per capita, (kg/capita) | 395 | (531) |
| Emissions per capita (t/cap.) | 3.1 | (7.5) | Material productivity (USD, 2015 PPPs/DMC, kg) | 2.2 | 2.5 |
| Emissions per GDP (t/1 000 USD, 2015 PPP) | 0.06 | (0.17) | Land area (1 000 km$^2$) | 407 | |
| GHG intensity: [c] | | | % of arable land and permanent crops | 6 | (11) |
| Emissions per capita (t/cap.) | 4.3 | (10.7) | % of permanent meadows and pastures | 1 | (23) |
| Emissions per GDP (t/1 000 USD, 2015 PPP) | 0.08 | (0.24) | % of forest area | 69 | (33) |
| Mean population exposure to air pollution ($PM_{2.5}$), µg/m$^3$ | 6 | (12) | % of other land (built-up and other land) | 24 | (33) |

a) Values earlier than 2018 are not taken into consideration. OECD value: where the OECD aggregate is not provided in the source database, a simple OECD average of the latest available data is calculated where data exist for a significant number of countries.

b) Higher-value inventions that have sought protection in at least two jurisdictions.

c) Excluding emissions/removals from land use, land-use change and forestry.

*Source*: Calculations based on data extracted from databases of the OECD, IEA/OECD, Eurostat and the World Bank.

# Executive summary

## Sweden has made progress on decoupling but has some way to go to achieve its environmental quality objectives

Sweden has an open, knowledge-based economy that grew faster than the OECD average between 2010 and 2022. Following a relatively strong performance during and after the COVID-19 pandemic, gross domestic product (GDP) shrank marginally in 2023 but signs of recovery are emerging. Sweden has successfully decoupled major environmental pressures from economic growth. However, 12 national environmental quality objectives out of 16 and the generational goal – to pass on to the next generation a society in which major environmental problems have been solved – are not expected to be met by 2030.

## The country needs an action plan to halt and reverse biodiversity loss by 2030…

The National Biodiversity Strategy and Action Plan should be updated, with a long-term vision and measurable milestone targets aligned with the Kunming-Montreal Global Biodiversity Framework, the EU Biodiversity Strategy for 2030 and the EU Nature Restoration Law. More than three-quarters of habitats and half of species of conservation importance are in poor or bad states. With 15% of land and marine areas protected, Sweden is not on track to meet the 2030 target of 30%. New protected areas should be designated to create an ecologically representative, coherent and functional network. The 2024 law on marine environment aims to strengthen the protection of marine areas.

## …and to better mainstream biodiversity in forestry and agriculture

Agriculture and forestry are the main pressures on terrestrial habitats. Nearly 70% of the land area is covered by forests and 7% by agricultural area. Longstanding intensive forestry and standard clear-cutting practices have adversely affected forest habitats. Sweden is not on track to meet its objective on sustainable forest for 2030. It should encourage forestry practices that better support biodiversity, particularly in areas of high conservation values. The Common Agricultural Policy (CAP) 2014-22 has helped prevent land abandonment – a key threat to biodiversity – but has also contributed to further intensification in areas already subject to intensive agriculture. Sweden should ensure the CAP 2023-27 encourages biodiversity-friendly farming practices, particularly in semi-natural grasslands, including in the Natura 2000 network, and adapt support to the geographical context.

## Reaching ambitious water quality objectives requires more cost-effective policies and faster progress

Only 40% of surface water bodies have good ecological status and none have good chemical status, when considering mercury and other widespread persistent toxic substances. Eutrophication, caused by excess nutrients from agriculture, wastewater and atmospheric deposition, remains a major challenge. Sweden should consider implementing an emissions trading system for diffuse pollution and continue efforts to co-ordinate measures at catchment level to address water quality. Hydropower exerts extensive pressure on lakes and rivers. Most hydropower concessions were granted decades before adoption of modern environmental legislation. Sweden should speed up consideration of environmental provisions in hydropower permits, balancing the benefits of improved freshwater ecosystems with hydropower

production. Reviewing the system of water abstraction permits would also be timely. Despite abundant water resources and low water stress at national level, water scarcity is a recurring issue in southeastern Sweden and emerging in other regions.

## The green tax shift has reversed

The green tax shift – reallocating the tax burden from labour to environmentally harmful activities –was implemented in the first half of the 2000s but has reversed in recent years. Revenue from environmentally related taxes decreased from 2.5% of GDP in 2010 to 1.6% in 2023. This is partly explained by lower fuel consumption and increased electrification of vehicles but also by the drastic cut in fuel tax rates. Sweden continues to have one of the highest effective carbon rates in the world. However, this rate has dropped significantly over 2021-23, weakening incentives to reduce emissions. The country should revert to a green tax shift with a view to applying the polluter pays principle more consistently. This also involves screening support measures, including tax provisions to identify those that are potentially harmful to the environment, and developing a plan to phase them out.

## Road pricing would help address transport externalities

Increased congestion charges in Gothenburg and Stockholm have yielded positive environmental and mobility outcomes. There is potential for other cities such as in Malmö and Uppsala to implement congestion charges or parking charges to internalise externalities and shift to other transport modes. Sweden should also modify road tolls for heavy goods vehicles to consider the distance travelled and better reflect the climate and air pollution costs of their use. The coherence of economic instruments that apply to transport needs to be improved. Over 2010-22, investment in roads increased much faster than investment in rail infrastructure. New applications for urban environment agreements for the development of cycling and public transport are no longer being signed.

## Sweden is a leader on many climate-related indicators

In 2022, Sweden's greenhouse gas (GHG) emission intensities per capita and per unit of GDP were the lowest in the European Union. Over 2010-22, GHG emissions, excluding land use, land-use change and forestry, fell by 29%, faster than the EU average of 19%. A large share of Sweden's emission reductions can be attributed to a practical phase-out of fossil fuels to produce electricity and heating. A shift to renewable energy and large-scale nuclear power development have played a prominent role in reducing dependence on fossil fuels. In 2022, renewable energy accounted for over two-thirds of electricity generation.

## Sweden should maintain its climate ambition as recent policy shifts have created uncertainty

Sweden's 2017 Climate Act and the associated governance system guide action on climate. Sweden aims to reach net-zero emissions by 2045, followed by negative emissions thereafter. At least 85% of emissions must be reduced within Sweden's borders. Supplementary measures can compensate for the remaining 15%. Sweden's climate policy is also shaped by EU obligations. The country fulfilled its commitments under the Kyoto Protocol (2008-12 and 2013-20) and met its 2020 target for sectors outside the EU Emissions Trading System. However, recent policy shifts, particularly in the transport sector, have put into question Sweden's ability to meet EU and domestic climate targets, with emissions projected to increase in 2024. Further, they have contributed to a less predictable framework for action. The budget bill for 2025 aims to

reverse the increase in emissions. If adopted, it would improve the conditions for achieving the 2030 target and narrow the gap to the 2045 target.

## Creating an enabling environment will be key for achieving the transition to net zero

As Sweden enters the next phase of the climate transition, the role of government in defining priorities, establishing the enabling environment and managing inevitable trade-offs becomes increasingly important. Transformations of the scale foreseen entail both economic benefits (e.g. new industries) and costs (e.g. loss of employment). The government also plays an important role in supporting regions in meeting the changing demand for social infrastructure and services. It has only recently focused on the labour market needs of the transition. The central government is also well placed to co-ordinate the numerous actors in assessing skill needs and developing training for the climate transition. Further, the strong reliance of Sweden's climate strategy on the electrification of sectors hinges on a potential doubling of fossil-free electricity use by 2045, as well as access to the electricity grid.

## The potential contribution of supplementary measures in meeting climate targets remains uncertain

Sweden's Climate Act specifies the role supplementary measures (increased carbon sinks in forests and land, carbon capture and storage from biogenic emissions [BECCS], verified emission reductions abroad) can play to offset emissions that are difficult or costly to mitigate. Sweden is pioneering technology developments for carbon capture use and storage, especially BECCS, and has played an active role in the climate negotiations on Article 6 of the Paris Agreement. However, all three groups of supplementary measures are complex and characterised by long lead times, highlighting the importance of demonstrating their potential contributions towards climate targets in the near term. For example, the sequestration of carbon by forests in a changing climate is uncertain, as is the scale of mitigation outcomes that can be sourced from abroad due to stringent EU targets and the relatively immature Article 6 market.

# Assessment and recommendations

The Assessment and Recommendations present the main findings of the OECD Environmental Performance Review of Sweden. They identify 28 recommendations to help the country make further progress towards its environmental objectives and international commitments.

# 1. Towards green growth

## *Addressing key environmental challenges*

*Sweden has made progress on decoupling but has some way to go to achieve its environmental quality objectives*

Sweden has an open, knowledge-based economy with high living standards, low inequality and good environmental quality. Over 2010-22, gross domestic product (GDP) grew faster in Sweden than in many other OECD countries. Following a relatively strong performance during and after the COVID-19 pandemic, GDP shrank marginally in 2023. With lower inflation and interest rates, private consumption is projected to drive the economic recovery in 2024 (+0.6%) and 2025 (+1.8%) (OECD, 2024a).

Over 2010-23, Sweden successfully decoupled emissions of greenhouse gases (GHGs) and major air pollutants, energy supply and freshwater abstractions, and to a lesser extent municipal waste generation, from economic growth. Domestic material consumption grew faster than GDP until 2021, reflecting increased extraction of non-metallic minerals and metal ores. However, it has since declined with the contraction of the construction sector.

Sweden is closer to its clean air and non-toxic environment targets than it was in 2012 (Table 1). However, it does not expect to meet 12 environmental quality objectives out of 16 or the generational goal (to pass on a society in which major environmental problems have been solved) by 2030. The negative trends in the climate (Chapter 2) and biodiversity objectives are a cause for concern and highlight the need for continued efforts to address environmental challenges.

### Table 1. Most environmental quality objectives are not expected to be met by 2030

| | 2023 | | 2012 | |
|---|---|---|---|---|
| Environmental quality objectives | Prospect of achieving the goal by 2030 | Trend | Prospect of achieving the goal by 2020 | Trend |
| Reduced climate impact | (No) ✗ | ↓ | ✗ | ↓ |
| Clean air | (Close) + | ↑ | ✗ | ↑ |
| Natural acidification only | ✗ | ↑ | ✗ | ↑ |
| A non-toxic environment | + | → | ✗ | → |
| A protective ozone layer | (Yes) ✓ | → | ✓ | ↑ |
| A safe radiation environment | + | → | + | → |
| Zero eutrophication | ✗ | → | ✗ | → |
| Flourishing lakes and streams | ✗ | → | ✗ | → |
| Good quality groundwater | ✗ | → | ✗ | ↑ |
| A balanced marine environment, flourishing coastal areas and archipelagos | ✗ | → | ✗ | → |
| Thriving wetlands | ✗ | → | ✗ | ↓ |
| Sustainable forests | ✗ | ↓ | ✗ | → |
| A varied agricultural landscape | ✗ | → | ✗ | ↓ |
| A magnificent mountain landscape | ✗ | ↓ | ✗ | ↑ |
| A good built environment | ✗ | → | ✗ | → |
| A rich diversity of plant and animal life | ✗ | ↓ | ✗ | ↓ |

Source: SEPA (2023a; 2012), In-depth evaluation of Sweden's environmental objectives.

*Swedes enjoy good air quality, but efforts are needed to reduce ammonia emissions*

Air pollution levels in Sweden are among the lowest in the OECD (OECD, 2024b). Nevertheless, the country continues to record exceedances of EU air quality standards (MoCE, 2024a; SEPA, 2024a). Around 6 700 people die prematurely each year in Sweden, mainly due to fine particulate matter and nitrogen dioxide pollution from long-range transport of pollution, road traffic (vehicle exhaust and wear particles) and domestic wood burning (Gustafsson et al., 2022).

Sweden met its 2020-29 emission reduction commitments under the National Emission Ceiling Directive, except for ammonia ($NH_3$). Since the mid-2010s, stricter emission standards, fuel switching, improved abatement technologies and the charge on nitrogen oxides (NOx) emissions have helped to further reduce air pollutant emissions. However, additional efforts are needed for $NH_3$ and NOx emissions to meet the 2030 targets. Broadening the NOx charge and introducing a distance-based charge for heavy goods vehicles, as provided by the National Air Pollution Control Programme, would help achieve the NOx target (MoCE, 2024a). New measures are needed to improve manure management (SEPA, 2024b). The proposed subsidy (SEK 100 million for 2025-27) to reduce $NH_3$ emissions from the handling of stable manure could help reach the goal on $NH_3$ (MoF, 2024a).

*Sweden needs an action plan to halt and reverse biodiversity loss by 2030…*

The National Biodiversity Strategy and Action Plan is outdated, lacking milestone targets and concrete actions to meet the requirements of the Convention on Biological Diversity's Kunming-Montreal Global Biodiversity Framework, the EU Biodiversity Strategy 2030 and the EU Nature Restoration Law (SEPA, 2023b). The government has commissioned a parliamentary committee to draw up a new strategy. Unfortunately, its proposals will come after the deadline of the 16th meeting of the Conference of the Parties (held in October 2024).

More than three-quarters of habitats and half of species of conservation importance[1] are in poor or bad states. Agriculture and forestry are the main pressures on terrestrial habitats (EEA, 2023). Marine habitats are affected by eutrophication and commercial fishing (SEPA, 2022a), while climate change is expected to further disrupt ecosystems. There was little or no improvement in the state of the Baltic Sea environment in 2016-21 (HELCOM, 2023). Sweden has good knowledge of protected habitats and species, but large gaps remain (SEPA, 2021). An economic evaluation of Sweden's ecosystem services, as carried out in Slovakia, would make the case for, and guide, biodiversity action (OECD, 2024c).

Sweden has designated 15% of land and marine areas under its jurisdiction for protection. It has achieved the 2020 Aichi target for marine and coastal areas (10%) but not for terrestrial areas (17%). The country is not on track to meet the 2030 target of 30%. Further efforts are needed to ensure the ecological representation, effectiveness, functionality and connectivity of the protected areas network (GoS, 2019). About 3 000 management plans need to be updated and some Natura 2000 sites, particularly those at sea, lack management plans (SEPA, 2021). In November 2024, Sweden adopted a law on the marine environment that aims, among other things, to strengthen the protection of marine areas.

*…and to better mainstream biodiversity in forestry and agriculture*

Longstanding intensive forestry and standard clear-cutting practices have adversely affected forest habitats. Long-term formal and voluntary protection of forests and environmental consideration during felling[2] have yielded positive results but have not halted the loss of forest ecosystems (SFA, 2022). Sweden has not met its objective on sustainable forest for 2020 and is not on track for 2030 (Table 1). Currently, 9% of forests are formally protected, 5% are voluntary set-asides and 2% are consideration patches (in productive forests,[3] these percentages are 6%, 6% and 2%, respectively) (SCB, 2024a). Unproductive forests account for 11% of all forest land. Further work is needed to preserve unprotected productive

forests, which are predominantly privately owned and face higher rates of loss, degradation and fragmentation (SEPA, 2022b).

Production and environmental objectives are not well balanced in the forestry policy, which favours voluntary biodiversity conservation initiatives (SFA, 2022). When owners of forests with high conservation values notify the Swedish Forest Agency of felling, the Agency often applies the Forestry Act instead of applying the Environmental Code. Since the Forestry Act's restriction on encroachment is often not sufficient to preserve the environmental values of forests with high conservation values, this often results in large parts of the core values being felled and the natural values in these parts being destroyed (SEPA, 2022b; SFA, 2022). Efforts to map high conservation value forests (Jonsson, B.G. et al., 2024) should be pursued to facilitate compliance. Stable funding is needed to improve oversight, advise landowners and compensate them for setting aside forest land and manage nature conservation in protected areas (SFA, 2022).

The Common Agricultural Policy (CAP) 2014-22 has helped maintain land management and grazing in marginal areas and pastures, preventing land abandonment – a key threat to biodiversity (SBA, 2022; SEPA, 2022a). However, it has also contributed to further intensification in areas already subject to intensive agriculture. Public support and management practices should be adapted to the diverse geographic context, particularly for grasslands in the Natura 2000 network. Like plans in other EU countries, Sweden's 2023-27 CAP Strategic Plan is not sufficient to protect biodiversity (EC, 2023a; 2022). In addition to CAP funding, the budget bill for 2025 proposed to allocate SEK 120 million for the restoration and management of semi-natural pastures and meadows over 2025-27 (MoF, 2024a).

### *Reaching ambitious water quality objectives requires more cost-effective policies and faster progress*

Only 40% of surface water bodies have good ecological status and none have good chemical status when considering substances like mercury and other ubiquitous pollutants.[4] Eutrophication, caused by excess nutrients from agriculture, wastewater, and atmospheric deposition, remains a major challenge (Table 1). Progress in reducing eutrophication is too slow to meet the 2027 deadline of the EU Water Framework Directive (WFD) (Barquet, 2021). Measures to reduce nitrogen and phosphorous in agriculture have not been sufficient and not always well targeted (Vattenmyndigheterna, 2024). Although pilot co-ordination programmes at catchment scale have been positive, the reliance on voluntary measures has not promoted effective prioritisation.

Hydropower exerts the most extensive pressure on lakes and rivers (SwAM, 2024). Most hydropower concessions were granted decades before adoption of modern environmental legislation (Rudberg, 2013). Consequently, permits lack environmental considerations such as minimum environmental flows and fish passages. In 2019, Sweden revised its legal framework and adopted the National Plan for Modern Environmental Provisions for Hydropower to reassess permits. The largest hydropower companies have established the Hydroelectric Environmental Fund, which will allocate SEK 10 billion (EUR 1 billion) to improve water quality and hydrological connectivity in affected water bodies. The process began in 2022, with a 20-year time horizon, but it has been postponed several times. The measures are not expected to be completed before 2045, long after the WFD deadline of 2027. A government review of the implementation of the National Plan highlights scope for improved co-operation between hydropower facilities and water authorities, clearer guidance on environmental standards development and the need to monitor the impact of environmental measures (SwAM, 2023). A recent legislative proposal seeks to enshrine in law the requirement to fully apply all exemptions and derogations allowed under the WFD (MoCE, 2024b). As a result, the reassessment of permits will likely prioritise electricity production when facing trade-offs with environmental objectives.

Sweden has abundant water resources and low water stress at national level: only 1% of renewable freshwater resources are withdrawn annually. However, water scarcity is a recurring issue in southeastern

Sweden and emerging in other regions (Swedish National Expert Council for Climate Adaptation, 2022). Sweden has faced droughts and floods, prompting measures to improve water efficiency, water retention in landscapes and monitoring. This is especially the case in the South Baltic Sea Water District where water shortages are pervasive. A review of the system for abstraction permits would be timely to revise older permits, broaden the coverage of users requiring a permit and strengthen the monitoring of abstractions. Sweden is one of only three OECD countries (along with Austria and Chile) that do not apply abstraction charges (Leflaive, 2024).

#### *Further progress is needed on the circular economy*

Swedes generate less municipal waste per capita than the EU average (395 vs. 513 kg/capita in 2022). As Sweden was already landfilling less than 1% of municipal waste in 2010, it is well ahead of the EU target of 10% by 2035. The landfill tax and ban on landfilling for combustible and organic waste introduced in the 2000s were key factors in this success (OECD, 2014). However, the country did not meet the target of recycling 50% of municipal waste by 2020 and is at risk of not meeting the 2025 target of 55%. Over 2010-19,[5] increasing amounts of waste were incinerated with energy recovery and, to a lesser extent, recycled. Sweden's circular material use rate remains low, at 6%, just over half the EU average in 2022 (Eurostat, 2023).

To improve recycling, the Swedish Environmental Protection Agency (SEPA) has proposed regulatory changes requiring increased sorting at source and improved separate collection of paper, plastic, metal and glass; better sorting of the reusable or recyclable part of combustible waste prior to incineration; and better information to households and businesses by municipalities on how waste should be handled. SEPA also suggested considering an extended producer responsibility system for furniture and mattresses; improving data on waste from businesses; investigating economic instruments to stimulate demand for recycled materials, improve conditions for repair, remanufacture and reuse; and supporting municipalities, particularly the smaller ones (SEPA, 2023c). In November 2024, the government initiated a reform of the waste legislation to prevent waste and increase material recycling (GoS, 2024a).

Since 2014, Sweden has introduced new economic instruments to promote a circular economy. The value added tax rate for repair services for bicycles, shoes, leather goods and clothes was reduced from 25% to 12% in 2017. The rate was further reduced to 6% in 2022 and increased again to 12% in 2023 to increase the uniformity of the tax system. Taxes on incineration and plastic carrier bags were introduced in 2020 but removed in 2023 and 2024, respectively. The tax on plastic bags was no longer deemed necessary as Sweden had exceeded the EU consumption target for plastic carrier bags. The tax on incineration was abandoned to maintain the profitability of combined heat and power production, but it was lifted before the effect of the tax on recycling had been measured. A tax on chemicals in certain electronic goods was introduced in 2017; its rate increased in 2019 and the deduction rules were changed in 2023. It is not always clear how environmental impacts are considered when amending or abolishing these instruments. An inquiry on economic instruments for a more circular economy is under public consultation (GoS, 2024b).

### *Improving environmental governance and management*

#### *Sweden has taken steps to better co-ordinate compliance and enforcement*

Sweden is a unitary state with a decentralised governance system including 21 counties and 290 municipalities. In 2022, the Ministry of the Environment was merged with the Ministry of Enterprise and Innovation to become the Ministry of Climate and Enterprise (MoCE). The MoCE oversees 36 government agencies, including SEPA which co-ordinates and implements environmental policy. After ten years of growth in the budgets of environmental agencies, the government has reduced their appropriations since 2022.

At the regional level, county administrative boards (CABs) are central government agencies responsible for environmental permitting, compliance monitoring and enforcement. Municipalities are responsible for spatial planning, environmental service provision and protection. Sweden has adopted a National Strategy for Environmental Supervision for 2022-25 (SEPA, 2024c). Increased appropriations for licensing and guidance have supported more effective and uniform supervisory activities by regional and municipal authorities (SEPA, 2024d). However, CABs lack resources and municipalities have skill shortages (SEPA, 2024e). Although annual monitoring provides positive indications of compliance levels, outcome indicators would help to better assess the strategy's effectiveness. Since 2018, Environmental Collaboration Sweden has been facilitating the follow-up of the municipalities' supervisory activities (Environmental Collaboration Sweden, 2024).

#### *Ensuring effective participation of the Sámi people in the green industrial revolution*

Sweden has yet to adopt adequate measures to address or mitigate the potential adverse effects of large renewable energy and mining projects on Sámi land and traditional lifestyle, including reindeer herding (OHCHR, 2024). A green industrial revolution has been launched with numerous ongoing investments. This includes producing steel from green hydrogen, developing batteries for electric vehicles and extracting critical minerals from mine waste (OECD, 2023a) (Chapter 2). However, the development of related infrastructures in northern regions is creating conflicts with the traditional land use of the Sámi people (MoCE, 2024c). The Constitution and the National Minorities and Minority Languages Act protect and promote the preservation of Sámi culture. The 2022 Act on Consultation (2022:66) requires the government and local authorities to consult Sámi representatives on issues significant to the Sámi people. However, in practice, it does not always lead to effective consultation in decision making that affects them, or to their free, prior and informed consent (OHCHR, 2024).

#### *Budget bills have increasingly integrated environmental considerations*

Sweden is one of the best performing OECD countries in terms of green budgeting practices (OECD, 2024d). The Budget Act requires the government to report to Parliament on progress towards environmental goals, and the Climate Act requires a separate report on climate mitigation progress to be attached to the budget bill (Pojar, 2023). The country has made progress on assessing the budget's contribution to environmental and climate objectives, notably through the update of the regulatory impact assessment ordinance (2024:183) and the development of guidance to help government agencies assess the climate impact of policy proposals (SEPA, 2024f). However, the climate report highlights inconsistencies between fiscal and climate policies (MoF, 2024b; 2023). There is still room for improvement in tagging measures with a negative environmental impact, including tax expenditure.

### ***Promoting investment and economic instruments for green growth***

#### *Investment in environmental and low-carbon infrastructure has grown, but needs are high*

Public expenditure on environmental protection grew significantly from 0.4% to 0.6% of GDP in 2010-22. This is due to the sharp rise in government subsidies to reduce GHG emissions and increased municipal investment in wastewater treatment. Overall, 97% of urban wastewater is treated according to the requirements of the EU Urban Waste Water Treatment Directive, well above the EU average of 82% (EEA, 2024). Sweden has made major investments to reduce emissions of pharmaceutical residues into the environment and has been a leader in addressing contaminants of emerging concern in freshwater (OECD, 2019). However, individual sewage treatment systems, on which around 15% of the population depends, remain a significant source of water pollution (EEA, 2024).

Sweden would benefit from investing more in measures to protect biodiversity and ecosystems, in the circular economy, and in pollution prevention and control (EC, 2024a). The environmental investment gap is expected to increase to EUR 7 billion over 2021-27. The gap is especially wide (EUR 4.4 billion) for biodiversity and ecosystem protection. After reaching its highest level for ten years in 2021-22, the budget for nature protection was drastically cut in 2023 (ESV, 2024).

The need for additional (mainly private) investment is estimated at SEK 30 billion per year in 2030 for electricity generation and SEK 48 billion by 2030 for transmission networks (MoCE, 2024d). Publicly financed climate measures, including for adaptation, could amount to SEK 25-45 billion per year over the coming decades, on top of the planned SEK 60 billion in annual investment for transport infrastructure over 2022-33 (SFPC, 2022). There is scope to prioritise transport investments with high benefit-cost ratio (SNAO, 2022). Over 2010-22, investment in roads increased much faster than investment in rail infrastructure (OECD, 2024e). Since 2023, applications for new urban environment agreements for the development of cycling and public transport are no longer being granted (MoF, 2023).

Subsidies for climate change mitigation have surged since 2015. These include the bonus for low-emission cars, support for local and regional climate investments, installation of charging infrastructure for electric vehicles and reduction in industry's process-related emission (Chapter 2). Although some subsidies have proved effective in reducing GHG emissions (SEPA, 2024g), there is scope to streamline them to avoid overlaps (SNAO, 2024). The cost effectiveness of climate mitigation subsidies should be systematically assessed and weighed against energy price support measures that counteract their effects.

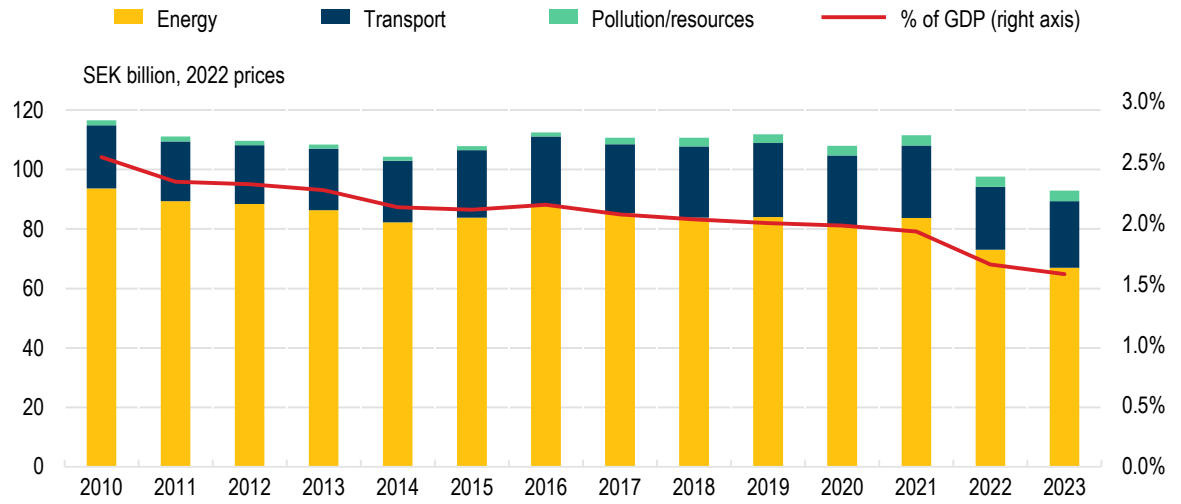
It is unclear when Sweden will benefit from EU recovery funds. The country dedicated 44% of its Recovery and Resilience Plan (RRP) budget (to be supported by EUR 3.4 billion in EU grants[6] until 2026) to climate objectives. However, as of September 2024, Sweden had not submitted a payment request (EC, 2024b), as it has not implemented certain reforms required for the disbursement of funds. These include the increase in the biofuel blending obligation (Chapter 2) and the abolition of reduced tax rates on fuels used in agriculture. Hence, discussions are under way with the European Commission on possible adjustments to the RRP.

### *The green tax shift has reversed*

The green tax shift (reallocating the tax burden from labour to environmentally harmful activities), implemented in the first half of the 2000s, has stalled and even reversed in recent years. While taxes on labour have fallen only marginally and remain high (OECD, 2024f), revenue from environmentally related taxes decreased from 2.5% of GDP in 2010 to 1.6% in 2023 (Figure 1). This is partly explained by the shrinking of the tax base (i.e. lower fuel consumption and increased electrification of vehicles) but also by the drastic cut in fuel tax rates.

## Figure 1. Revenue from environmentally related taxes fell due to a shrinking tax base and the cut in fuel tax rates

Environmentally related taxes by tax base, 2010-23




Note: 2023 provisional data.
Source: SCB (2024b), Environmental taxes.

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With an average effective carbon rate (ECR[7]) of EUR 90 per tonne of $CO_2$ in 2023, Sweden continues to have one of the highest carbon prices in the world (OECD, 2024g). However, this rate dropped by almost 20% over 2021-23, compared with a 10% fall in the European Union. Combined with the increase in permit prices in the EU Emissions Trading System (ETS), the cut in fuel tax rates has narrowed the ECR gap between transport and other sectors, and between diesel and petrol. However, it has also weakened incentives to reduce emissions. While most GHG emissions from road transport, buildings, electricity and industry are priced at over EUR 60 per tonne of $CO_2$, emissions from agriculture – methane and nitrous oxide – remain unpriced.

### *Road pricing would help address transport externalities and the erosion of the tax base*

In real terms, revenue from taxes on motor vehicles and transport (excluding fuel duty) increased over 2010-19, then fell with the decline in car registrations and the growing share of low-emission vehicles. Sweden taxes the ownership of motor vehicles but does not apply purchase tax. The annual motor vehicle tax is the main source of revenue from transport taxes. Since 2018, new cars and light vehicles have been charged a higher tax (malus) based on their $CO_2$ emissions in the first three years. For diesel vehicles, an environmental charge and a fuel charge are added to the malus to reflect their higher impact on local air pollution and offset the lower energy tax rate on diesel. The climate bonus, which has subsidised the purchase of low-emission vehicles, was abolished in 2022 (Chapter 2).

As the use of electric vehicles increases, road pricing will be needed to address transport externalities and loss of fuel and vehicle duty revenue. While fuel taxes are well suited to reduce carbon emissions, distance-based charges and congestion charges address many externalities from road transport more effectively (van Dender, 2019). Increased congestion charges in Gothenburg and Stockholm have yielded positive environmental and mobility outcomes (Börjesson, 2018). There is potential for other cities such as in Malmö and Uppsala to implement congestion charges or parking charges to internalise externalities and shift to

other transport modes (Pyddoke and Lind, 2024). Sweden should also modify road tolls for heavy goods vehicles to consider the distance travelled and better reflect the climate and air pollution costs of their use. It applies a road toll to heavy-duty vehicles (above 12 tonnes) on the main roads, which varies with Euro standards and the number of axles. The charge is time-based but does not change with distance travelled.

As recommended in 2014 (OECD, 2014), Sweden analysed the incentive mix in the transport sector (Trafikanalys, 2024a; 2024b; 2018). However, the conclusions have not always been acted upon. For example, Parliament's decision in 2022 (informed by a dedicated committee) to introduce a new tax reduction for commuting – regionally differentiated, based on distance and neutral in terms of mode of transport – was ultimately not implemented. On the contrary, tax deductions for using a car for commuting to work or for business trips were increased in 2023. The coherence of the economic instruments that apply to transport needs to be improved.

### *Sweden does not track support potentially harmful to the environment*

Under SDG 12,[8] Sweden is committed to rationalising inefficient fossil fuel subsidies. However, it has not adopted intermediate targets for doing so (MoCE, 2024d). Like other OECD countries, Sweden delivers support to fossil fuels through tax expenditures (OECD, 2023b). The reduced energy tax for diesel used in motor vehicles is the main source of forgone revenue (MoF, 2024c). This is followed by reduced energy and carbon taxes for diesel used in agriculture, fishing and forestry, as well as exemptions for domestic shipping and aviation. Over 2022-23, these measures represented almost 0.3% of annual GDP or 40% of fuel tax revenue (MoF, 2024c; SCB, 2024b). In addition, the increased income tax deduction for car commuting expenses in 2023 resulted in a tax expenditure of SEK 7.8 billion (0.12% of GDP).

With energy tax on petrol (the national benchmark) falling faster than that on diesel, tax expenditures related to fossil fuels will reduce substantially between 2022 and 2025 (MoF, 2024c). However, lower fuel taxes weaken the incentive to reduce transport emissions. This highlights the need to regularly assess the environmental impact of tax expenditures in the national context, as Belgium, Germany and Italy are doing (MASE, 2022; SFP Finances, 2024; UBA, 2021).

Sweden should also systematically evaluate incentives that could potentially affect biodiversity as required by Target 18 of the Kunming-Montreal Global Biodiversity Framework. For example, coupled income support to cattle production under the CAP maintains livestock numbers and associated enteric fermentation emissions.

# Recommendations on green growth

### Addressing key environmental challenges

#### *Biodiversity*

- Update the National Biodiversity Strategy and Action Plan with a long-term vision and measurable milestone targets aligned with the Kunming-Montreal Global Biodiversity Framework, the EU Biodiversity Strategy for 2030 and the EU Nature Restoration Law.
- Designate new protected areas to create an ecologically representative, coherent and functional network. Ensure predictable, stable funding for biodiversity and develop valuation of ecosystem services to prioritise management efforts.
- Encourage forestry practices that better support biodiversity, particularly in areas of high conservation values, through better mapping of these areas to facilitate compliance with the Environmental Code and stronger economic incentives for forest owners. Ensure the CAP 2023-27 effectively encourages biodiversity-friendly farming practices, particularly in semi-natural grasslands, including in the Natura 2000 network, and adapt support to the geographical context.

#### *Water*

- Consider progressively implementing an emissions trading system for diffuse pollution, gradually widening the coverage of the system to enhance efficiency; continue efforts to co-ordinate measures at catchment level supporting a holistic approach to addressing water quality.
- Accelerate the modernisation of permits for hydropower to include environmental provisions; clarify guidance on the development of environmental standards in impacted water bodies, balancing the benefits of improved freshwater ecosystems with hydropower production; ensure monitoring of the impact of environmental measures and improve co-operation between hydropower facilities and water authorities in the context of the National Plan.
- Review the system of water abstraction permits, prioritising areas at risk of water scarcity; broaden coverage of abstractions requiring a permit; strengthen monitoring of abstractions; consider introducing abstraction charges where water shortages are pervasive.

#### *Waste and circular economy*

- Clarify the role of taxes in moving up the waste hierarchy and promoting a circular economy.

#### *Improving environmental governance and management*

- Ensure the effective consultation and participation of the Sámi people in decisions that affect them and address or mitigate the potential adverse effects of development projects on Sámi land and traditional lifestyle, including reindeer herding.
- Secure human and financial resources necessary for supervisory activities by regional and municipal authorities; continue co-ordination efforts and define outcome indicators to assess the effectiveness of the National Strategy for Environmental Supervision.

#### *Promoting investment and economic instruments for green growth*

- Revert to a green tax shift with a view to applying the polluter pays principle more consistently and supporting a green and inclusive recovery.

- Improve the coherence of economic instruments that apply to transport. Consider implementing congestion or parking charges in cities other than Stockholm and Gothenburg; vary road tolls with the distance travelled; differentiate the tax deduction for commuting according to region and distance and make it neutral on the mode of transport used. Prioritise transport investments with the highest social return.
- Continue to assess the cost effectiveness of environmentally motivated subsidies with a view to maximising their environmental impact, while reducing overlaps.
- Systematically screen actual and proposed support measures, including tax provisions, to identify those unjustified on economic, social and environmental grounds and, on the basis of this assessment, develop a plan to phase out fossil fuel and other environmentally harmful support.

## 2. Climate change mitigation and negative emissions promotion

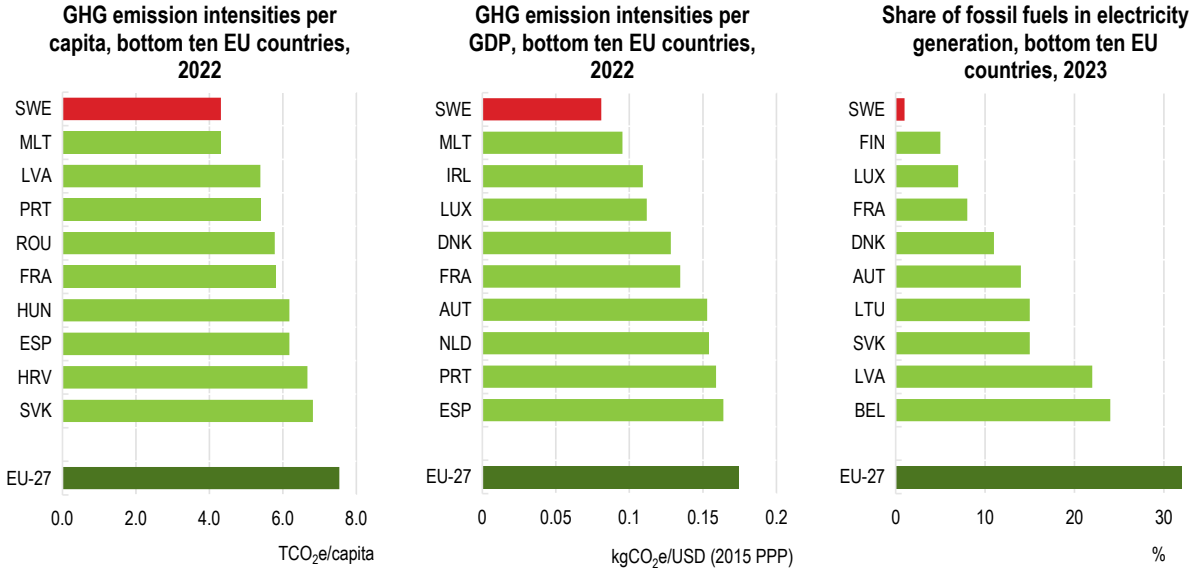
### *Trends and performance on climate change mitigation*

*Sweden is a leader on many climate-related indicators*

Between 2010 and 2022, greenhouse gas (GHG) emissions, excluding land use, land-use change and forestry (LULUCF) fell by 29%, faster than the EU average of 19% (OECD, 2024h). A large share of Sweden's emission reductions to date can be attributed to a practical phase-out of fossil fuels to produce electricity and heating. A shift to renewable energy has been a longstanding policy priority in Sweden, and large-scale nuclear power development has also played a prominent role in reducing dependence on fossil fuels. In 2022, renewable energy accounted for over two-thirds of electricity generation and GHG emission intensities per capita and per unit of GDP were the lowest in the European Union (Figure 2). Sweden met its 2020 target for ESR sectors (not covered by the EU Emissions Trading System) and fulfilled its commitments under the Kyoto Protocol (2008-12 and 2013-20) (Figure 3).

Sweden is consistently ranked among the top performers on the European Eco-Innovation Scoreboard (EC, 2023b). This reflects high government spending on research, development and deployment (RD&D) related to environment and energy, as well as robust patenting activity. Sweden is pioneering technology developments for carbon capture use and storage (CCUS). Venture capital investments in climate tech start-ups and scale-ups increased significantly over 2019-23, contributing to enhanced industrial competitiveness both domestically and within the European Union (EC, 2024a).

### Figure 2. Sweden has the lowest GHG emission intensities in the European Union




Source: OECD (2024h), Air Emissions - Greenhouse gas emissions Inventories (database); IEA (2024a), IEA World Energy Balances (database).

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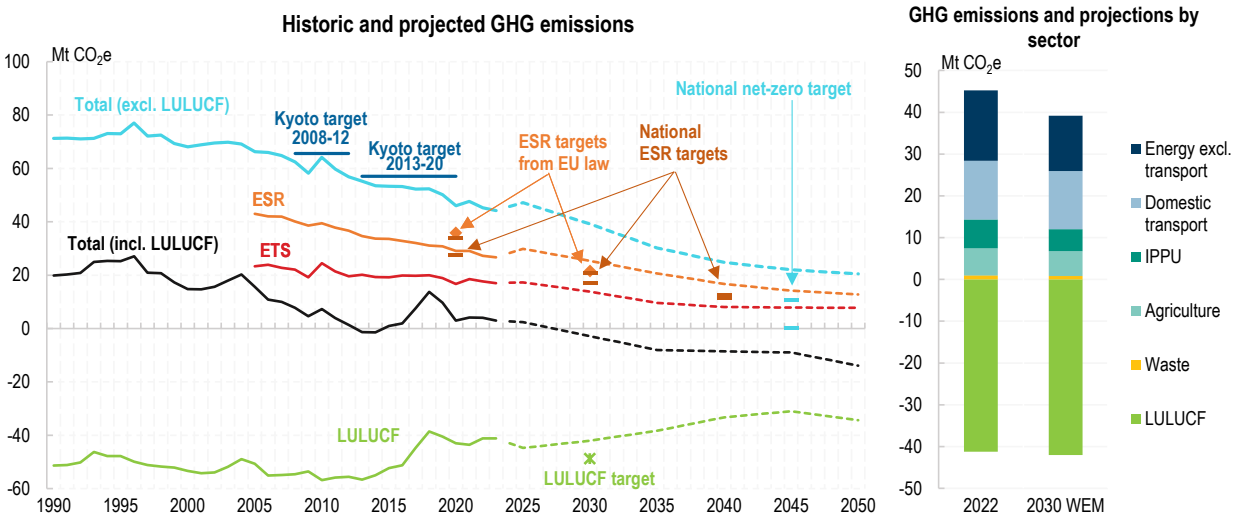
*Recent policy shifts have created an uncertain environment for climate action*

Sweden aims to reach net-zero emissions by 2045, followed by negative emissions thereafter, with at least 85% of emissions reduced within Sweden's borders. Supplementary measures, such as verified emission reductions abroad, increased carbon sink and carbon capture and storage from biogenic emissions (BECCS), can compensate for the remaining 15%. Recent policy shifts, particularly in the transport sector (see below), have put into question Sweden's ability to meet legally binding EU and domestic climate targets, with emissions projected to increase in 2024. The latest official projections estimate the emissions gap to the 2045 target at around 22 million tonnes of carbon dioxide equivalent (Mt $CO_2$e) without supplementary measures, and 11 Mt $CO_2$e with full use of supplementary measures (Figure 3) (MoCE, 2024d).

For ESR sectors, the accumulated gap to the 2030 target is estimated to range from 1 to 9 Mt $CO_2$e. For LULUCF, the gap for the year 2030 is projected to be around 7 Mt $CO_2$e in a scenario with medium forest growth, and up to 19 Mt $CO_2$e with reduced forest growth. The budget bill for 2025 aims to reverse the increase in emissions by proposing measures in the transport sector in particular (MoF, 2024b). If adopted, they would improve the conditions for achieving the 2030 target and narrow the gap to the 2045 target.[9] However, the bill's expectation to close the gap to the ESR target is based on the most optimistic scenario associated with large uncertainties, e.g. related to private transport choices when fuel prices are low, and fewer electric cars are registered. In addition, no new measures have been proposed to address the gap in meeting the LULUCF target. Further measures will be needed to achieve the long-term goal of 2045 (MoF, 2024b).

## Figure 3. GHG emissions trend downward but not at the pace required to meet climate targets




Note: LULUCF: land use, land-use change and forestry. IPPU: Industrial processes and product use. Dotted lines refer to national projections with existing measures (WEM) as of March 2024 assuming average growth of forest land. ESR targets from EU law: 2020 under the EU Effort Sharing Decision (406/2009/EC); 2030 under the EU Effort Sharing amended Regulation (EU 2023/857). LULUCF 2030 target: under the LULUCF Regulation (EU 2023/839). ETS: emissions under the EU Emissions Trading System. Under the Swedish Climate Policy Framework, the national targets include possibilities to attain parts of the targets through supplementary measures. Such measures may be used to achieve up to 8% of the 2030 target and 2% of the 2040 target. For the long-term target, such measures can be used for the remaining reductions down to zero. National targets are therefore presented in ranges. 2023: provisional data; LULUCF: 2022 data.
Source: SEPA (2024), Sweden's emissions and removals of greenhouse gases, June; SEPA (2024), GHG emissions projections and approximated data for 2023 reported under the Governance Regulation (EU 2018/1999), July; EEA (2024), EU ETS Data Viewer, May; MoCE (2024d), Sweden's updated National Energy and Climate Plan 2021-2030.

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Historically, broad public and private sector support for ambitious climate action, combined with strong political commitment, have provided Sweden with a clear and predictable framework for action. However, recent policy shifts on key issues (e.g. on fuel blending and taxation) are eroding this predictability. The government has emphasised the importance of a successful climate policy taking a long-term perspective and being grounded in legitimacy, trust, fairness and acceptance, putting in place the conditions to enable action by the private sector and households. It has initiated, or expressed its intention to initiate, numerous inquiries to examine policy options. While the inquiry system facilitates an informed policy dialogue, it is lengthy; some recommendations are only expected in 2027, i.e. after the next election. With action delayed, future measures will have to accelerate the pace of the transition. The business community has cautioned the government against lowering climate ambition given its negative impact on competitiveness.

### *A clear climate governance system informs key policy processes*

Sweden's 2017 climate policy framework is transparent and comprises three pillars: i) the Climate Act and associated governance framework; ii) emission reduction targets; and iii) an independent Climate Policy Council. Government action on climate is reviewed annually with assessments publicly available. The government is not obliged to formally respond to the recommendations of the Climate Policy Council. However, as part of the annual budget bill, it must submit a climate report to Parliament showing progress towards the targets.

Sweden's climate policy is also shaped by EU obligations on climate and energy. The EU climate policy framework provides Sweden the flexibility of transferring up to 2% of its ETS allowances for offsetting emissions in effort sharing sectors. Sweden has notified the European Commission that it intends to use the full amount of this flexibility for 2025-30. However, if Sweden fails to meet the requirements under the LULUCF Regulation, emission allocations corresponding to the gap will automatically be deducted from the ESR. A further flexibility provided by the EU framework is the option of banking and borrowing annual emission allocations and to sell or buy emission allocations from other EU countries. Updated 2024 National Energy and Climate Plans (NECPs) indicate that surplus emission allocations will be limited (EC, 2024c). This calls for accelerating domestic emission reductions.

As the ambition of EU policy on climate increases, the relative ambition of domestic targets by "early movers" like Sweden decreases. This applies equally to energy, where Sweden's updated NECP is not in line with EU targets on renewable energy and energy efficiency. The government has announced that a public inquiry will be tasked to put forward proposals on how to align national climate targets with EU targets.

### *Creating an enabling environment for the transition to net zero*

As Sweden enters the next phase of the climate transition, the role of government in defining priorities, establishing the enabling environment and managing inevitable trade-offs becomes increasingly important. Transformations of the scale foreseen entail both economic benefits (e.g. new industries) and costs (e.g. loss of employment). Sweden's climate strategy does not include an explicit focus on ensuring a just climate transition. Instead, social and economic impacts are addressed through Sweden's general welfare system. While this system is well suited to support households that go through structural changes – employment status or life circumstances – it may not adequately support households that experience increased costs, e.g. in the context of passenger transport or electricity use. EU members are due to submit their Social Climate Plans in June 2025.

The government also plays an important role in supporting regions in meeting the changing demand for social infrastructure and services. The labour market needs of the transition have only recently become a focus of the government. In the northern part of the country, public employment services are collaborating with the industrial sector, as well as with education and training institutions, to respond to labour shortages foreseen by the transition. However, such collaboration is not in place in other parts of the country. The

central government is well placed to co-ordinate the numerous actors involved in assessing skill needs and in developing training and educational measures supportive of the climate transition. Further, since many climate-related projects are in northern sparsely populated areas, complementary investments in basic social infrastructure are needed to attract and retain a skilled workforce.

Permitting processes present an important barrier to the acceleration and scaling up of renewable energy. It takes on average nine years to secure the necessary permits for land-based wind projects, one of the longest timelines in Europe (OECD, 2023a). The share of approved permits has also been falling over time. The government recognises the need for a faster and more streamlined permitting process, with numerous inquiries exploring how it can be improved. Further, many industries wishing to electrify or scale up their operations cannot access the grid in a timely manner. This delays the green transition and creates uncertainty for businesses. In 2024, amendments to the Environmental Code and the Electricity Act to streamline the permitting process for the expansion of electricity networks were approved.

### *Sectoral mitigation measures*

#### *The pathway to decarbonising the energy system remains uncertain*

Renewable energy accounts for nearly half of Sweden's energy supply. The European Union has a binding renewable energy target of at least 42.5% in 2030, and endeavours to increase this to 45%. Member states do not have individual targets, but they are obliged to specify national contributions to the EU target in their NECPs. EU guidelines recommend a target of 76% for Sweden. National projections show that the recommended target will not be reached with policy measures in place (MoCE, 2024d). The share of energy from renewable sources is projected to reach 67% in 2030.

In 2023, Sweden replaced its target of 100% renewable electricity generation by 2040 with a target of 100% fossil-free electricity production. Factors driving this shift include a focus on energy security and resilience, and the geographical imbalance between energy demand and supply. The ambition is to build the equivalent of at least two large-scale nuclear reactors by 2035. The government foresees that a considerable expansion will be needed by 2045 that could correspond to ten large-scale reactors, with the scale of expansion to be determined by the rate of expansion in the electricity system, the location of new consumption and production, the technology development of both new nuclear power and the possibility of extending the operating time of existing reactors.

Given lengthy time horizons, high cost and the technical uncertainty of expanding nuclear capacity, this renewed focus on nuclear energy must consider the full range of costs and benefits. Estimates of levelised cost of energy (operation, maintenance and investment costs) indicate that nuclear is always more expensive than wind or solar energy in Sweden (GoS, 2024c; Holmberg and Tangerås, 2022; IEA, 2023; SEPA, 2024h). Experience has also shown that the state must take on a large share of the financial risk of new nuclear capacity. A proposed risk-sharing model for Sweden shows that a nuclear power programme equivalent to around four large reactors would increase the national debt by between SEK 300 billion (no cost overruns) and SEK 450 billion (50% cost overruns). In the former scenario, public debt may decrease somewhat in the long term due to a gradual increase of interest rates on state loans and since state loans are expected to be refinanced with private loans (MoF, 2024d). In the latter scenario, public debt will be higher in the long term. At the same time, the future of small modular reactors remains unclear. Their designs are yet to be certified for construction and costs remain uncertain.

In 2021, 78% of all wind power projects were vetoed by municipal administrations (OECD, 2023a). The proposed financial compensation to communities hosting new wind power projects and to residents living within proximity to the new developments is a positive step to improve acceptance (MoF, 2024b). Similarly, the Swedish Armed Forces have vetoed almost 90% of all offshore wind projects to date due to security concerns. As maritime spatial plans will be amended, it will be important to consider the multiple, and

potentially conflicting, uses of marine areas. Sweden should designate renewable acceleration areas, as required by the revised EU Renewable Energy Directive.

### *Energy efficiency is improving, but energy use is projected to increase*

Sweden should focus on smarter and more flexible energy systems to reduce overall demand. Between 2005 and 2023, energy intensity decreased by 38%, in line with the EU average (IEA, 2024a). Sweden has developed an exemplary modern district heating system with a combined focus on energy efficiency, heat recycling and renewable heat. It is a leader in combined heat and power plant technologies. Further efforts are required to meet the domestic target to halve energy intensity over the period 2005-30, a target the government plans to review since it is not deemed suitable with the substantial planned electrification of the industrial sector.

Electrification is a central aspect of Sweden's climate transition. Demand for fossil-free electricity is projected to more than double from current levels by 2045, mainly due to increased electricity consumption in the iron and steel industry. While this will reduce GHG emissions, it will be achieved through increased energy use, contrary to the EU target on reduced energy consumption. Sweden's commitments to reduce energy consumption are less ambitious than the reductions required to achieve the collective EU target of the updated Energy Efficiency Directive (MoCE, 2024d). Moreover, the updated NECP projects that Sweden will not meet the 2030 targets set by the Directive. Although the government may consider this an acceptable trade-off in the pursuit of its climate targets, Sweden will need to reconcile the planned increase in electricity production with EU requirements.

### *Recent policy changes contribute to a short-term increase in transport emissions*

Despite an increase in the number of kilometres travelled, emissions from the transport sector have decreased by 34% over 2010-23 (SEPA, 2024i). Road transport accounts for most of these emissions. However, this progress, is considerably short of the domestic target of 70% emission reductions by 2030, a goal that the government plans to review. To achieve this target, emissions will have to fall by an average of 1 Mt $CO_2$e per year in 2023-30 (SEPA, 2024i). Instead, policy changes introduced by the government are expected to increase transport emissions in 2024. Sweden's ability to meet the 2030 ESR target also requires substantial reductions in transport sector emissions.

In an important election promise, the government committed to reduce the cost of transport fuels. In 2023, the obliged blending of biofuels into petrol and diesel was reduced from 7.8% and 30.5%, respectively, to 6% for both. This change, initially planned for 2024-26, is expected to increase emissions in 2024 (MoCE, 2024d), whereas previous blending requirements were projected to halve emissions in the sector by 2030. However, the government announced that the blending requirement for both petrol and diesel will increase to 10% starting in July 2025 (GoS, 2024d). To address the expected increases in fuel prices, fuel taxes will be further reduced along with targeted support measures. While the proposals outlined in the budget bill for 2025 (except fuel tax reductions) aim to improve the likelihood of achieving the 2030 target and narrowing the gap to the 2045 target, they will not suffice to meet the domestic transport target (MoF, 2024b).

In 2023, battery electric vehicles and plug-in hybrid electric vehicles accounted for 60% of car sales and for 11% of the passenger car fleet. A bonus for buying electric cars was removed in 2022 as the total cost of owning and driving low-emission cars was approaching that of petrol and diesel cars. In 2024, a new premium was introduced for car owners replacing an old car with the purchase or lease of an electric car. Another electric car premium targeted at groups in need of support (e.g. those living in sparsely populated areas) has also been proposed in the budget bill for 2025 within the framework of the EU Social Climate Fund (MoF, 2024b).

The government has announced further investments in charging infrastructure for both light and heavy-duty electric vehicles. Nonetheless, many of the 4.4 million fossil-fuelled cars will still be on the road in 2030. Additional measures are therefore required to minimise private vehicle use, e.g. by ensuring consistent incentives and extending road pricing (Chapter 1). This would also prepare the sector for its forthcoming inclusion in EU ETS-2 in 2027 and the EU zero $CO_2$ emissions target by 2035 for all new cars and vans.

*Industry is benefitting from R&D support, but its transformation is challenging*

The industrial sector is one of the hardest sectors to decarbonise. Still, it is playing a key role in reducing emissions and strengthening Sweden's competitiveness internationally (GoS, 2024c). Emissions from the sector have varied with production volumes and economic growth. In 2023, they were 23% lower compared with 2010, largely due to increased electrification, the use of biofuels and enhanced energy efficiency (SEPA, 2024j). Strong public support for research and development has propelled Swedish companies to the forefront of technological developments. Further emission reductions will require new technological developments in the iron and steel industry, large investments in new process technology and increased supply of electricity. However, with overall demand for electricity projected to double by 2045, progress in mitigating emissions from the sector is likely to contribute to increased electricity prices. Further, government support for technological innovations risks favouring some technologies over the development and maturation of potentially more efficient approaches, such as closed-loop carbon recycling (OECD, 2023a). Such approaches contribute to resource savings and emission reductions but remain far from commercialisation.

*Emission reductions in the agricultural sector have been minimal over the past decade*

The emission intensity of the Swedish agricultural sector is below the OECD average, but emission reductions have been minimal over the past decade. This is common across many EU countries. The composition of emissions has remained unchanged, with enteric fermentation and agricultural soils in 2022 accounting for 50% and 40% of emissions, respectively. Agricultural emissions face low carbon prices or are not priced (Chapter 1), and most climate measures are voluntary.

The government considers that further emission reductions in the sector will be difficult, could affect its competitiveness and might result in emissions leakage, one reason for including supplementary measures in the climate policy framework (GoS, 2023). Sweden may wish to follow the implementation of the Danish agricultural tax to explore what aspects it could adopt. As the European Commission is considering pricing GHG emissions from agriculture, Sweden should take a proactive approach in exploring all options available and in piloting potential measures. A complementary focus could be on further reducing food loss and waste and influencing consumer behaviour and preferences.

Sweden's Strategic Plan for the EU CAP provides an opportunity to increase the climate ambition in the agricultural sector, e.g. by making payments conditional on achieving emission reductions. Sweden will use 30%, or around EUR 1.3 billion, of the EU CAP financial contribution to support environmental and climate objectives, including carbon sequestration. This will be particularly important as Sweden aims to increase domestic food production while achieving relevant environmental objectives and generating growth and employment.

### *Supplementary measures*

Sweden's climate policy framework specifies that supplementary measures can account for up to 15% of the total emission reductions needed by 2045. These include: i) increased carbon sinks in forests and land; ii) implementing carbon capture and storage (CCS) from biomass combustion (i.e. BECCS); iii) facilitating verified emission reductions through investments in other countries. The use of supplementary measures

is intended to offset emissions that are difficult or costly to mitigate. However, all three groups are complex and characterised by long lead times, further highlighting the importance of limiting reliance on such measures to meet climate targets. Moreover, there are numerous uncertainties and risks associated with their eventual contributions to Sweden's climate targets. For example, the scale of mitigation outcomes that can be sourced from abroad is uncertain, due to stringent EU targets and the relatively immature Article 6 market (see below).

### *Increasing carbon sinks in forests is challenging, particularly in a changing climate*

Forests and woodlands account for almost 70% of Sweden's land area. Sweden has high net carbon removals from LULUCF, but the level of sequestration is declining. Increased harvesting, decreased forest growth in part due to the impacts of climate change, and lower sequestration of carbon by ageing forests contribute to this downward trend. Under the EU LULUCF Regulation, Sweden is obliged to increase its annual net carbon removals by nearly 4 Mt $CO_2$e by 2030, compared to the average from 2016-18. However, Sweden is not on track to meet this obligation and projections indicate that net carbon removals may continue to decrease over time. An important unknown variable is the impact of a changing climate on forest growth and health.

To meet the target of the LULUCF sector, Sweden must take additional measures. Today, few policy instruments directly address emissions and removals in the LULUCF sector. In 2022, the government tasked a cross-party inquiry to propose a strategy with intermediary targets, policies and measures for Sweden to reach its international and EU obligations on both biodiversity and LULUCF, with the proposal expected in February 2025. In 2024, an investigation was launched to review the national forest policy in light of developments within the European Union, but also to consider measures for long-term sustainable and competitive forestry.

### *The risks associated with technological measures to promote negative emissions should be carefully considered*

Sweden is pioneering technology developments for CCUS, especially BECCS. Based on the current landscape of operating support for BECCS, an estimated 1.7-2.6 Mt $CO_2$ could be captured by 2030 (IEA, 2024b), with the potential to reach 3-10 Mt $CO_2$ by 2045 (GoS, 2020). Currently, all CCUS projects are at the planning phase. Some investment decisions are expected in 2024, but around half of the projects remain uncertain.

For CCS deployment to occur at scale, both regulatory and economic support are needed. A public inquiry is examining how permit processes can be shortened and simplified. The government also provides direct financial support. To date, this has primarily been through the Industrial Leap, a support scheme that aims to reduce emissions from industrial processes, contribute to achieving negative emissions through BECCS and support strategic projects for the industry transition. In 2024 a new support scheme in the form of a reverse auction for biogenic $CO_2$ was put in place. The scheme allows companies to put forward bids on how much biogenic $CO_2$ they can capture and store and at what cost. The companies (one or more) requesting the lowest amount of support per tonne of biogenic $CO_2$ removed win the auction, receiving financial support for investment and operational expenses for 15 years. The government can commit up to SEK 36 billion (around EUR 3 billion) over 2026-46. The beneficiaries can sell the carbon credits tied to their negative emissions in voluntary carbon markets.

Despite the large financial commitment, the number of recipients eligible for the auction scheme will be limited. It will therefore be important to explore alternative incentives with broader application. One example is the provision of tax credits for captured carbon. Being part of a CCUS hub or cluster can also help bring down transport and storage costs (Dechezleprêtre, Mulligan and Vitkova, forthcoming). However, the development of such hubs requires careful planning and permitting co-ordination across industries, and in Sweden's case, across national borders.

As the sector develops, close attention must be paid to associated risks. For example, the efficiency of CCUS technology in capturing carbon and the additional energy required for the entire process (capture, transport and storage) are still poorly understood. Current technologies are best suited for point source emissions with high concentrations of $CO_2$, which is the case for most facilities in Sweden. For emission sources in remote locations or with low concentration of $CO_2$, the economics of CCUS may pose challenges. Associated regulatory frameworks are also evolving. While the EU Directive on geological storage of $CO_2$ was introduced in 2009, Sweden together with five other European countries has called for a better EU regulatory framework for cross-border transport of captured $CO_2$ in 2024. Sweden has also signed bilateral agreements with Norway and Denmark, allowing $CO_2$ transport across borders for geological storage.

### *There are barriers to increasing verified emission reductions and removals outside Sweden's borders*

To meet its domestic climate targets, Sweden can, among other things, use Article 6 of the Paris Agreement to co-operatively implement mitigation actions in other countries, thereby supporting a higher overall mitigation ambition. The government is also considering purchasing emission allocations from other EU countries to fulfil its commitments under the 2030 ESR and LULUCF regulations.

Sweden has played an active role in the climate negotiations on Article 6 and has entered Memoranda of Understanding with Zambia, Nepal, Rwanda and the Dominican Republic, as well as a bilateral agreement with Ghana, with discussions ongoing with other countries. Sweden is also working with international organisations and multilateral development banks to facilitate the implementation of Article 6 collaborations. To advance understanding of the international rules for Article 6, Sweden has also signed a Memorandum of Understanding with Switzerland, with the aim of piloting international transfers and reporting of emissions removals.

However, there are multiple barriers to increasing the share of verified emission reductions and removals outside Sweden. Potential challenges in growing Sweden's pipeline of Article 6 activities include limited capacity in host countries, long project lead times and risks due to ongoing Article 6 negotiations and an evolving rulebook. The Article 6 market is still nascent, making the transaction costs of engaging in these markets high. Furthermore, there are risks associated with each project. For example, a project may not achieve the expected mitigation impacts and host countries may no longer want to authorise mitigation outcomes. In the EU context, emission allocations have in the past been available from the newer EU members with lower emission reduction targets. However, the availability of such allocations is becoming scarcer as the stringency of EU climate and energy policy increases.

# Recommendations on climate change mitigation and negative emissions promotion

### Climate mitigation policy

- Maintain Sweden's climate ambition outlined in the 2017 Climate Act. Calibrate climate actions in ESR and LULUCF sectors to achieve the legally binding EU 2030 targets. Play a proactive role in setting ambitious EU targets for 2040, reconcile national energy targets with European objectives and avoid stop and go policy to ensure a predictable environment for investments.
- Continue the reform of environmental assessments and permitting processes to speed up the development of renewable and fossil-free energy infrastructure, ensuring that environmental quality is not compromised, and promoting public participation, including of the Sámi people. Identify and address skills gaps and support municipalities in the green transition.

### Sectoral mitigation measures

#### *Energy*

- Accelerate expansion of renewable energy, preventing and minimising environmental impacts. With the renewed focus on nuclear energy, carefully consider the full range of costs and benefits, and the associated time horizons of different energy sources. Ensure that policy decisions are guided by the cost effectiveness of different approaches in contributing to climate and energy targets.
- Implement the proposal to compensate municipalities hosting wind power projects to improve local support. Designate renewable acceleration areas while avoiding the most ecologically sensitive areas. Factor the potential use of marine areas for offshore wind into forthcoming amendments of the maritime spatial plans.
- Make energy and resource efficiency a fundamental component of Sweden’s climate transition policy and identify pathways to contribute to the achievement of EU’s energy efficiency goals.

#### *Transport*

- Further develop the strategy for the decarbonisation of the transport sector, strengthening the role of public, shared and active transport and increasing energy efficiency.
- Recognise the role of price signals in discouraging the use of fossil-fuelled private vehicles. Review carbon prices in line with climate objectives. Address distributional impacts through targeted support to vulnerable households while maintaining price incentives.
- Accelerate transport electrification. Address existing barriers, including access to the electrical grid for the expansion of charging infrastructure, particularly in sparsely populated areas.
- Identify measures that will prepare the sector for the inclusion of road transport in EU ETS-2 in 2027, with a focus on sustainable transport alternatives, increased energy efficiency in vehicles and ships, and increased use of sustainable renewable fuels, including electrification.

#### *Agriculture*

- Further develop economic incentives to improve the climate performance of the agricultural sector, while maintaining its competitiveness. Reward the creation of climate benefits and tax harmful approaches. Proactively explore approaches to pricing GHGs from agriculture.
- Explore opportunities for using the CAP Strategic Plan and associated funding mechanisms to increase the level of ambition in the agricultural sector. Prioritise measures that can contribute

to the achievement of multiple environmental objectives, including water and biodiversity, in addition to the mitigation of GHG emissions.

**Supplementary measures**

***LULUCF***

- Scale up efforts to increase net removals from LULUCF across all land-use categories in line with Sweden's 2030 EU commitment. Establish a long-term strategy promoting synergies between biodiversity conservation and carbon sequestration in Swedish forests and wetlands. Encourage private forest owners to adopt practices that will increase the capacity of forests to act as carbon sinks.

***Technology-based measures***

- Continue engagements with relevant actors involved in the expansion of bioenergy carbon capture and storage (BECCS) as part of a broad policy and technology-neutral support to energy RD&D, to bring clarity on the feasibility of BECCS to contribute to negative emissions by 2045.
- Develop a clear overview of legal and environmental risks and continue to champion within the European Union the development of an associated regulatory requirement for cross-border transport of captured $CO_2$, complementing existing regulation on geological storage.

***Transfer of emission credits from other countries***

- Continue supporting implementation of co-operative mitigation approaches and the development of a high-integrity rulebook under Article 6 of the Paris Agreement.

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## Notes

[1] The Habitats Directive (92/43/EEC) protects habitats and species of Community interest, i.e. that are threatened to disappear in the European Union, have a small natural range, or present outstanding examples of typical characteristics of Europe's biogeographical regions.

[2] Sweden distinguishes between i) formally protected forests, which include national parks, nature reserves, habitat protection areas, nature conservation agreements and Natura 2000 sites governed by laws and regulations; ii) voluntary set-asides – smaller areas for which the landowner has voluntarily decided not to carry out measures that can damage natural values, the cultural environment or social values; and iii) consideration patches – smaller areas designated for regeneration felling, voluntarily by the landowner or pursuant to the Forestry Act.

[3] With a yearly wood volume increment of more than 1 $m^3$/ha.

[4] Omitting the uPBTs (ubiquitous, persistent, bioaccumulative and toxic substances, i.e. mercury, brominated diphenyl ethers, tributyltin and certain polyaromatic hydrocarbons) results in 1% of surface water bodies not being in good chemical status.

[5] Changes in the definition of municipal waste in 2020 make recent trends difficult to interpret.

[6] Considering the 2022 downward revision of the Recovery and Resilience Facility, REPowerEU grants and Brexit Adjustment Reserve.

[7] Effective carbon rates summarise how countries price GHG emissions through fuel excise taxes, carbon taxes and ETS without considering free allocations of allowances in the EU ETS.

[8] SDG 12 calls for ensuring sustainable consumption and production patterns.

[9] Official updated SEPA projections with measures implemented after March 2024 will be available in 2025.

# Annex 1. Actions taken to implement selected recommendations from the 2014 OECD Environmental Performance Review of Sweden

| Recommendations | Actions taken |
|---|---|
| **Chapter 1. Towards green growth** | |
| Assess the economic benefits of environmental measures and how they could contribute to green growth, e.g. by contributing to competitiveness and employment. | Economic benefits of environmental policies are regularly assessed as part of regulatory impact assessments. The government has mandated the Swedish Environmental Protection Agency (SEPA) and the National Institute of Economic Research (NIER) to develop guidelines for the *ex ante* and *ex post* evaluation of the cost effectiveness of climate policies. Each year, NIER publishes an Environmental Economics Report dealing with a specific environmental theme. For example, it assessed the competitiveness and employment effects of the climate policy in 2017, 2018 and 2019, and its distributional effects in 2023. |
| Consider further extending the use of environmental taxes and pricing instruments, especially in areas other than energy use, while possibly reducing other taxes; for example, consider introducing taxes on fertilisers, hazardous chemicals and activities harmful to ecosystem services, and removing the refund mechanism for the NOx charge; and ensure that all rates are systematically adjusted to maintain the incentive and revenue-raising functions of taxes. | Since 2014, Sweden has increased the rate of some environmental taxes, such as those on pesticides and landfill. The tax on mineral fertilisers was repealed in 2009. Taxes on incineration and plastic carrier bags were introduced in 2020 but removed in 2023 and 2024, respectively. Sweden also introduced a tax on chemicals in certain electronic goods in 2017. The refund mechanism for the NOx charge is still in place. Revenue from environmentally related taxes decreased from 2.5% of GDP in 2010 to 1.6% in 2023. |
| Systematically evaluate the incentive mix in the transport sector, including motor fuel taxes and vehicle taxes, the tax treatment of biofuels and the taxation of company cars and commuting allowances; reform the tax treatment of company cars; and increase the energy tax rate on diesel, with a view to reaching energy tax parity with petrol. | Sweden analysed the incentive mix in the transport sector. However, the conclusions have not always been acted upon. For example, Parliament's decision in 2022 to introduce a new tax reduction for commuting regionally differentiated, based on distance and neutral in terms of mode of transport, was ultimately not implemented. On the contrary, tax deductions for using a car for commuting to work or for business trips were increased in 2023. Pure and high-blended liquid biofuels are exempt from carbon and energy taxes. The taxable benefit rate for company cars has been adjusted to make the tax system neutral between car benefits and cash salary. Over 2021-24, combined carbon and energy taxes fell in real terms by 29% for petrol and 26% for diesel, narrowing the gap between them. Diesel continues to be taxed at a lower level. The coherence of the economic instruments that apply to transport needs to be improved. |
| Regularly assess the potential environmental consequences of tax expenditure and other subsidies, possibly as part of the annual survey of tax expenditure conducted by the Ministry of Finance. | Sweden does not regularly assess subsidies potentially harmful to the environment. SEPA carried out a survey in 2017. The country has not adopted time-bound targets for phasing out fossil fuel subsidies. |
| Systematically evaluate the cost effectiveness of environmentally motivated subsidies with a view to maximising their environmental impact, while reducing overlaps and potential windfall profits; and improve budget reporting of such subsidies. | Environmentally motivated subsidies are often assessed, notably by SEPA, NIER and the Swedish National Audit Office. Subsidies for climate change mitigation have surged since 2015. Although some subsidies have proved effective in reducing greenhouse gas (GHG) emissions, there is scope to streamline them to avoid overlaps. Sweden has made progress on assessing the budget's contribution to environmental and climate objectives, notably through the update of the regulatory impact assessment ordinance and the development of guidance to help government agencies assess the climate impact of policy proposals. The Budget Act requires the government to report to Parliament on progress towards environmental goals in the budget bill. |
| Improve transparency in water pricing policy for different sectors with a view to more fully implementing the polluter- and user-pays principles; include environmental and resource costs in the calculation of cost recovery; and further promote more efficient delivery of water services | Water bills provide information on the unit price of consumption and the cost components of delivering public water supply. The financial costs of environmental measures are covered by water abstraction permit holders, where Land and Environmental Courts require them. For example, the largest hydropower companies have established the Hydroelectric Environmental Fund, |

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| through inter-municipal co-operation and, where appropriate, private sector participation. | which will allocate SEK 10 billion to improve water quality and hydrological connectivity in affected water bodies. Agricultural water users do not cover the full cost of their water use. There are no abstraction charges in Sweden. Such charges would help to reflect resource costs of water supply. |
| Further develop payment for ecosystem service programmes and extend the use of market-based approaches for reducing marine pollution, especially from nutrients and hazardous substances, e.g. through trading systems for nitrogen and phosphorous discharges. | The Swedish Agency for Marine and Water Management has examined the possibility of a trading system to reduce eutrophication and the preconditions for a system of compensation measures against eutrophication has been studied. These policies have not been implemented to date. |
| Consider how the EQO system could be made a more effective strategic framework for environmental policy, including by distinguishing the EQOs that mainly require domestic efforts from those requiring international efforts; setting short- and medium-term priorities among EQOs; and clearly defining economically feasible measures, and allocating sufficient resources, to achieve these priorities within definite timeframes. | Together with a goal "to pass on to the next generation a society in which major environmental problems have been solved", Sweden's environmental quality objectives (EQOs) provide long-term strategic orientation for environmental policy. Sweden does not expect to meet 12 EQOs out of 16 or the generational goal by 2030. Since 2009, 43 milestone targets have been adopted to specify concrete actions for achieving EQOs. Of the 24 targets whose target year had passed by 2023, almost half were deemed to have been achieved on time.<br>Established in 2015, the Environmental Objectives Council is mandated by the government to accelerate the achievement of EQOs in a cost-effective way. It comprises heads of 17 agencies, county administrative boards (CABs) and the Sámi Parliament with key responsibilities for delivering the generational goal and the EQOs. Each year, the Council reports to the government and can make policy suggestions, except on taxes.<br>Since 2010, the All-Party Environmental Objectives Committee has developed and suggested strategies, milestone targets and cost-effective policy measures in priority areas. In 2022, the government tasked the Committee with proposing a strategy for meeting Sweden's EU and international commitments on biodiversity and net GHG removals in the land-use sector. |
| Strengthen the Environmental Protection Agency's oversight of supervisory activities conducted by regional and municipal authorities; and establish a performance measurement system with a uniform set of input, output and outcome indicators and data reporting procedures. | Sweden has adopted a National Strategy for Environmental Supervision for 2022-25. Increased appropriations for licensing and guidance have supported more effective and uniform supervisory activities by regional and municipal authorities. However, CABs lack resources and municipalities have skill shortages. Although annual monitoring provides positive indications of compliance levels, outcome indicators would help to better assess the strategy's effectiveness. Since 2018, Environmental Collaboration Sweden has been facilitating the follow-up of the municipalities' supervisory activities. |
| Further expand marine protected areas (MPAs) with a view to meeting the Aichi target by 2020; establish effective management plans for all MPAs and allocate adequate resources to implement them; and assess the potential of market-based instruments (e.g. marine biodiversity offsets) to help finance the management of MPAs. | Sweden has designated 15% of marine areas under its jurisdiction for protection. It has achieved the 2020 Aichi target for marine and coastal areas (10%) but is not on track to meet the 2030 target of 30%. Only 4.5% of MPAs have completed Protected Area Management Effectiveness assessments required by the Convention on Biological Diversity. Additionally, not all Natura 2000 sites have effective management plans in place. In the three marine regions (the Gulf of Bothnia, the Baltic Proper and the Swedish parts of the Kattegat and the Skagerrak), CABs have developed plans to reach the national goal of an ecologically representative, coherent and functional network of MPAs. In November 2024, Sweden adopted a law on the marine environment which aims, among other things, at strengthening the protection of marine areas. |
| **Chapter 2. Climate change mitigation and negative emissions promotion** | |
| Develop a strategic action plan, including intermediate domestic targets, for achieving the 2030 and 2050 climate policy objectives; establish institutional arrangements to enhance inter-agency co-ordination for developing and implementing climate-related policies; strengthen the oversight of policy implementation, for example, by presenting an annual report to Parliament. | In 2017, the Swedish Parliament adopted a national climate policy framework comprising: i) the Climate Act and associated governance framework; ii) a long-term target of net-zero GHG emissions by 2045, mid-term targets for 2030 and 2040, and a specific target for the transport sector for 2030; and iii) an independent Climate Policy Council, which reviews the government's climate action annually. As part of the annual budget bill, the government must submit a climate report to Parliament showing progress towards the targets. The government published a climate policy action plan in 2023. |
| Strengthen the *ex ante* and *ex post* economic evaluation of climate-related measures and policies; promote the use of consistent guidelines for this purpose, including for a consistent shadow price of carbon; and consider fully the distributional impact of policies. | SEPA develops the use of economic analysis for environmental policy, in co-operation with other relevant government agencies. It has developed guidance for socio-economic analysis. In 2022, it published guidance to assess the impact of policies and measures on GHG emissions and removals. The Swedish Transport Administration develops socio-economic analysis in the transport sector. Its report "Methodology and cost-benefit analysis for the transport sector" estimates the shadow price of carbon. |

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| Continue to remove exemptions from carbon and energy taxes that are not justified on environmental, economic and social grounds. | Sweden has removed some tax breaks such as the carbon tax reduction for fossil fuel use in industries not covered by the EU Emissions Trading System, as well as energy and carbon tax reductions for diesel used in non-road vehicles in the mining industry. However, tax expenditures related to energy and carbon taxes (e.g. reduced energy tax for diesel used in motor vehicles and reduced energy and carbon taxes for diesel used in agriculture, fishing and forestry) represented almost 0.3% of annual GDP in 2022-23. |
| Promote greater integration of transport and climate policies, including by: ensuring that transport investments are consistent with climate policy objectives; reviewing the environmental effectiveness and economic efficiency of biofuels-support policy; and strengthening measures to reduce GHG emissions from heavy goods vehicles; accelerating the introduction of alternatives to private vehicles such as public transport and bicycle infrastructure. | Over 2010-22, investment in roads increased much faster than investment in rail infrastructure. In 2022, investment in transport infrastructure was dominated by roads (0.5% of GDP), although the share for rail (0.4% of GDP) was higher than in many other OECD countries. Over 2015-22, the government co-financed municipal and regional investments in infrastructure for public transport and cycling through urban environment agreements. New applications are no longer being accepted.<br><br>In 2018, Sweden introduced a biofuel blending obligation, which was to increase over time. In 2023, the obliged blending of biofuels into petrol and diesel was reduced from 7.8% and 30.5%, respectively, to 6% for both. In 2024, the government announced that the blending requirement for both petrol and diesel will increase to 10% in 2025.<br><br>Since 2015, the Climate Leap has supported investments in gas-powered heavy vehicles and charging infrastructure. In 2024, Sweden supported adoption of stricter $CO_2$ emission standards for heavy-duty vehicles in the European Union. Sweden applies a road toll to heavy-duty vehicles (above 12 tonnes) on the main roads, which varies with Euro standards and the number of axles. The charge is time-based but does not change with distance travelled. |
| Maintain the strong commitment to environment and climate in Sweden's development co-operation; ensure that environmental and climate considerations are systematically addressed in all aid investments and activities; and ensure that staff are trained and adequate resources are allocated for this purpose. | Over 2021-22, 26% of total bilateral allocable aid focused on climate change (compared with 31% on average for the members of the OECD Development Assistance Committee) with a greater focus on adaptation (25%) than on mitigation (14%). The 2023 climate action plan and the 2023 government reform agenda call for expanded and more effective climate aid, included through more focus on energy efficiency and effective emission reductions (including fossil-free energy) in major emission countries, including middle-income countries. |
| Reinforce efforts to develop and disseminate environmentally related technologies by streamlining funding programmes and scaling-up centres of research excellence; considering the introduction of binding environmental requirements in public procurement procedures; maximising the leverage of private capital; and continuing to assess the outcomes of policies intended to promote environmentally related innovation. | Sweden is consistently ranked among the top performers on the European Eco-Innovation Scoreboard. This reflects high government spending on research, development and deployment related to environment and energy, as well as robust patenting activity. Sweden is pioneering technology developments for carbon capture use and storage. Venture capital investments in climate tech start-ups and scale-ups increased significantly over 2019-23, contributing to enhanced industrial competitiveness both domestically and within the European Union. The Public Procurement Act (2016) encourages environmental considerations in public procurements, but it does not include any mandatory requirement to use green public procurement. Since 2016, the National Public Procurement Agency, has been providing support on all aspects of public procurement, including environmental considerations. |

*Source:* OECD secretariat based on country submission and findings of the 2025 EPR; OECD (2014), *OECD Environmental Performance Reviews: Sweden 2014*, OECD Environmental Performance Reviews, OECD Publishing, Paris, https://doi.org/10.1787/9789264213715-en.

# Chapter 1. Towards green growth

This chapter provides a brief overview of key environmental trends and progress towards Sweden's environmental quality objectives. It assesses the environmental effectiveness and economic efficiency of the environmental policy mix, including regulatory, fiscal and economic instruments and investment in environment-related infrastructure. It also examines the interaction between the environment and other policy areas with a view to highlighting the opportunities and barriers to enhance policy coherence for green growth.

## 1.1. Introduction

Sweden has an open, knowledge-based economy with high living standards, low inequality and good environmental quality. Over 2010-22, gross domestic product (GDP) in Sweden grew faster than in many OECD countries. After a relatively strong performance during and after the COVID-19 pandemic, GDP shrank marginally in 2023 due to low domestic demand. With lower inflation and interest rates, private consumption is projected to drive economic recovery in 2024 (+0.6%) and 2025 (+1.8%) (OECD, 2024a).

Sweden has rich reserves of timber, iron and other metals, as well as freshwater. Hydropower, nuclear power and biomass provide a large part of its energy supply. Sweden's economy is predominantly service based. Industry is led by exports and has traditionally focused on processing the abundant forest and mineral resources.

With a total area of 529 000 $km^2$ and 11 000 km of coastline, Sweden occupies about two-thirds of the Scandinavian Peninsula. More than two-thirds of its territory is flat and covered by forests. The countryside is dotted with nearly 100 000 lakes, and thousands of islands are located off its coast. The country is sparsely populated with 10.5 million inhabitants. Most Swedes live in the south, with roughly one-third in the metropolitan areas of Stockholm, Gothenburg and Malmö.

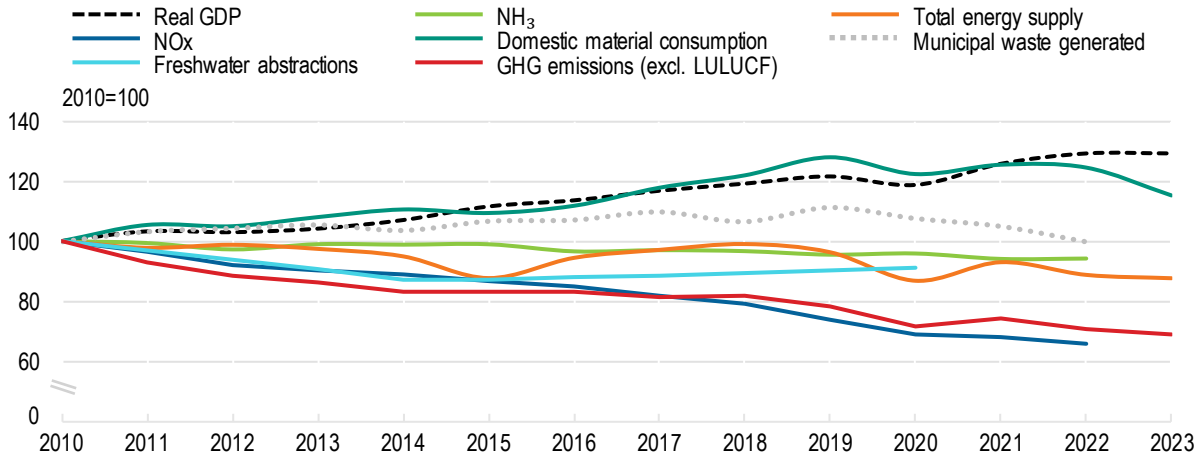
Since the end of the 19th century, average temperature in Sweden has risen by almost 2°C, twice as much as the global average. By the end of the century, it is projected to be 2-6°C higher than the 1961-1990 average (SHMI, 2022). Climate change will also result in increased precipitation by up to 30% by 2100, varying by location and scenario. Heavy rainfall and cloudbursts are already causing loss of life and significant economic damage. The frequency and magnitude of extreme weather events are expected to increase (MoCE, 2022).

## 1.2. Addressing key environmental challenges

### *1.2.1. Sweden has made progress on decoupling, but has some way to go to achieve its environmental quality objectives*

Over 2010-23, Sweden managed to decouple emissions of greenhouse gases (GHGs) and major air pollutants, energy supply and freshwater abstractions, and to a lesser extent municipal waste generation, from economic growth (Figure 1.1). Domestic material consumption grew faster than GDP until 2021, reflecting increased extraction of non-metallic minerals and metal ores. However, it has since declined with the contraction of the construction sector.

## Figure 1.1. Sweden managed to decouple environmental pressures from economic growth




Note: Break in the time series on municipal waste generation in 2020. GDP: gross domestic product; GHG: greenhouse gas; LULUCF: land use, land-use change and forestry; $NH_3$: ammonia; NOx: nitrogen oxides.
Source: IEA (2024), IEA World Energy Balances (database); OECD (2024), Environment Statistics (database); SEPA (2024), Sweden's emissions and removals of greenhouse gases, June.

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Together with a goal "to pass on to the next generation a society in which major environmental problems have been solved", Sweden's environmental quality objectives (EQOs) provide long-term strategic orientation for environmental policy (OECD, 2014).

Sweden is closer to its clean air and non-toxic environment targets than it was in 2012 (Table 1.1). However, 12 of 16 EQOs and the generational goal are not expected to be reached by 2030. The negative trends in the climate (Chapter 2) and biodiversity objectives are a cause for concern. Since 2009, 43 milestone targets have been adopted to specify concrete actions for achieving EQOs. Of the 24 targets whose target year had passed by 2023, almost half were deemed to have been achieved on time (SEPA, 2023a).

### Table 1.1. Most environmental quality objectives are not expected to be met by 2030

| | 2023 | | 2012 | |
|---|---|---|---|---|
| Environmental quality objectives | Prospect of achieving the goal by 2030 | Trend | Prospect of achieving the goal by 2020 | Trend |
| Reduced climate impact | (No) ✗ | ↓ | ✗ | ↓ |
| Clean air | (Close) + | ↑ | ✗ | ↑ |
| Natural acidification only | ✗ | ↑ | ✗ | ↑ |
| A non-toxic environment | + | → | ✗ | → |
| A protective ozone layer | (Yes) ✓ | → | ✓ | ↑ |
| A safe radiation environment | + | → | + | → |
| Zero eutrophication | ✗ | → | ✗ | → |
| Flourishing lakes and streams | ✗ | → | ✗ | → |
| Good quality groundwater | ✗ | → | ✗ | ↑ |
| A balanced marine environment, flourishing coastal areas and archipelagos | ✗ | → | ✗ | → |
| Thriving wetlands | ✗ | → | ✗ | ↓ |
| Sustainable forests | ✗ | ↓ | ✗ | → |
| A varied agricultural landscape | ✗ | → | ✗ | ↓ |
| A magnificent mountain landscape | ✗ | ↓ | ✗ | ↑ |
| A good built environment | ✗ | → | ✗ | → |
| A rich diversity of plant and animal life | ✗ | ↓ | ✗ | ↓ |

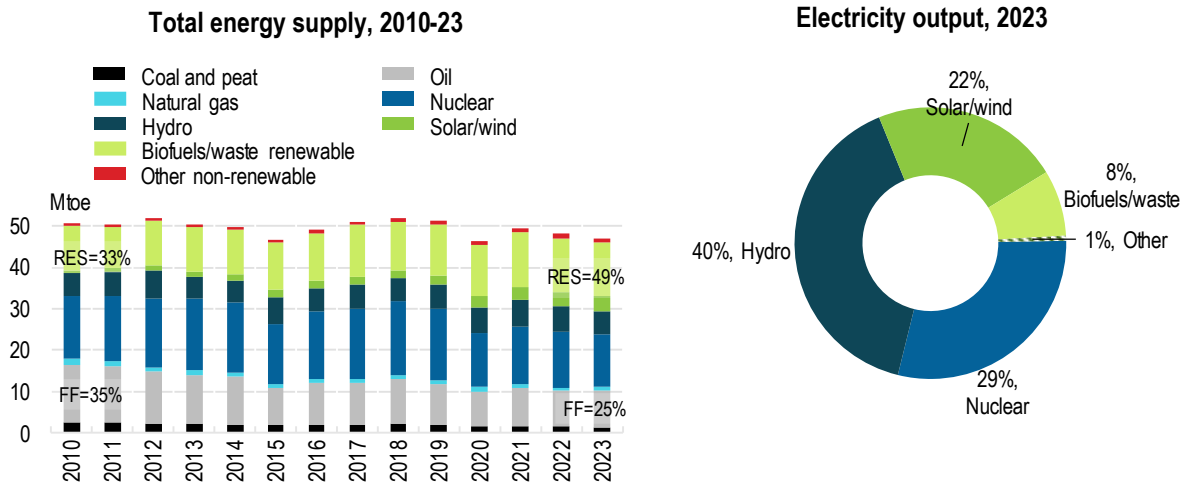
Source: SEPA (2023, 2012), In-depth evaluation of Sweden's environmental objectives.

#### *1.2.2. The economy is more carbon efficient*

*The energy mix has further shifted to renewables*

The Swedish economy has one of the lowest GHG emission intensities in the OECD. In the past decade, the energy mix has further shifted to renewables (Figure 1.2). In 2023, fossil fuels accounted for 25% of Sweden's total energy supply, the second lowest share in the OECD. Electricity generation is almost fossil free. Thanks to its production of nuclear power, hydropower, bioenergy and, increasingly, wind power, Sweden is highly self-sufficient. It remains dependent on imports of fossil and nuclear fuels.

## Figure 1.2. Renewable energy has developed further, while electricity generation is almost fossil free




Note: Breakdown of total energy supply excludes electricity trade. RES: renewables. FF: fossil fuels.
Source: IEA (2024), IEA World Energy Balances (database).

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In 2020, renewable energy accounted for 60% of gross final energy consumption, the highest share in the European Union, well above the target of 49% set for Sweden in the EU Renewable Energy Directive. The updated National Energy and Climate Plan projects to reach 67% of renewable energy in gross final energy consumption by 2030 (MoCE, 2024a). This is below the 76% recommended by the European Commission but is the most ambitious target among EU countries (EC, 2023a). In 2023, Sweden replaced its target of 100% renewable electricity generation by 2040 with a target of 100% fossil-free electricity production (Chapter 2).

The Swedish economy is more energy intense than the OECD Europe average due to its low population density, cold winters, and pulp and paper and metals industries. Energy consumption fell by 10% over 2010-22 mainly due to structural changes in industry, and improvements in the energy efficiency of manufacturing processes, vehicles and residential buildings. The industry (41%), residential (23%), transport (21%) and service (13%) sectors are the largest energy users. The residential and service sectors mainly use energy from electricity and district heating. Industry primarily uses biomass and electricity, while transportation is mainly based on oil products and biofuels. Sweden has met its 2020 target under the EU Directive on Energy Efficiency but is not on track to meet the more stringent requirement for 2030 (MoCE, 2024a).

### *Swedes enjoy good air quality, but efforts are needed to reduce ammonia emissions*

Air pollution levels in Sweden are among the lowest in the OECD (OECD, 2024b). Nevertheless, the country continues to record exceedances of EU air quality standards for particulate matter ($PM_{10}$) and nitrogen dioxide ($NO_2$) in 2022 (MoCE, 2024b) and for $PM_{10}$ and carbon monoxide (CO) in 2023 (SEPA, 2024a). Around 6 700 people die prematurely each year in Sweden, mainly due to fine particulate matter and $NO_2$ pollution from long-range transport of pollution, road traffic (vehicle exhaust and wear particles) and domestic wood burning (Gustafsson et al., 2022).

Sweden met its 2020-29 emission reduction commitments under the National Emission Ceiling Directive, except for ammonia ($NH_3$). Since the mid-2010s, stricter emission standards, fuel switching, improved

abatement technologies and the charge on NOx emissions have helped to further reduce air pollutant emissions. However, additional efforts are needed for $NH_3$ and NOx emissions to meet its 2030 targets. Among the measures of the updated National Air Pollution Control Programme (NAPCP) (MoCE, 2024b), the broadening of the NOx charge to recovery and lye boilers in the pulp and paper industry and the introduction of a distance-based charge for heavy goods vehicles (Section 1.4.4), have yet to be implemented. Reducing $NH_3$ emissions will require new measures, notably to improve manure management. The NAPCP will not be enough to reach the 2030 target for $NH_3$ (SEPA, 2024b). The proposed subsidy (SEK 100 million for 2025-27) to reduce $NH_3$ emissions from the handling of stable manure could help narrow the gap (MoF, 2024a).

### *1.2.3. Sweden needs an action plan to halt and reverse biodiversity loss by 2030*

The National Biodiversity Strategy and Action Plan (NBSAP) is outdated. Until 2020, the ten milestone targets related to biodiversity[1] and the Act on Biodiversity and Ecosystem Services (Gov. Bill 2013/14:141, adopted in 2014) formed the main strategy for biodiversity. Parties to the Convention on Biological Diversity (CBD) have committed to update their NBSAPs by the 16th meeting of the Conference of the Parties (COP 16) in October 2024 (CBD, 2024).

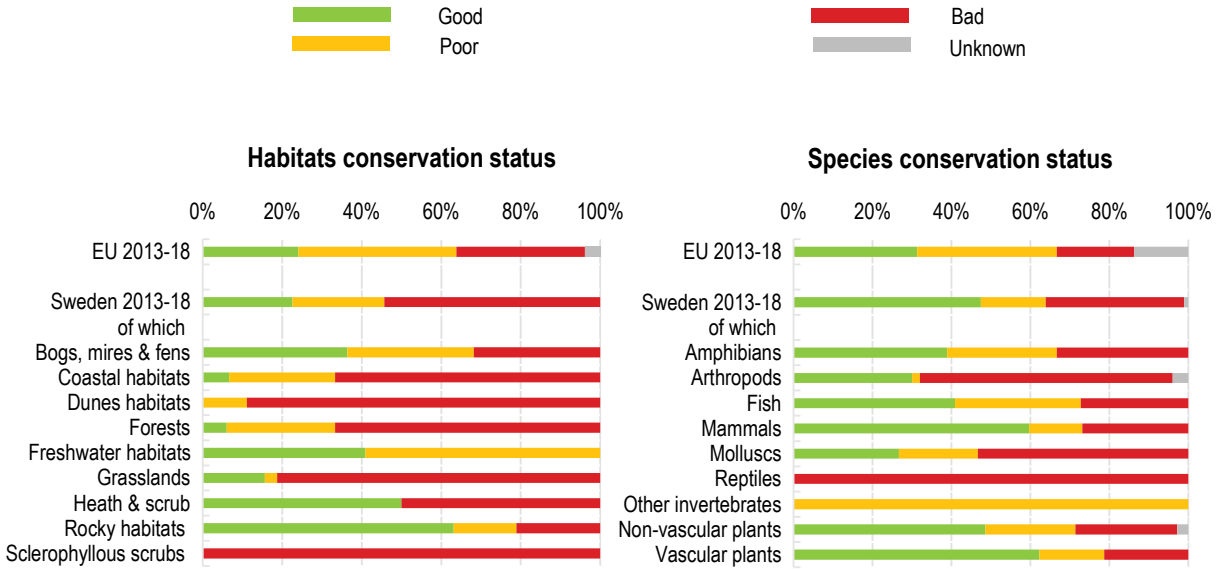
Sweden has not yet defined milestone targets or specified concrete actions to meet the requirements of the CBD's Kunming-Montreal Global Biodiversity Framework, the EU Biodiversity Strategy 2030 and the EU Nature Restoration Law (SEPA, 2023b). The government has tasked the All-Party Environmental Objectives Committee with proposing a strategy for meeting Sweden's EU and international commitments on biodiversity and net GHG removals in the land use sector. However, its proposals will come after COP 16. In June 2024, Sweden was one of the six EU countries to vote against the Nature Restoration Law, on which it had built a compromise during its EU presidency in the first half of 2023.

#### *Biodiversity loss has continued*

More than three-quarters of habitats and half of species of conservation importance[2] in Sweden are in a poor or bad state (Figure 1.3). The situation is particularly worrying for forest, grasslands, coastal habitats and dunes. Improvements have nevertheless been recorded for some species of amphibians, reptiles and mammals (SEPA, 2022a). Despite signs of recovery for certain species, the state of marine species and habitats remains critical, and their use is not sustainable (SwAM, 2023a). There was little or no improvement in the state of the Baltic Sea environment in 2016-21 (HELCOM, 2023).

Agriculture and forestry are the main pressures on terrestrial habitats (EEA, 2023). Marine habitats are affected by eutrophication and commercial fishing (SEPA, 2022a). Negative impacts of climate change are observed mostly notably in mountain areas and the Baltic Sea. Changes in temperature, ice cover and salinity are expected to further disrupt ecosystems. Increased precipitation and runoff are expected to exacerbate eutrophication.

## Figure 1.3. A significant share of habitats and species are in an unfavourable state




Note: The unit shown (share of assessments) refers to single assessments in one biogeographical region over 2013-18. Therefore, one species or habitat type that occurs in more than one biogeographical region can have more than one assessment. Sclerophyllous scrubs: Juniperus communis formations on heaths or calcareous grasslands.
Source: EEA (2021), Conservation status of habitat types and species: Datasets from Article 17, Habitats Directive 92/43/EEC reporting.

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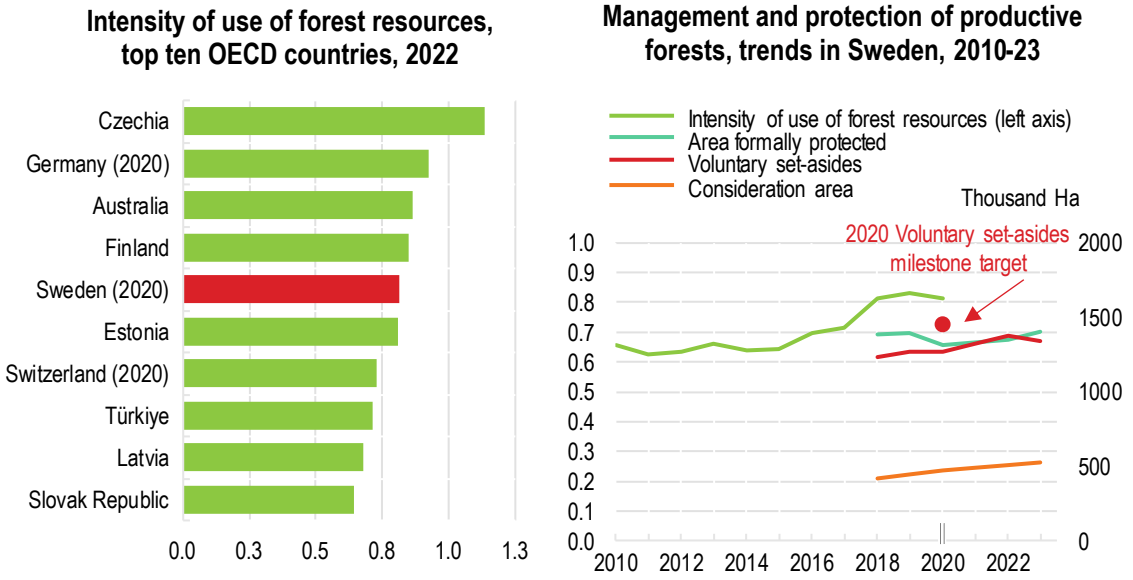
Sweden's history of intensive forestry and standardised clear-cutting practices have adversely affected forest habitats (Figure 1.3) (Figure 1.4). Long-term formal and voluntary protection of forests and environmental consideration during felling[3] have had positive effects but have not halted the loss of forest ecosystems (SFA, 2022). The country has not achieved its objective on sustainable forest for 2020 and is not on track for 2030 (Table 1.1) (Figure 1.4). Only 9% of forests and 6% of productive forests[4] are formally protected; 5% are voluntary set-asides and 2% are consideration patches (in productive forests[5] these percentages are 6% and 2%, respectively) (SCB, 2024a). Productive forests that are not formally protected, most of which are privately owned, are subject to higher rates of loss, degradation and fragmentation (SEPA, 2022b). Unprotected boreal old-growth forests are being cut at a rate that could lead to their complete loss by the 2070s (Ahlström and Canadell, 2024). Forestry practices need to be adapted to better support biodiversity, especially in areas of high conservation values.

Production and environmental objectives are not well balanced in forestry policy, which favours voluntary biodiversity conservation (SFA, 2022). When owners of forests with high conservation values notify the Swedish Forest Agency of felling, the Agency often applies the Forestry Act instead of applying the Environmental Code. Since the Forestry Act's restriction on encroachment is often not sufficient to preserve the environmental values of forests with high conservation values, this often results in large parts of the core values being felled and the natural values in these parts being destroyed (SEPA, 2022b; SFA, 2022). Ongoing efforts to map high conservation value forests (Jonsson, B.G. et al., 2024) should be pursued to facilitate compliance with the Environmental Code. Predictable and stable funding are also needed to ensure better oversight; advise landowners and compensate them for setting aside forest land; and manage nature conservation in protected areas (SFA, 2022).

## Figure 1.4. Logging intensity has increased sharply, while protected forest areas are growing slowly




Note: Intensity of use of forest resources: ratio of fellings to productive capacity (gross increment). Sweden 2020: 2018-22 average. Productive forests: with a yearly wood volume increment more than 1 $m^3$/ha. Formally protected forests: national parks, nature reserves, habitat protection areas, nature conservation agreements and Natura 2000 sites governed by laws and regulations. Voluntary set-asides: smaller areas for which the landowner has voluntarily decided not to carry out measures that can damage natural values, the cultural environment or social values. These areas must be documented in a management plan. Consideration patches: smaller areas that have been designated for regeneration felling, voluntarily by the landowner or pursuant to the Forestry Act. Comparisons of protected areas over time must be made with caution.
Source: OECD (2023), OECD Environment Statistics (database); SLU (2024), Productive forest land: Annual volume increment; SCB (2024), Formally protected forest land, voluntary set-asides, consideration areas and unproductive forest land.

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Agricultural area accounts for 7% of land area, predominantly located in the southern regions due to favourable climatic conditions (SCB, 2023). Sweden has a limited number of crops and a large dairy sector. Around half of the agricultural area has natural or other area-specific constraints. In the centre and south of the country, large cropping farms dominate, while in the north there are mainly small livestock farms. Almost 85% of agricultural area is arable land and 15% permanent pasture. After a drastic decline in agricultural land for most of the 20th century, arable land has continued to fall, albeit more slowly, while pasture has increased slightly since 2014. The Common Agricultural Policy (CAP) 2014-22 has helped maintain land management and grazing in marginal areas and pastures, preventing land abandonment – a key threat to biodiversity (SBA, 2022; SEPA, 2022a). However, it has not been sufficient to reverse the long-term loss of landscape diversity and has contributed to further intensification in areas already subject to intensive agriculture.

Public support and management practices should be adapted to the diverse geographic context, particularly for grasslands in the Natura 2000 network. About 30 000 of 80 000 ha of grasslands of special conservation interest requiring management were not included in payment schemes over 2014-22, mainly due to a shortage of farmers and grazing animals (SEPA, 2022a). On the other hand, the CAP has supported intensive grazing in some Natura 2000 sites, harming target species and habitats on the Gotland Island (Kindvall et al., 2022). Sweden's 2023-27 CAP Strategic Plan supports biodiversity mainly through compensation for management of semi-natural pastures and organic farming. In 2022 Sweden had the third largest area (20%) under organic farming in the European Union (Eurostat, 2024a). However, like plans in other EU countries, Sweden's 2023-27 CAP Strategic Plan is not sufficient to protect biodiversity

(EC, 2023b; 2022a). Although comparisons should be made with caution, financial allocations to the biodiversity objective (24%) and the share of Natura 2000 area under supported commitments (3%) seem low compared to the respective EU averages (29% and 19%) (EC, 2024a). In addition to CAP funding, the budget bill for 2025 proposed to allocate SEK 120 million for the restoration and management of semi-natural pastures and meadows over 2025-27 (MoF, 2024a).

Sweden has good knowledge of protected habitats and species, but large gaps remain for forest habitats outside protected areas; for certain grassland habitats, freshwater and marine habitats; and for many species (SEPA, 2021). Long-term, stable support for ecosystem mapping and assessment would be key to mainstream biodiversity in sectoral policies and align biodiversity conservation efforts with EU policies (EC, 2022b). With the exception of the production of materials and bioenergy from trees, there is no monetary valuation of the 20 or so ecosystem services linked to the forests in Sweden (SFA, 2022). Such an assessment was carried out in Slovakia, making a strong case for biodiversity conservation (Box 1.1).

### Box 1.1. The value of ecosystems and their services in Slovakia

Slovakia mapped its ecosystems using geographic information systems and field surveys. It examined the capacity of Slovak ecosystems to deliver 11 regulatory, 10 provisioning and 2 cultural services. The monetary value of each ecosystem service was ascertained using the value transfer methodology. The value of ecosystems was estimated at about twice Slovakia's GDP, with forests making a major contribution to these benefits. However, due to ecosystem degradation, Slovakia loses about EUR 20 billion/year (equivalent to 20% of GDP) in potential ecosystem service value.

Source: Černecký et al. (2021), "Value of ecosystems and their services in Slovakia"; OECD (2024), Environmental Performance Reviews: Slovak Republic.

*Sweden is not on track to meet the 2030 targets for protected areas*

Sweden has designated 15% of land and marine areas under its jurisdiction for protection. It has achieved the 2020 Aichi target for marine and coastal areas (10%). It has not achieved the target for terrestrial areas (17%), although the areas under strict protection represent a larger share of its territory than in most other European countries. The country is not on track to meet the 2030 target of 30% (Figure 1.5).

Further efforts are needed to ensure the ecological representation, effectiveness, functionality and connectivity of the protected areas network (GoS, 2019). Formal protection combined with compensation programmes for landowners would help safeguard threatened habitats. Increasing formal protection of sub-montane, boreal, continental and alpine forests is necessary to halt their loss (SEPA, 2021).

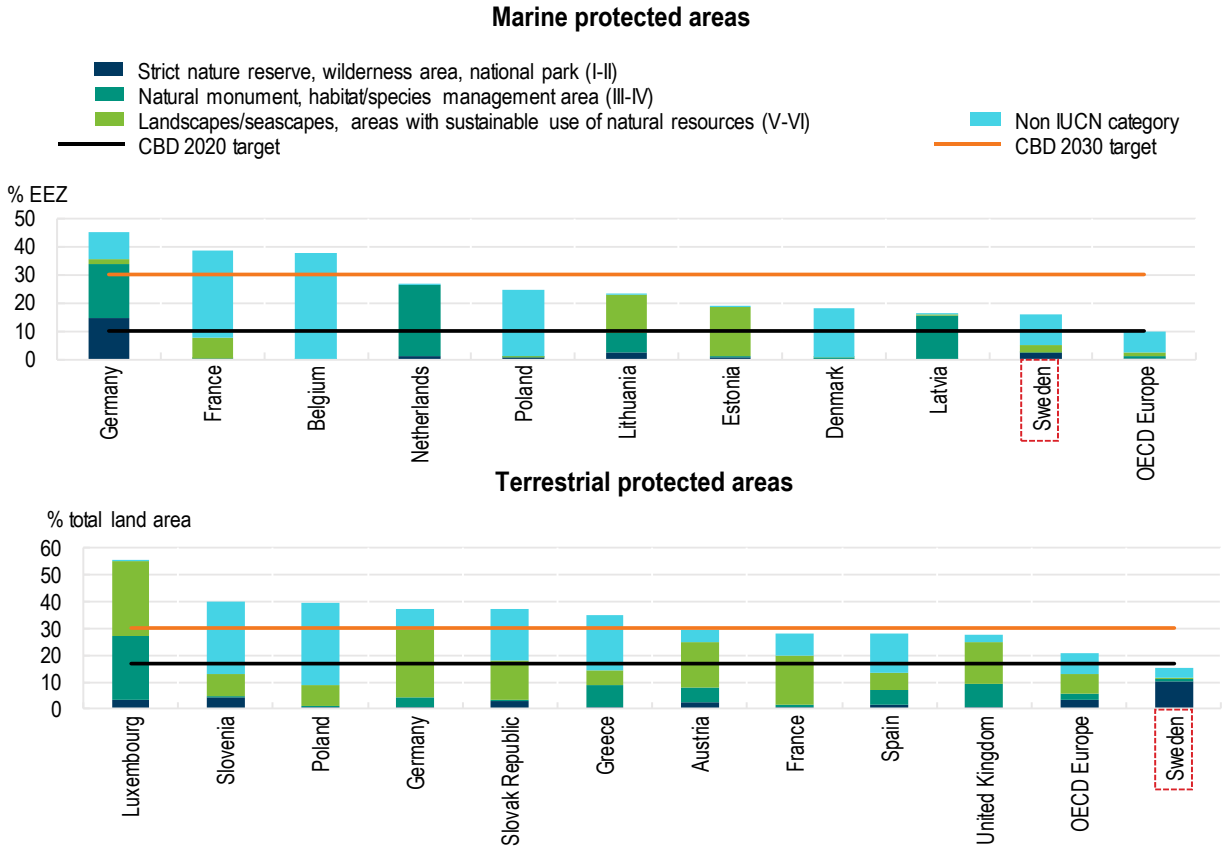
About 3 000 management plans need to be updated. Management strategies and guidelines are rarely comprehensive and the evidence-base for conservation measures and their priority varies at national and regional levels. Country administrative boards (CABs) and the Swedish Environmental Protection Agency (SEPA) aim to create a centralised database of conservation plans to support municipal land-use planning (SEPA, 2021).

Only 16.2% of terrestrial and 4.5% of marine protected areas have completed Protected Area Management Effectiveness assessments required by the CBD (UNDP/SCBD, 2021). These are essential to identify and address weaknesses and ensure compliance with EU directives. Additionally, not all Natura 2000 sites, particularly those at sea, have effective management plans in place (SEPA, 2021). In November 2024, Sweden adopted a law on the marine environment which aims, among other things, to strengthen the protection of marine areas. Sweden faces EU infringement procedures regarding its wolf hunting regime,

the sufficiency of its Natura 2000 network designation and the protection of harbour porpoises from fishing activities (EC, 2022b).

### Figure 1.5. Sweden is not on track to meet its 2030 targets for protected areas

Extent of protected areas by IUCN category, top ten OECD Europe countries and Sweden, 2022




Note: IUCN: International Union for Conservation of Nature. CBD: Convention on Biological Diversity. EEZ: exclusive economic zone. Some protected areas have not been designated under a specific international category. This includes areas with international or regional labels (like Natura 2000) that might actually fit an IUCN standard category. Because they have not been officially classified yet, they are listed as "No IUCN Category".
Source: OECD (2023), OECD Environment Statistics (database).

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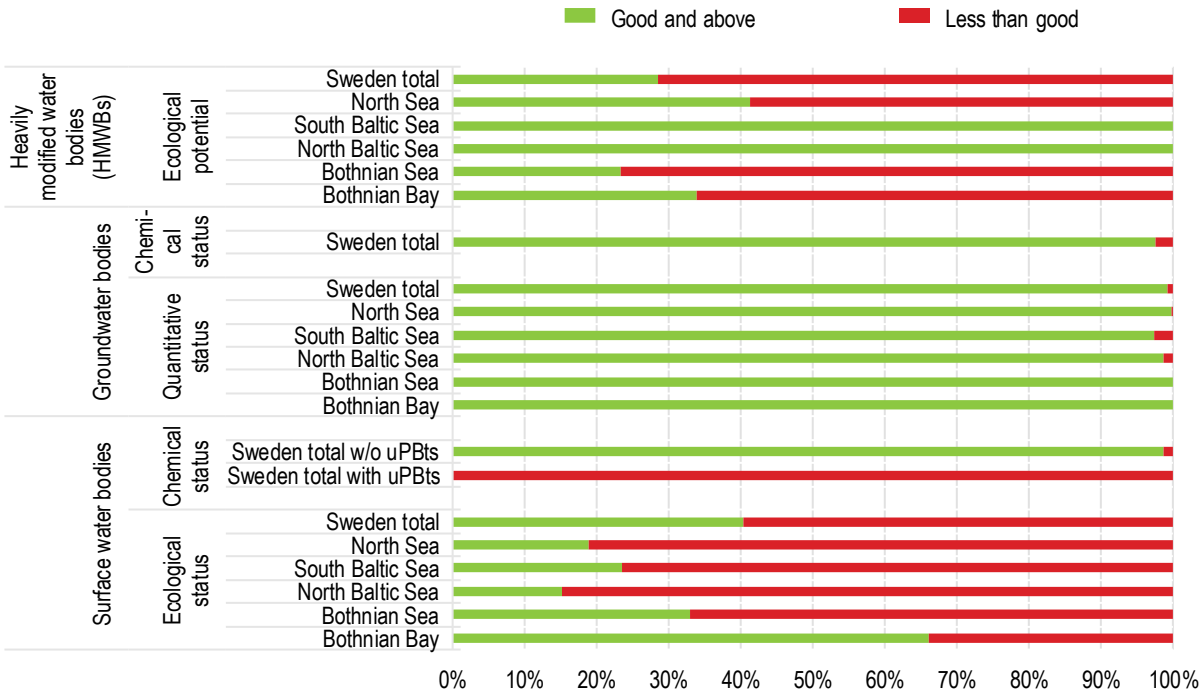
#### *1.2.4. Reaching ambitious water quality objectives requires more cost-effective policies and faster progress*

Only 40% of surface water bodies have good ecological status and none have good chemical status when considering mercury and other ubiquitous substances[6] (Figure 1.6). The status of surface water is better in the north than in the south, where population density and agricultural intensity are higher. Hydromorphological changes, notably from hydropower, as well as diffuse pollution, are the main pressures on surface water bodies. Eutrophication, caused by excess nutrients from agriculture, wastewater and atmospheric deposition, remains a major challenge in Swedish freshwater and marine environments. Excess nutrients cause various impacts, such as algal blooms and about 30% of the Baltic

Sea is either affected by oxygen deficiency or completely lacks oxygen, negatively affecting marine ecosystems (SwAM, 2023b). Although the status of most groundwater bodies is assessed as positive, the national objective is not on track due to insufficient evidence to support this assessment (Lång et al., 2022).

### Figure 1.6. Further efforts are needed to achieve good water status

Status of freshwater bodies by river basin district




Note: Data cover 2017-21. uPBTs: ubiquitous, persistent, bioaccumulative and toxic substances, i.e. mercury, brominated diphenyl ethers, tributyltin and certain polyaromatic hydrocarbons.
Source: VISS (2024), Water Information System for Sweden; WISE (2021), Freshwater Information System for Europe.

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In 2010, Sweden set the ambitious goal of "Zero eutrophication" by 2020, which was not met. Nutrient balances (nitrogen and phosphorous) declined between 2010-19 (OECD, 2024c). The Local Engagement for Water (LEVA) initiative established in 2018 has supported action to reduce eutrophication at local level. However, the overall pace of measures implemented to reduce eutrophication is too slow to reach the 2027 deadline of the EU Water Framework Directive (WFD) (SwAM, 2021). Swedish water authorities estimate that implemented measures to reduce nitrogen and phosphorous in agriculture have not been sufficient and have not always been well targeted (Vattenmyndigheterna, 2024). For phosphorous, the effect of the implementation of measures is low (about 23%) compared to what is required to reach good status. Moreover, some measures were poorly targeted in water bodies that do not require action. For nitrogen, the assessment is more positive, with a much higher rate (about 85%) of impact of measures implemented as a share of the impact of possible measures; however, some of these have been incorrectly targeted (Vattenmyndigheterna, 2024).

Extending the use of economic instruments such as taxes, trading schemes or compensation measures to address eutrophication would improve cost effectiveness. The current policy mix to address eutrophication relies to a large extent on voluntary measures supported by financial grants, from the EU CAP and

government grants to co-finance local water management initiatives (LOVA grants). The approach does not promote effective prioritisation or cost effectiveness. Moreover, funding programmes are not well-designed to meet water quality objectives, and the level of funding is insufficient and lacks long-term stability. Pilot programmes to support co-ordination of measures at catchment scale via Catchment Officers have proven effective at increasing the rate of uptake of implementation and better prioritisation of measures; these efforts should be continued. Sweden has studied options to improve cost effectiveness and efficiency of reducing diffuse pollution. A proposal for an emissions trading system was developed, but the government has not taken further action. Ecological compensation measures could be a first step towards a trading system. Such measures are being investigated but may require changes in regulations to implement. A tax on mineral fertilisers (targeting nitrogen and phosphorus) had been in place for 25 years before it was repealed in 2009 (Andersen, 2018).

### *Hydropower production should be better balanced with the benefits of freshwater ecosystem services*

Hydropower accounts for an important share (40%) of electricity production (Figure 1.2). There are nearly 11 000 dams in flowing water, of which 2 000 are active hydropower plants (SwAM, 2023b). Large-scale facilities play a pivotal role in enabling the expansion of wind and solar energy by maintaining the balance of the electricity system. Hydropower is also the most extensive pressure on lake and river water bodies in Sweden (SwAM, 2024) and impacts from hydropower and dams are one of the main threats to biological diversity (SwAM, 2023c). These impacts need to be addressed to achieve good ecological status under the WFD and to achieve the national objective of “Flourishing lakes and streams”, among others. About 90% of active hydropower concessions were granted decades before modern environmental legislation was enacted (Rudberg, 2013); hence, many older permits for hydropower lack or have limited environmental considerations, especially for minimum environmental flows and fish passages. About 12% of hydropower installations produce 98% of produced electricity (SwAM, 2023b). However, small-scale hydropower installations can still have significant environmental impacts despite low electricity production.

The revision of the legal framework for hydropower in 2019 was a major development to adapt facilities to maximise benefits to the freshwater ecosystems, while providing an efficient supply of hydropower. The National Plan for Modern Environmental Provisions for Hydropower calls for Land and Environmental Courts to reassess permits in line with the WFD. Over 75% of hydropower plants have signed up to the national plan for re-examination.[7] Facilities affecting Natura 2000 sites have been prioritised. The Hydroelectric Environmental Fund, established and financed by the largest hydropower companies, will allocate SEK 10 billion (EUR 1 billion) to improve water quality and hydrological connectivity in water bodies and river basins affected by hydropower. The process began in 2022, with a 20-year time horizon. However, the schedule has been postponed several times to better assess potential negative consequences on hydropower production. The reassessment process is expected to resume on 1 July 2025. Measures for water bodies affected by hydropower are not expected to be completed before 2045, long after the deadline of 2027 to reach WFD objectives.

The reassessment of permits for hydropower weighs heavily towards protecting electricity production when facing trade-offs with environmental objectives. The government introduced an obligation for water management to fully use all the opportunities provided by EU law regarding exemptions and declaring water as heavily modified (GoS, 2020) with the aim that the modernisation of the hydropower should mean as little loss of production as possible (GoS, 2020).[8] In August 2024, the government proposed legislative amendments to enshrine this approach in law, requiring the full use of exemptions and derogations in reaching environmental objectives allowed under the WFD (MoCE, 2024c). To support efforts to reach WFD objectives and Sweden’s broader EQOs, Sweden should clarify guidance on the development of environmental standards in affected water bodies, ensuring a balance between the benefits of improvements in freshwater ecosystems and impacts on hydropower production. In addition, monitoring of

the impact of environmental measures and improving co-operation between hydropower facilities and water authorities would facilitate successful implementation of the national plan.

*Addressing increasing water scarcity calls for stronger controls on abstractions*

Despite overall water abundance, water scarcity has been an issue for some time in southeastern Sweden. It is also an emerging concern in other regions, with risk of shortage during dry summers (Swedish National Expert Council for Climate Adaptation, 2022). Sweden has abundant water resources and overall low water stress at national level: only 1% of renewable freshwater resources are withdrawn annually. Industry is the largest water user, accounting for 61% of abstractions in 2020, with public water supply accounting for 35% and agriculture 4% (SCB, 2022). However, increased variability of rainfall and higher temperatures due to climate change are expected to exacerbate scarcity, decreasing available supply and increasing demand for water. Sweden has also faced droughts, leading to negative impacts on agriculture (Copernicus, 2023). At the same time, numerous areas are prone to flooding, especially in the northern, central and southeastern parts of the country (Panahi et al., 2023). The Swedish National Expert Council for Climate Adaptation has identified water security as one of the top three risks related to climate change in the country. This highlights the need to continue to integrate climate adaptation into water management planning and policies.

To address drought and water shortages in the South Baltic Sea Water District, where water shortages are pervasive, Sweden developed the Partial Management Plan and Partial Action Programme 2022-27. The impact of water withdrawals in the district is so significant that environmental quality standards are not met or at risk of not being met in 81 groundwater bodies and 10 surface water bodies (The South Baltic Sea Water District, 2022). Measures in the Action Programme include development of guidance on water efficiency and water retention in landscapes, as well as stronger monitoring of water abstraction.

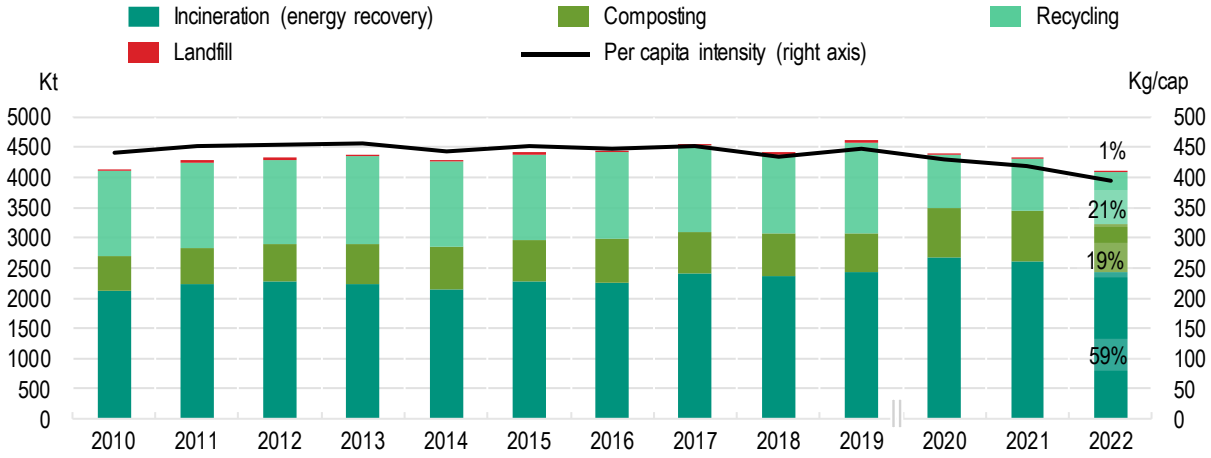
Sweden is one of only three OECD countries (along with Austria and Chile) that do not charge for water abstraction (Leflaive, 2024). A broader review and strengthening of the system for abstraction permits would be timely to adapt to current and emerging water challenges. While newer abstraction permits are time-bounded and consider minimum environmental flows, most older permits do not. The “exception rule” in the Environmental Code, intended to exempt smaller surface water abstractions from obtaining an abstraction permit, has been widely used, including for some large abstractions. Water used for household purposes or for an agricultural property does not require a permit.

More comprehensive monitoring of abstractions would support Sweden’s efforts to manage water scarcity and its impact on reaching EQOs. The Geological Survey of Sweden has developed maps to identify areas affected by shortage and drought in the future. However, many water abstractions are not known or monitored and national funding for environmental monitoring has decreased. Requirements for more comprehensive monitoring of abstractions is expected with forthcoming revisions to EU regulations.

### *1.2.5. Further progress is needed on the circular economy*

Swedes generate less municipal waste per capita than the EU average (395 vs. 513 kg/capita in 2022) (Eurostat, 2024b). After a decade of stability, municipal waste generation seems to have fallen in recent years although changes in the definition make recent trends difficult to interpret (Figure 1.7). The introduction of a landfill tax and bans on landfilling for combustible and organic waste in the 2000s led to a drastic reduction of municipal waste sent to landfill (OECD, 2014). Over 2010-19, increasing amounts of municipal waste were incinerated with energy recovery and, to a lesser extent, recycled (Figure 1.7).

## Figure 1.7. Municipal waste generation has fallen recently, but most is incinerated with energy recovery




Note: Break in the time series on municipal waste generation and management in 2020.
Source: Eurostat (2024), Municipal waste by waste management operations.

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As Sweden was already landfilling less than 1% of municipal waste in 2010, it is well ahead of the EU target of 10% by 2035. However, it did not meet the target of recycling 50% of municipal waste by 2020. Moreover, it is at risk of not meeting the 2025 target (Table 1.2).

## Table 1.2. Sweden risks missing its targets for waste reduction and recycling

Progress towards selected targets on waste management

| Target | 2022 performance | 2025 target | Prospects for meeting EU targets |
|---|---|---|---|
| Municipal waste prepared for reuse and recycled (%) | 40% | 55% | At risk |
| Total food waste per capita reduced from 2020 levels (%) | -3% | -20% | At risk |
| Recycling of overall packaging (%) | 60% (2021) | 65% | At risk |
| Recycling of plastic packaging (%) | 35% | 50% | At risk |
| Recycling of wooden packaging (%) | 28% (2021) | 25% | Achieved |
| Recycling of ferrous metals packaging (%) | 82% | 70% | Achieved |
| Recycling of aluminium packaging (%) | 82% | 50% | Achieved |
| Recycling of glass packaging (%) | 86% | 90% (70%) | At risk |
| Recycling of paper/cardboard packaging (%) | 78% | 85% (75%) | At risk |

Note: Selected targets of the National Waste Management Plan and Waste Prevention Programme 2018-24, the Waste Framework Directive (EU 2018/851) and Packaging Waste Directive (EU 2018/852). Sweden's recycling targets for glass and paper packaging are higher than the EU targets in brackets.
Source: Eurostat (2024), Municipal waste by waste management operations; Eurostat (2023), Recycling rates of packaging waste by type of packaging; SEPA (2024) Food waste in Sweden in 2022; SEPA (2023), Sweden's recycling of packaging.

To improve recycling, SEPA has proposed regulatory changes requiring increased sorting at source and improved separate collection of paper, plastic, metal and glass; better sorting of the reusable or recyclable

part of combustible waste before incineration; and better information to households and businesses by municipalities on how waste should be handled. SEPA also suggested considering an extended producer responsibility system for furniture and mattresses; improving data on waste from businesses; investigating economic instruments to stimulate demand for recycled materials; and improve conditions for repair, remanufacture and reuse; and supporting municipalities, particularly the smaller ones (SEPA, 2023c). The updated National Waste Management Plan and Waste Prevention Programme includes these and other proposals, stressing the importance of all stakeholders in implementation (SEPA, 2024c). In November 2024, the government initiated a reform of the waste legislation to prevent waste and increase material recycling (GoS, 2024a).

Municipalities are responsible for the collection and treatment of municipal waste. Since 2024, they also collect packaging from producers, although producers continue to bear the collection cost (Avfall Sverige, 2024). In 2023, 12% of municipalities implemented weight-based charges to incentivise waste reduction in households (Avfall Sverige, 2024).

At 6%, Sweden's circular material use rate under SDG 12 remains low – just over half the EU average in 2022 (Eurostat, 2023). The country adopted a Circular Economy Strategy (2020) prioritising plastics, textiles, food, the construction and building sector, renewable and bio-based raw materials, and innovation for critical metals and minerals. Sweden also adopted a Circular Economy Action Plan (2021), although it lacks concrete timelines for implementation (EC, 2022b).

Sweden has implemented several new economic instruments to promote a circular economy. In 2017, repair services were taxed at a reduced value added tax rate (from 25% to 12%) to extend the life of bicycles, shoes, leather goods and clothes. The rate was further reduced to 6% in 2022 but increased again to 12% in 2023 to increase uniformity of the tax system. In 2020, Sweden introduced a tax on incineration (excluding hazardous waste and bio energy) and gradually increased the rate from SEK 75/t to SEK 125/t in 2022. The tax was removed in 2023 to maintain the profitability of combined heat and power production, but it was lifted before the effect of the tax on recycling had been measured. Sweden also introduced a tax on plastic bags, which contributed to a 75% reduction in their use over 2020-22 (SEPA, 2024d). This tax was abolished in 2024. It was no longer deemed necessary as Sweden had exceeded the EU consumption target for plastic carrier bags. A tax on chemicals in certain electronic goods was introduced in 2017; its rate increased in 2019 and the deduction rules were changed in 2023. It is not always clear how environmental impacts are considered in decisions to modify or abolish these instruments. An inquiry on economic instruments for a more circular economy is under public consultation (GoS, 2024b).

## 1.3. Improving environmental governance and management

### *1.3.1. Sweden has decentralised environmental governance with many agencies*

Sweden is a unitary state with a decentralised governance system including 21 counties and 290 municipalities. The municipalities have extensive autonomy in implementing national policies and legislation. Higher-level authorities generally do not have the mandate to direct subnational and local governments. Rather, they employ a range of guidance and co-ordination mechanisms to ensure consistent policy implementation nationwide.

In 2022, the Ministry of the Environment was merged with the Ministry of Enterprise and Innovation to become the Ministry of Climate and Enterprise (MoCE). The MoCE is responsible for matters relating to climate, the environment, energy, enterprise, innovation and radiation safety. It oversees 36 government agencies, including SEPA, which co-ordinates and implements environmental policy; the Swedish Agency for Marine and Water Management (SwAM); the Swedish Energy Agency; and the Swedish Research Council for Sustainable Development (Formas), which supports research and innovation in the fields of

the environment, agricultural sciences and spatial planning. After ten years of growth in the budget of environmental agencies, the government has reduced their appropriations since 2022.

Other central agencies with key environmental responsibilities are the National Board of Housing, Building and Planning; the Swedish Board of Agriculture; the Swedish Forestry Agency; and the Swedish Transport Administration under the Ministry of Rural Affairs and Infrastructure.

At the regional level, CABs – central government agencies headed by appointed governors – have major environmental permitting, compliance monitoring and enforcement responsibilities. Locally, municipalities are responsible for spatial planning, public service provision (water supply, sanitation and waste management), and environment and health protection.

### *1.3.2. The country has taken steps to better co-ordinate compliance monitoring and enforcement*

Sweden has established various horizontal and vertical co-ordination mechanisms such as the Supervision and Regulation Council, the Environmental Collaboration Sweden network, the Environmental Objectives Council (Box 1.2), and inter-municipal environmental agencies. Nonetheless, the previous Environmental Performance Review highlighted a lack of consistency and an uneven playing field across regions, and particularly across municipalities, in the application of environmental legislation (OECD, 2014).

#### Box 1.2. The Environmental Objectives Council to improve horizontal co-ordination

Established in 2015, the Environmental Objectives Council is mandated by the government to accelerate the achievement of environmental objectives in a cost-effective way. It comprises heads of 17 agencies, county administrative boards and the Sámi Parliament with key responsibilities for delivering the generational goal and the environmental quality objectives. Each year, the Council reports to the government and can make policy suggestions, except on taxes.

Priorities for 2023-26 include: a framework for national planning; collaboration for a sustainable food system; health as a driver for environmental goals and sustainable development; circularity in the material flows of the climate transition; carbon sequestration and biodiversity in land-based ecosystems. The Council will submit its final report in 2026.

Source: Environmental Objectives Council, www.sverigesmiljomal.se/miljomalsradet.

The country has strengthened SEPA's oversight by adopting a National Strategy for Environmental Supervision for 2022-25 (SEPA, 2024e). The strategy focuses on seven areas (waste, contaminated areas, health protection, chemicals control, environmentally hazardous activities, nature and water activities) covering the Environmental Code. Increased appropriations for licensing and supervisory guidance have supported more effective and uniform supervisory activities by regional and municipal authorities (SEPA, 2024f). However, CABs lack resources for inspections and municipalities have difficulty recruiting and retaining staff with the right skills (SEPA, 2024g). Although annual monitoring of the strategy provides positive indications of compliance levels, outcome indicators would help to better assess its effectiveness. Since 2018, Environmental Collaboration Sweden has been facilitating the follow-up of the municipalities' supervisory activities, creating a base for more equal assessment and improved supervision (Environmental Collaboration Sweden, 2024).

### *1.3.3. Sweden is a front runner in green budgeting*

Sweden is one of the best performing OECD countries in terms of green budgeting practices (OECD, 2024d). The Budget Act requires the government to report to Parliament on progress towards environmental goals and the Climate Act requires a separate report on climate mitigation progress to be attached to the budget bill (Pojar, 2023). The country has made progress on assessing the budget's contribution to environmental and climate objectives, notably through the update of the regulatory impact assessment ordinance (2024:183) and the development of guidance to help government agencies assess the climate impact of policy proposals (SEPA, 2024h). However, the climate report highlights inconsistencies between fiscal and climate policies: the 2024 budget bill will lead to increased GHG emissions in 2024 (MoF, 2023).

There is still room for improvement in assessing the climate impact of reforms, which the government plans to do in future budget bills (MoF, 2023). The 2024 budget bill lists the main measures with a positive and negative impact on GHG emissions. However, it does not present the total allocated to green and brown measures. The bill provides examples of tax expenditure with a negative impact, but their total amount is not indicated in the climate report, although the information exists in the report of tax expenditure (MoF, 2024b) (Section 1.4.4).

## 1.4. Promoting investment and economic instruments for green growth

### *1.4.1. A green industrial revolution was launched*

A large share of Swedish firms views the climate transition as an opportunity (43% vs. 29% in the European Union) (EIB, 2024). In 2015, ahead of the United Nations Framework Convention on Climate Change Conference of the Parties (COP 21) in Paris, the government initiated “Fossil Free Sweden”. Through this co-operation platform, Sweden intended to accelerate the climate transition by identifying business opportunities and barriers to decarbonisation. As part of Fossil Free Sweden, 23 industries have produced roadmaps for fossil-free competitiveness, including steel, cement, transportation and electricity. A green industrial revolution was launched across the country, notably in the northern regions (OECD, 2023a) (Chapter 2).

The green revolution promises renewed growth in Sweden’s remote northern regions after decades of depopulation (OECD, 2023a). However, this will require significant investment in electricity generation and grid, housing and public infrastructure. Labour and skill shortages, competing land uses and lengthy permitting processes must be overcome. The OECD recommended streamlining and improving co-ordination of the environmental permitting process, ensuring early-stage public consultation and participation, including of the Sámi people (Box 1.3); allocating a share of wind power profits to host municipalities; ensuring a holistic approach to skills for the green transition; and investing in public infrastructure and housing (OECD, 2023a; 2021) (Chapter 2).

### Box 1.3. Effective participation of the Sámi people in the green industrial revolution

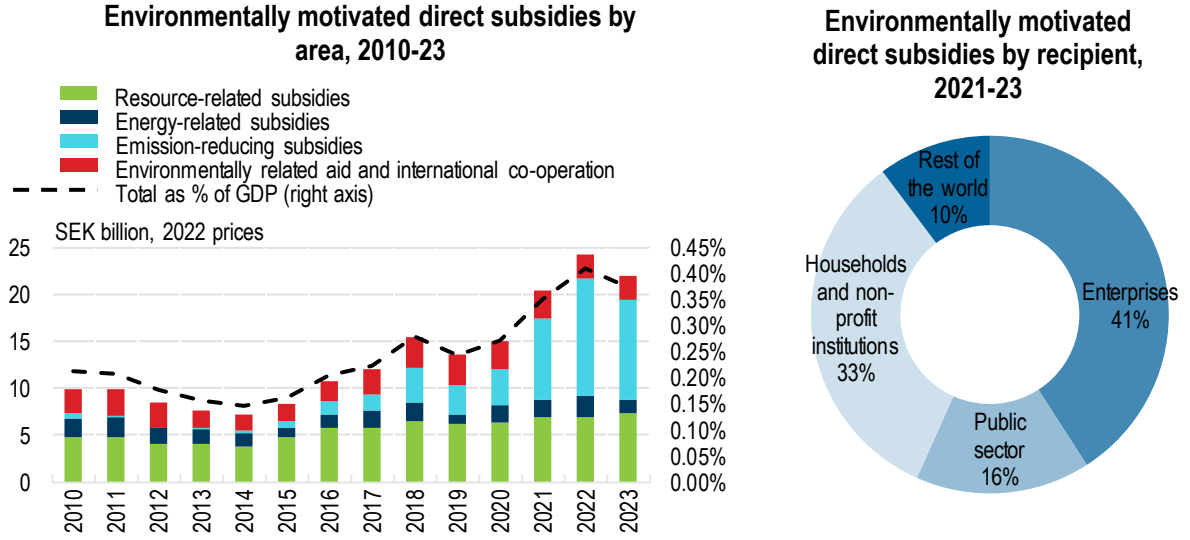
The green industrial revolution in northern regions is creating conflicts with the traditional land use of the Sámi people. The Constitution and the National Minorities and Minority Languages Act protect and promote the preservation of Sámi culture. The 2022 Act on Consultation (2022:66) requires the government and local authorities to consult Sámi representatives on issues significant to the Sámi people. However, in practice, the law does not always lead to effective consultation of the Sámi in decisions that affect them, or to their free, prior and informed consent. Sweden has yet to adopt adequate measures to address or mitigate the potential adverse effects of large renewable energy and mining projects on Sámi land and traditional lifestyle, including reindeer herding.

Source: MoCE (2024), Strategy for new industrialisation and societal transformation in Norrbotten and Västerbotten counties; OHCHR (2024), "Concluding observations on the seventh periodic report of Sweden", Report No. E/C.12/SWE/CO/7.

### *1.4.2. Subsidies to climate change mitigation have surged*

Subsidies for climate change mitigation have surged since 2015 (Figure 1.8). These include the bonus for low-emission cars (Climate Bonus), support for local and regional climate investments and for the installation of charging infrastructure for electric vehicles (EVs) (Climate Leap), as well as for reducing industry's process-related emissions (Industrial Leap). The Climate Bonus, which received the largest subsidies, was phased out in 2022 as the EV market was maturing (Section 1.4.4). While the Climate Leap has helped reduce GHG emissions and create jobs (SEPA, 2024i), the Industrial Leap has supported projects in the research, development and early deployment phases, notably in the iron and steel, and chemical industries. Its potential for emission reductions has yet to materialise (SEA, 2024a), and there is scope to streamline these subsidies. There are indications of overlap between the Industrial Leap and other support (SNAO, 2024).

## Figure 1.8. Environmentally motivated subsidies have focused on reducing GHG emissions




Note: An environmentally motivated subsidy is determined by the motivation of the subsidy/appropriation that gave rise to the subsidy. It does not include subsidies from the European Union. It includes payments from government to producers, individuals, organisations, non-profit-making associations, municipalities and county councils, as well as to EU countries and international activities. This definition is broader than the one used in the national accounts.
Source: SCB (2024), Total environmentally motivated direct subsidies.

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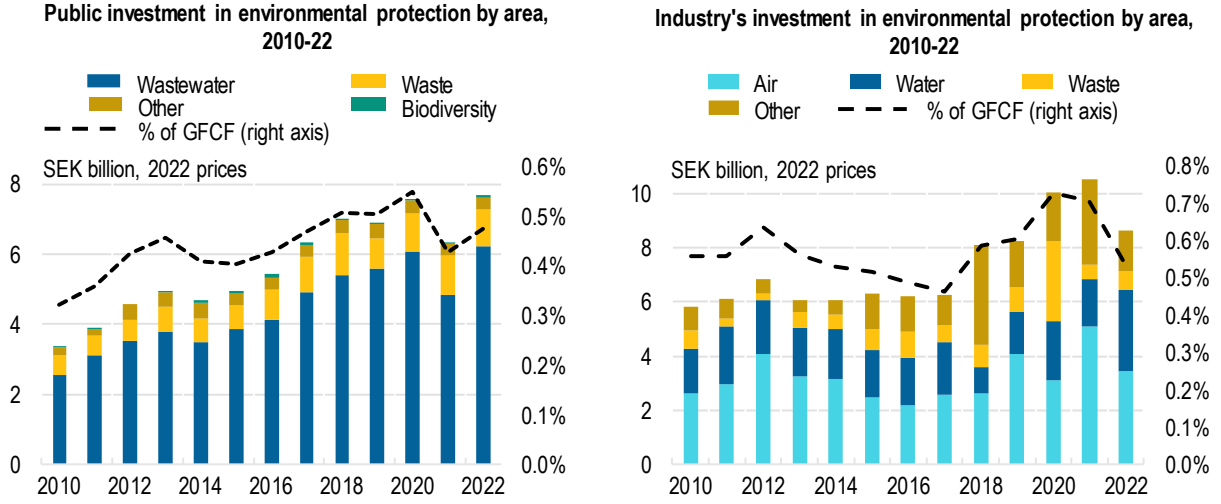
### *1.4.3. Investment in environmental and low-carbon infrastructure has grown*

*Investment in environmental protection has increased significantly*

Public expenditure on environmental protection grew significantly from 0.4% to 0.6% of GDP in 2010-22. This was due to the sharp rise in government subsidies to reduce GHG emissions (Figure 1.8); increased municipal investment in wastewater treatment (Figure 1.9); and, to a lesser extent, increased spending on biodiversity protection.

Industrial investment for environmental protection grew in all areas between 2017 and 2021, before levelling off in 2022 (Figure 1.9). The electricity, gas and heating industry invested the most in environmental protection in 2022, followed by the mining, water supply and paper industries.

## Figure 1.9. Public investment in wastewater treatment has more than doubled




Note: GFCF: gross fixed capital formation; Public other: includes environmental protection n.e.c, and research and development in environmental protection; Industry other: includes biodiversity and landscape, land and groundwater.
Source: OECD (2024), Annual government expenditure by function (COFOG); SCB (2024), Investments in environmental protection in industry by environmental domain.

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The share of the Swedish population connected to urban wastewater treatment systems is among the highest in Europe. Sweden has identified all of its water bodies as sensitive areas.[9] Overall, 97% of the urban wastewater is treated according to the requirements of the EU Urban Waste Water Treatment Directive, well above the EU average of 82% (EEA, 2024a). Sweden has made major investments to reduce emissions of pharmaceutical residues into the environment[10] and the country has been a leader in addressing contaminants of emerging concern in freshwater (OECD, 2019). However, as in many countries, there are challenges related to individual sewage treatment systems. About 1.2 million residents (about 15% of the population) and about the same number of holiday homes depend on individual water supply and wastewater disposal (Lindqvist and Sköld, 2023). Discharges of wastewater from unconnected dwellings contribute significantly to less than good water quality in 44% of coastal water bodies (EEA, 2024a).

Sweden would benefit from investing more in measures to protect biodiversity and ecosystems, in the circular economy and in pollution prevention and control (EC, 2024b). The environmental investment gap reached at least EUR 6 billion over 2014-20 and is expected to increase to EUR 7 billion over 2021-27.

The gap is especially wide (EUR 4.4 billion) for investment in biodiversity and ecosystem protection. After reaching their highest levels for ten years in 2021-22, budget allocations for nature protection were drastically cut in 2023.

### *Investment needs in sustainable energy and transport are high*

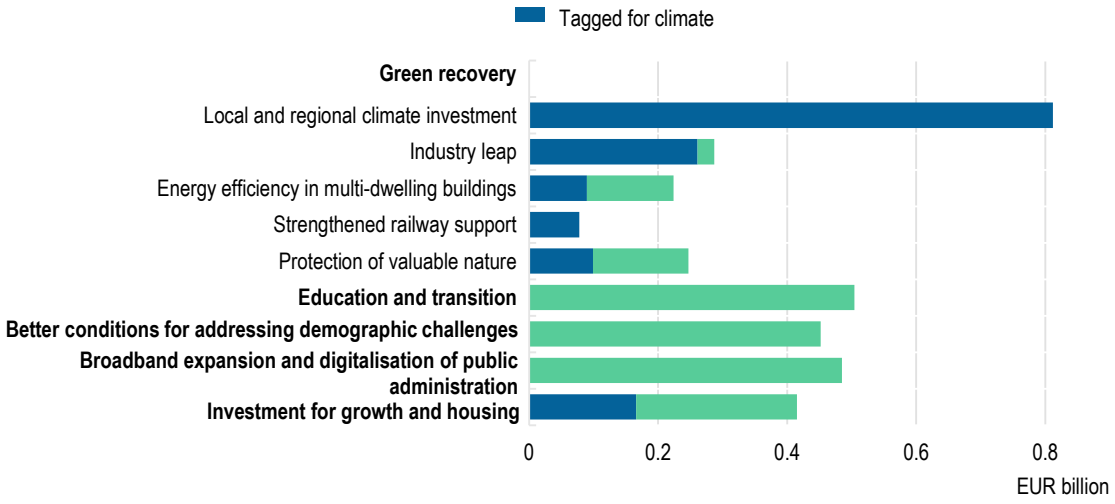
Sweden's updated National Energy and Climate Plan includes estimates of additional (mainly private) investment needs in electricity generation (SEK 30 billion per year in 2030) and transmission networks (SEK 48 billion by 2030) (MoCE, 2024a). However, it lacks a comprehensive assessment of investment needs to meet climate targets, including specific estimates for industry and transport sectors (EC, 2023c). Other official sources suggest that the need for publicly financed climate measures, including for adaptation, adds up to SEK 25-45 billion per year over the coming decades (SFPC, 2022). This comes on top of the planned investments of the 2022-33 Transport Infrastructure Plan (about SEK 60 billion per year in 2021 prices).

Over 2010-22, investment in rail infrastructure increased by 6% compared with 31% for roads (OECD, 2024e). In 2022, roads dominated investment in transport infrastructure (0.5% of GDP), although the share for rail (0.4% of GDP) was higher than in many other OECD countries. There is scope to prioritise transport investments with high benefit-cost ratio (SNAO, 2022). Although the budget allocated to urban environment agreements (for developing local infrastructure for cycling and public transport) increased in 2022, new applications are no longer being accepted (MoF, 2023).

### *It is unclear when Sweden will benefit from EU recovery funds*

Sweden's Recovery and Resilience Plan (RRP) consists of 16 reforms and 14 investments to be supported by EUR 3.4 billion in EU grants[11] (about 0.6% of 2021 GDP) until 2026. Sweden dedicated 44% of its RRP budget to climate objectives, well above the EU requirement of 37% (Figure 1.10). Green measures support the Climate Leap, the Industrial Leap and the designation of protected areas. Its REPowerEU chapter (added in 2023 to deal with the consequences of the Russian Federation's invasion of Ukraine) includes additional investments for the energy efficiency of buildings and reforms to speed up authorisation for electricity grid construction. By September 2024, Sweden had not yet submitted a payment request (EC, 2024c), as it has not implemented certain reforms required for the disbursement of funds. These include the increase in the biofuel blending obligation and the abolition of reduced tax rates on fuels used in agriculture. Hence, discussions are under way with the European Commission on possible adjustments to the RRP.

## Figure 1.10. Sweden's Recovery and Resilience Plan could help support the green transition




Note: Energy efficiency in multi-dwelling buildings and Investment for growth and housing include REPowerEU allocations.
Source: EC (2023), Analysis of the Recovery and Resilience Plan of Sweden.

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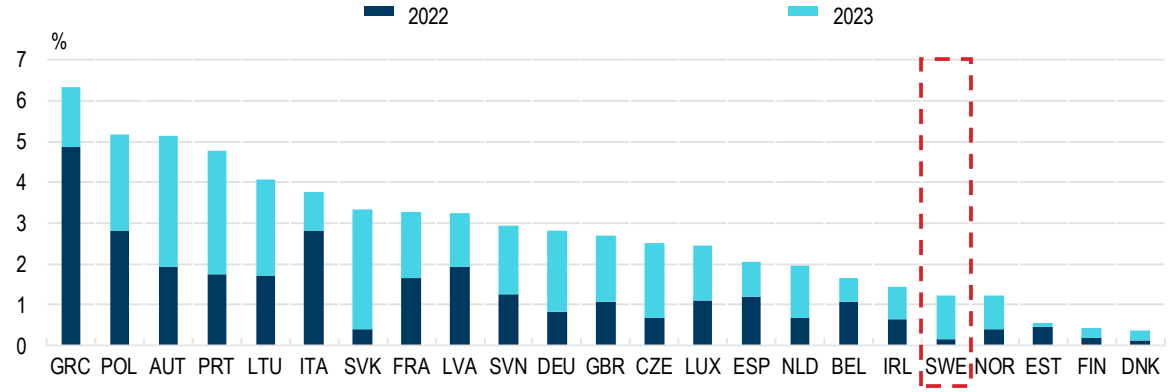
The government expects the direct effect of the RRP to boost GDP by less than 0.1% by 2026. This is because the RRP continues measures approved in the previous (2021) budget bill (Binder, 2024). At that time, the total effect of the measures was estimated to increase growth in 2021 by about 2.3%.

In 2022-23, in response to increasing energy prices, the government added discretionary spending amounting to 1.2% of GDP to its already expansionary budget (Figure 1.11) (OECD, 2023a). The measures included electricity subsidies for households in southern Sweden where electricity prices are relatively high. They also included tax cuts on diesel and petrol, and a temporary increase in housing allowances for economically vulnerable families with children. Sweden should move from broad-based, untargeted energy support to targeted interventions that maintain incentives to reduce energy use.

## Figure 1.11. Response to the energy crisis has focused on untargeted support measures

Gross fiscal costs of energy support measures as % of GDP, 2022-23




Source: OECD (2023), OECD Energy Support Measures Tracker.

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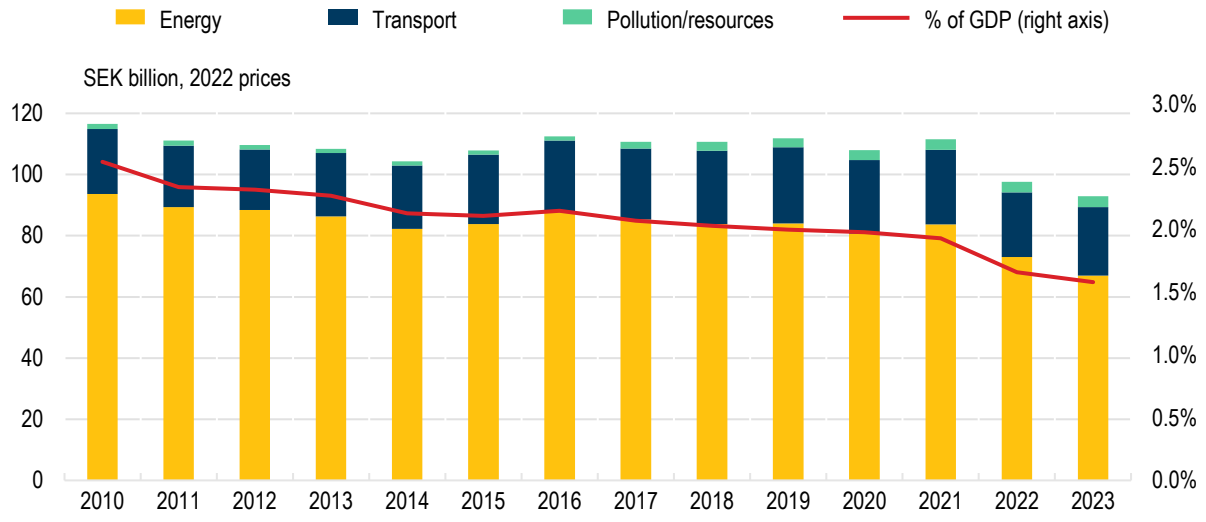
### *1.4.4. The green tax shift has reversed*

*The green tax shift has reversed in recent years*

Sweden has been a forerunner in environmental taxation (OECD, 2014) and continues to have high carbon prices by international standards (OECD, 2023b). However, the green tax shift (reallocating the tax burden from labour to environmentally harmful activities), implemented in the first half of the 2000s, has stalled and even reversed in recent years. While taxes on labour have fallen only marginally and remain high (OECD, 2024f), revenue from environmentally related taxes decreased from 2.5% of GDP in 2010 to 1.6% in 2023 (Figure 1.12). This is partly explained by the shrinking of the tax base (i.e. lower fuel consumption and increased electrification of vehicles) but also by the drastic cut in fuel tax rates. Over 2021-24, combined carbon and energy taxes fell in real terms by 29% for petrol and 26% for diesel (SEA, 2024b).

**Figure 1.12. Revenue from environmentally related taxes fell due to a shrinking tax base and the cut in fuel tax rates**

Environmentally related taxes by tax base, 2010-23




Note: 2023 provisional data.
Source: SCB (2024), Environmental taxes.

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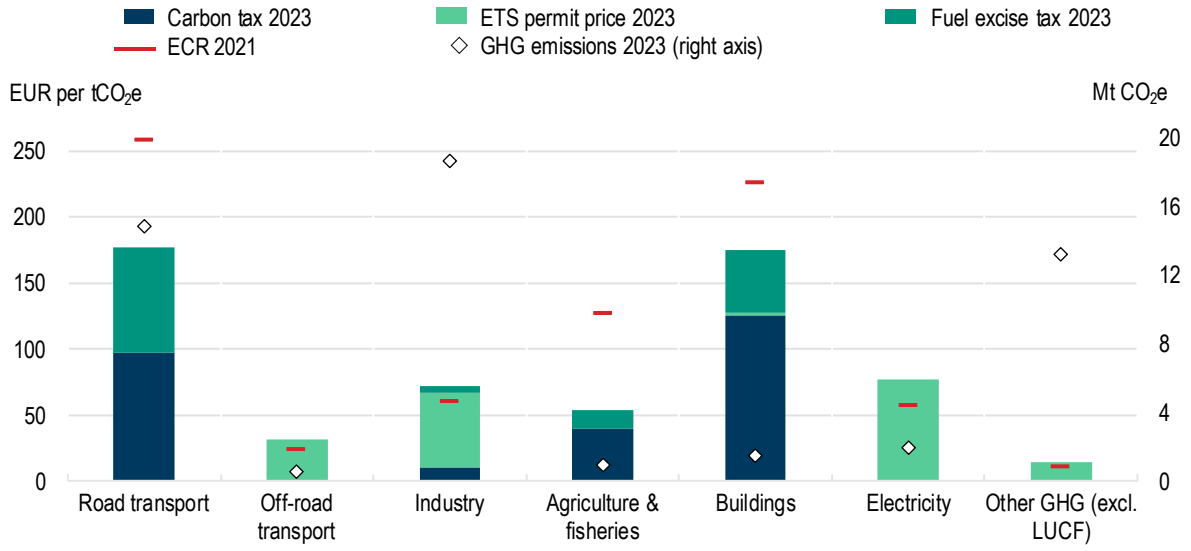
*Carbon prices are high but decreasing*

With an average effective carbon rate (ECR) of EUR 90[12] per tonne of $CO_2$ in 2023, Sweden continues to have one of the highest carbon prices in the world (OECD, 2024g). However, this rate has dropped by almost 20% over 2021-23 (Figure 1.13), compared with a 10% fall in the European Union. About 70% of Sweden's GHG emissions (excluding emissions from biofuel combustion) are priced through fuel excise taxes, a carbon tax and the EU Emissions Trading System (EU ETS). While most emissions from road transport, buildings, electricity and industry are priced at over EUR 60 per tonne of $CO_2$, most emissions from agriculture – methane and nitrous oxide – remain unpriced.

## Figure 1.13. Effective carbon rates dropped significantly between 2021 and 2023

Average effective carbon rates and GHG emissions by sector, 2021 and 2023




Note: ECR for Sweden is the sum of prices from the carbon tax, fuel excises and ETS permits. Excludes emissions from the combustion of biomass. Other GHG emissions: methane, nitrous oxide, F-gases and process $CO_2$ emissions excluding land-use change and forestry (LUCF).
Source: OECD (2024), Pricing Greenhouse Gas Emissions 2024.

StatLink https://stat.link/kwzuqm

Combined with the increase in permit prices in the EU ETS, the cut in fuel tax rates has narrowed the ECR gap between transport and other sectors, and between diesel and petrol. However, it has also weakened incentives to reduce GHG emissions. In addition to lower fuel taxes, the reduction of the biofuel blending obligation in 2024 has put into question Sweden's ability to meet its climate targets (Chapter 2).

### *Road pricing would help address transport externalities and the erosion of the tax base*

In real terms, revenue from taxes on motor vehicles and transport (excluding fuel duty) increased over 2010-19, then fell with the decline in car registrations and the growing share of low-emission vehicles. Sweden taxes the ownership of motor vehicles but does not apply purchase tax. The annual motor vehicle tax is the main source of revenue from transport taxes. Since 2018, new cars and light vehicles have been charged a higher tax (malus) based on their $CO_2$ emissions in the first three years. For diesel vehicles, an environmental charge and a fuel charge are added to the malus to reflect their higher impact on local air pollution and offset the lower energy tax rate on diesel. The Climate Bonus, which has subsidised the purchase of low-emission vehicles, was abolished in 2022 as the price gap with combustion engines was closing. The instrument was costly, had a regressive effect and encouraged the export of subsidised EVs (SNAO, 2020). The introduction of the bonus-malus system was followed by a rapid increase in sales of EVs which, after a slowdown in 2024, is projected to pick up again (Trafikanalysis, 2024a) (Chapter 2). Sweden has one of the lowest average $CO_2$ emissions from new cars and vans in the European Union (EEA, 2024b; 2024c).

As use of EVs increases, road pricing will be needed to address transport externalities and loss of fuel and vehicle duty revenue. While fuel taxes are well suited to reduce carbon emissions, distance-based charges and congestion charges address many externalities from road transport more effectively (van Dender, 2019). Higher congestion charges in Gothenburg and Stockholm have yielded positive environmental and

mobility outcomes (Börjesson, 2018). There is potential for other cities such as in Malmö and Uppsala to implement congestion or parking charges to internalise externalities and shift to other transport modes (Pyddoke and Lind, 2024).

Sweden should also modify road tolls for heavy goods vehicles to consider the distance travelled and better reflect the climate and air pollution costs of their use, as required by the revised Eurovignette Directive (EU 2022/362). The country is part of the Eurovignette co-operation with Denmark, Luxembourg and the Netherlands. It applies a road toll to heavy-duty vehicles (above 12 tonnes) on the main roads, which varies with Euro standards and the number of axles. The charge is time-based but does not change with distance travelled. Denmark will change from the Eurovignette to a kilometre-based road tax for heavy goods vehicles in 2025.

As recommended in 2014 (OECD, 2014), Sweden analysed the incentive mix in the transport sector (Trafikanalys, 2024b; 2024c; 2018). However, the conclusions have not always been acted upon. For example, Parliament's decision in 2022 (informed by a dedicated committee) to introduce a new tax reduction for commuting – regionally differentiated, based on distance and neutral in terms of mode of transport – was ultimately not implemented. On the contrary, tax deductions for using a car for commuting to work or for business trips were increased in 2023. The coherence of the economic instruments that apply to transport needs to be improved.

Since 2018, airlines serving Swedish airports pay a tax per passenger differentiated by destination. The tax aims to reduce the climate impact of aviation. It is adjusted for inflation annually. Although its impact has not been quantified (MoF, 2023), the government plans to abolish the tax in 2024 due to its overlap with the EU ETS (MoF, 2024a).

### *Sweden does not track support potentially harmful to the environment*

Under SDG 12,[13] Sweden is committed to rationalising inefficient fossil fuel subsidies. However, it has not adopted intermediate targets for doing so (MoCE, 2024a). Like other OECD countries, Sweden delivers support to fossil fuels through tax expenditures; oil attracts the bulk of government support (OECD, 2023c). The reduced energy tax for diesel used in motor vehicles is the main source of forgone revenue (MoF, 2024b). This is followed by reduced energy and carbon taxes for diesel used in agriculture, fishing and forestry and exemptions for domestic shipping and aviation. Over 2022-23, these measures represented almost 0.3% of annual GDP or 40% of fuel tax revenue (MoF, 2024b; SCB, 2024b). In addition, the income tax deduction for car commuting expenses was increased significantly in 2023, resulting in a tax expenditure of SEK 7.8 billion (0.12% of GDP).

With energy tax on petrol (the national benchmark) falling faster than that on diesel, tax expenditures related to fossil fuels will more than halve between 2022 and 2025 (MoF, 2024b). However, lower fuel taxes weaken the incentive to reduce transport emissions. This illustrates the need to regularly assess the environmental impact of tax expenditures in the national context. Other countries such as Belgium, Germany and Italy assess the potentially harmful effect of their tax expenditure (MASE, 2022; SFP Finances, 2024; UBA, 2021). Sweden could follow their example to draw up a national inventory of fossil fuel subsidies.

Sweden should also systematically evaluate incentives that could potentially affect biodiversity as required by Target 18 of the Kunming-Montreal Global Biodiversity Framework. Under the CAP, coupled income support to cattle production (13% of direct payments in 2014-22 and 2023-27) maintains livestock numbers and associated enteric fermentation emissions, although it also contributes to the management of semi-natural pastures. The country should closely monitor implementation of the new CAP and assess its impact on the environment.

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## Notes

[1] Ecosystem services and resilience; importance of biodiversity and the value of ecosystem services; threatened species and habitat types; invasive alien species; knowledge about genetic diversity; holistic approach to the use of land; protection of land areas, freshwater areas and marine areas; environmental consideration in forestry; varied forestry; and a dialogue process in a national forestry programme.

[2] The Habitats Directive (92/43/EEC) protects habitats and species of Community interest, i.e. which are threatened to disappear in the European Union, have a small natural range or present outstanding examples of typical characteristics of Europe's biogeographical regions.

[3] Sweden distinguishes between i) formally protected forests, which include national parks, nature reserves, habitat protection areas, nature conservation agreements and Natura 2000 sites governed by laws and regulations; ii) voluntary set-asides – smaller areas for which the landowner has voluntarily decided not to carry out measures that can damage natural values, the cultural environment or social values; and iii) consideration patches – smaller areas that have been designated for regeneration felling, voluntarily by the landowner or pursuant to the Forestry Act.

[4] With a yearly wood volume increment more than 1 $m^3$/ha. Productive forests cover more than half of Sweden’s land area.

[5] With a yearly wood volume increment of more than 1 $m^3$/ha.

[6] Omitting the uPBTs (ubiquitous, persistent, bioaccumulative and toxic substances, i.e. mercury, brominated diphenyl ethers, tributyltin and certain polyaromatic hydrocarbons) results in 1% of surface water bodies not being in good chemical status.

[7] Others either do not need to be reassessed or have “uncertain status”, whereby information on participation has not been submitted to SwAM.

[8] The government adopted a target of 1.5 TWh reduction in hydroelectric production as constituting “significant adverse impact” on power generation when declaring Heavily Modified Water Bodies.

[9] All agglomerations above 10 000 p.e. have to implement a more stringent treatment for N and/or P and report individual equipment and performance for each of their treatment plants.

[10] Approximately SEK 250 million was allocated between 2018 and 2020 for the expansion of advanced treatment technology in wastewater treatment plants (Lindqvist and Sköld, 2023).

[11] Considering the 2022 downward revision of the Recovery and Resilience Facility, REPowerEU grants and Brexit Adjustment Reserve.

[12] Without considering free allocations of allowances in the EU ETS.

[13] SDG 12 calls for ensuring sustainable consumption and production patterns.

# Chapter 2. Climate change mitigation and negative emissions promotion

With an electricity mix that is almost fossil free, Sweden is the least carbon-intensive country in the European Union. Despite significant reductions in greenhouse gas (GHG) emissions, recent policy shifts have introduced uncertainty regarding climate action. This chapter assesses the progress achieved and the effectiveness and efficiency of sectoral and horizontal policies towards Sweden's climate goals. It also reviews the contribution of carbon removals from forests, carbon capture and storage, and emission reductions abroad to reach Sweden's 2045 carbon neutrality goal.

## 2.1. Trends and performance on climate change mitigation

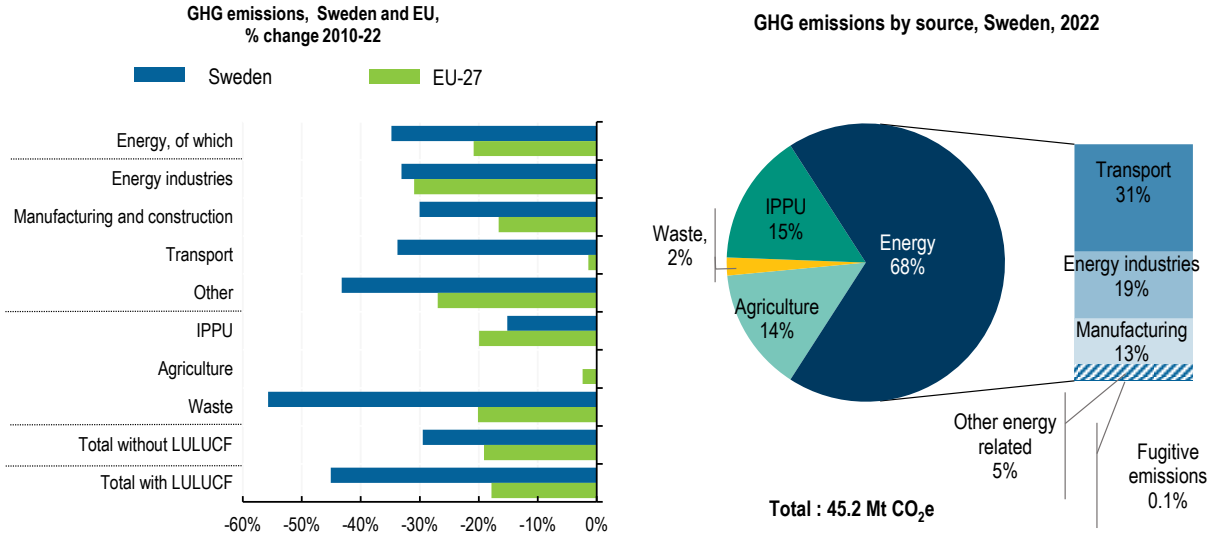
### *2.1.1. The carbon intensity of the economy is decreasing*

Sweden has successfully decoupled GHG emissions from strong economic growth and a growing population (Chapter 1). Between 2010 and 2022, GHG emissions, excluding land use, land-use change and forestry (LULUCF), fell by 29%, faster than the EU average of 19% (Figure 2.1). In 2022, Sweden's GHG emission intensities per capita and per unit of gross domestic product (GDP) were the lowest in the European Union (OECD, 2024a).

A large share of Sweden's emission reductions to date can be attributed to a practical phase-out of fossil fuels to produce electricity and heating. In 2022, renewable sources of energy accounted for more than two-thirds of electricity generation. Of this, most was from hydro, with the contribution from wind power increasing (Box 2.1). The switch to district heating in buildings and the use of more energy-efficient heating systems have also played an important role in reducing emissions.

Emissions from domestic transport have decreased by 34% since 2010 despite an increase in the number of kilometres travelled. This reduction is mainly due to increased use of biofuels, energy efficiency improvements and electrification of the vehicle fleet. Industrial emissions (including fuel combustion and industrial processes) have fallen by 21% over 2010-22. Changes in the fuel types used by industry and enhanced energy efficiency have contributed to this reduction. These reductions have occurred despite the continued high emissions intensity of the manufacture of basic metals. Increased incineration of waste in combined heat and power plants has reduced methane emissions from landfills. Meanwhile, improved capture of methane at landfills and improved management of wastewater have also contributed to large emission reductions. Emissions from agriculture have only marginally decreased over the past decade.

### Figure 2.1. GHG emissions have dropped significantly



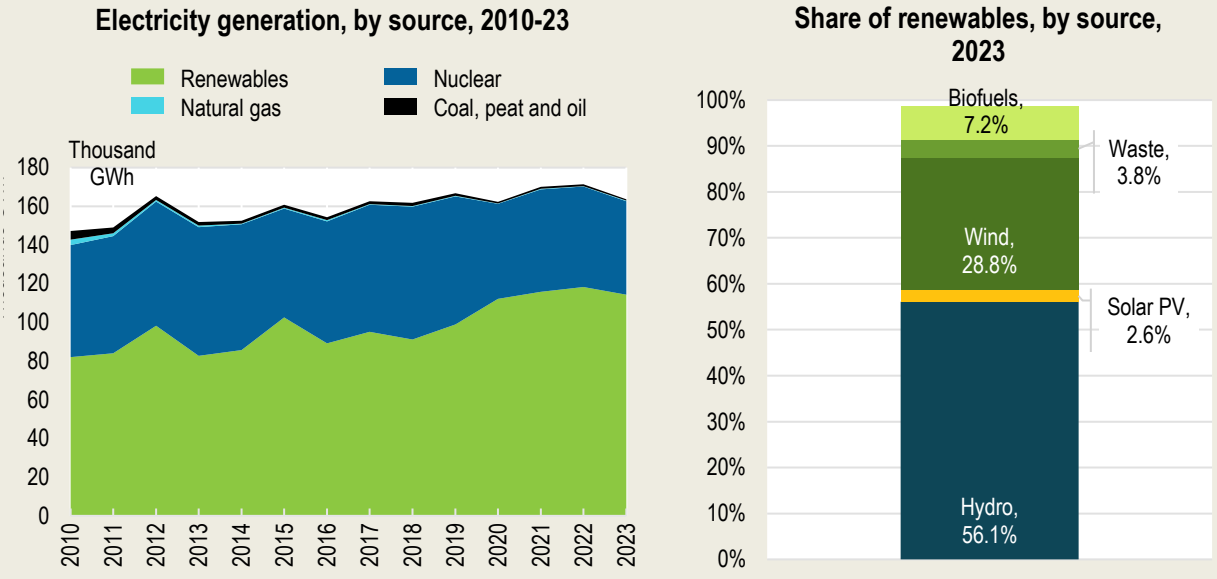

Note: IPPU: Industrial processes and product use. LULUCF: Land use, land-use change and forestry.
Source: SEPA (2024), National Inventory Report 2024; EEA (2024), EEA (2024), National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism.

StatLink https://stat.link/7cr4xe

### Box 2.1. Swedish electricity generation is already nearly fossil free

In 2023, 69% of Sweden's electricity was generated by renewable energy, with nuclear accounting for 29% (Figure 2.2). The generation of electricity from wind has seen a rapid increase since 2010. Hydro and nuclear power generation has fluctuated over the years due to water availability and the decommissioning of some reactors. Starting from a much lower level, the installation of photovoltaic solar panels increased by almost 70% in 2023 compared to 2022.

### Figure 2.2. Hydro and wind power drive Sweden's growth in renewable electricity generation




Note: PV: photovoltaics.
Source: IEA (2024), IEA World Energy Balances (database); SEPA (2024), The Swedish Environmental Protection Agency's basis for the Government's Climate Report 2024.

StatLink https://stat.link/nshyoj

#### *2.1.2. Early and ambitious domestic climate action is falling behind evolving obligations at the European level*

As a member of the European Union, Sweden has shaped its climate policy to align with EU obligations on climate and energy. As the ambition of EU policy on climate increases, the relative ambition of domestic targets by "early movers" such as Sweden decreases. EU-legislated targets now cover all major sectors. While in many cases these targets will be challenging for EU members to achieve, burden- sharing agreements enable some trading of emission allowances or applications between EU member states or across sectors.

The Swedish Climate Act (2017) includes a legally binding target to reach net-zero emissions by 2045 at the latest, followed by negative emissions thereafter. If reached, the country would achieve climate neutrality five years ahead of the EU target of 2050. The Climate Act specifies that emissions within Sweden's borders shall be reduced by at least 85% by 2045 compared with 1990 levels. Supplementary measures, such as verified emission reductions abroad, increased carbon sink, and carbon capture and storage from biogenic emissions (BECCS), can compensate for the remaining 15%. The target covers emissions included in the EU Emissions Trading System (EU ETS)[1] and those covered by the EU Effort

Sharing Regulation (ESR).[2] Increased net carbon removals in the LULUCF sector can be counted towards domestic targets but only as a supplementary measure. The 2045 target is complemented by interim domestic targets applicable to ESR sectors for 2020, 2030 and 2040, as well as a domestic 2030 target for the transport sector. The EU ESR and LULUCF targets for 2030 are legally binding, but the interim targets are not (Table 2.1).

EU energy targets complement the climate targets. In their National Energy and Climate Plans (NECPs), EU members specify how they will achieve the objectives of the energy union on renewable energy and energy efficiency. Sweden submitted its initial NECP in 2019 and published an update in July 2024. In principle, the NECP should reflect EU climate regulation, including the Fit for 55 package and the 2022 REPower EU Plan. However, Sweden's updated NECP is not in line with EU targets on renewable energy and energy efficiency (Section 2.3.2).

### Table 2.1. Sweden's main climate and energy targets

| Law or regulation | Objective variable | Objective | Base year | Objective year |
|---|---|---|---|---|
| Effort Sharing Regulation (EU 2023/857) | GHG emissions from ESR sectors | -50% | 2005 | 2030 |
| Effort Sharing Decision (406/2009/EC) | GHG emissions from non-EU ETS sectors | -17% | 2005 | 2020 |
| LULUCF[1] Regulation (EU 2023/839) | Net GHG removals in the LULUCF sector | - 48.8 Mt $CO_2e$[2] | Avg 2016-18 | 2030 |
| Swedish Climate Policy Framework[3] | Total territorial GHG emissions (excl. LULUCF) | At least -85%; max 15% supplementary measures | 1990 | 2045 |
| | GHG emissions from ESR sectors | At least -75% max 2% supplementary measures | 1990 | 2040 |
| | GHG emissions from ESR sectors | At least -63% max 8% supplementary measures | 1990 | 2030 |
| | GHG emissions from ESR sectors | -40% max 13% flexible mechanisms | 1990 | 2020 |
| | GHG emissions from domestic transport (excl. domestic flights) | -70% | 2010 | 2030 |
| Updated National Energy and Climate Plan (NECP) | Energy efficiency[4] (primary energy consumption) | 41.2 Mtoe (million tonnes of oil-equivalent) | - | 2030 |
| | Energy efficiency[4] (final energy consumption) | 30.1 Mtoe | - | 2030 |
| | Renewable energy[5] (as a share of final consumption) | 67% | - | 2030 |

Note: LULUCF: land-use, land-use change and forestry; average net GHG removals in the LULUCF sector over 2016-18 minus 3.955 Mt $CO_2e$; in the Swedish Climate Policy Framework, only the 2045 target is binding; Sweden also has a national target of improving energy intensity by 50% by 2030 compared to 2005; the percentage given in the table corresponds to NECP projection and not to Sweden's target; Sweden has a 100% fossil-free electricity production target for 2040.
Source: MoCE (2024), Sweden's updated National Energy and Climate Plan 2021-2030.

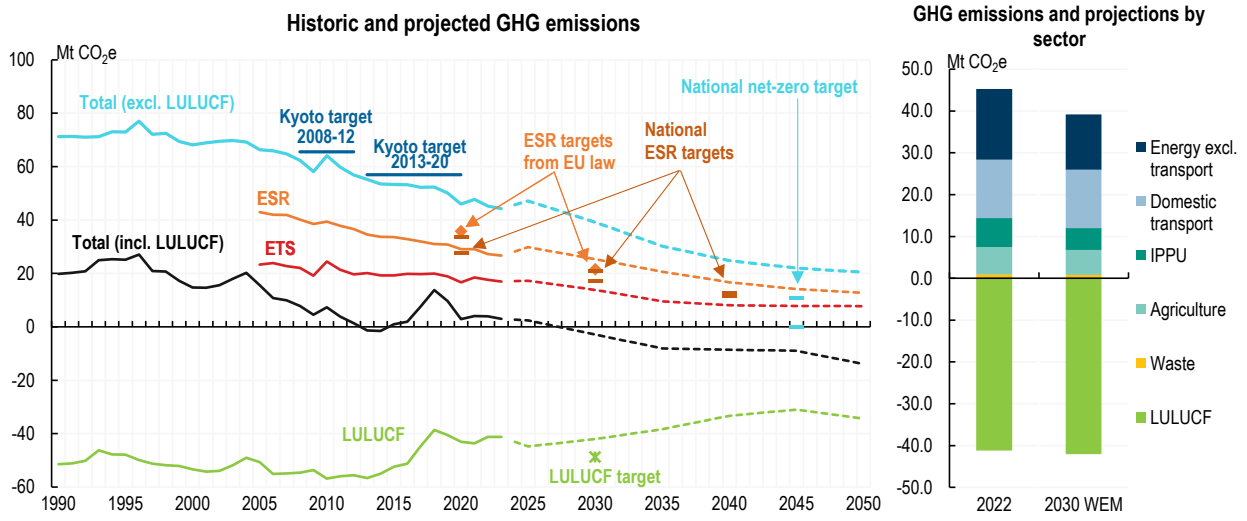
Sweden met its ESR target for 2020, as well as its commitments under the first and second periods of the Kyoto Protocol (2008-12 and 2013-20). The latest official projections (July 2024) showed that Sweden is not on track to meet climate and energy targets for 2030, 2040 and 2045 with existing measures (MoCE, 2024). The emissions gap to the 2045 target is estimated at 22 million tonnes of carbon dioxide equivalent (Mt $CO_2e$) without supplementary measures, and 11 Mt $CO_2e$ with full use of supplementary measures (MoCE, 2024). To meet the 2045 target, Sweden must reduce emissions by an average of 2 Mt $CO_2e$ per

year until 2045 (CPC, 2023). This is faster than the average annual emission reductions since 1990 of just under 0.8 Mt $CO_2$e, and in sharp contrast to Sweden's projected increases in emissions in 2024.

For ESR sectors, the accumulated gap to the 2030 target is estimated at 1-9 Mt $CO_2$e. This estimate considers the flexibilities included in the ESR of banking and borrowing annual emission allocations (Box 2.2). For LULUCF, the gap for the year 2030 is projected at around 7 Mt $CO_2$e in a scenario with medium forest growth, and up to 19 Mt $CO_2$e with reduced forest growth (SEPA, 2024a).

The budget bill for 2025 aims to reverse the projected increase in emissions, especially through measures proposed in the transport sector (MoF, 2024a) (Section 2.3.2). If adopted, the measures would improve conditions for achieving the 2030 target and narrowing the gap to the 2045 target. However, the bill's expectation to close the gap to the ESR target is based on the most optimistic scenario associated with large uncertainties, e.g. related to private transport choices when fossil and petrol prices are low and fewer electric cars are registered. In addition, no new measures have been proposed to address the gap in meeting the LULUCF target. Further measures will be needed to achieve the long-term goal of 2045 (MoF, 2024a).

## Figure 2.3. Sweden's GHG emissions are expected to decline but not at the pace required to meet climate targets




Note: LULUCF: land use, land-use change and forestry. IPPU: industrial processes and product use. Dotted lines refer to national projections with existing measures (WEM) as of March 2024 assuming average growth of forest land. ESR targets from EU law: 2020 under the EU Effort Sharing Decision (406/2009/EC); 2030 under the EU Effort Sharing amended Regulation (EU 2023/857). LULUCF 2030 target: under the LULUCF Regulation (EU 2023/839). ETS: emissions under the EU Emissions Trading System. Under the Swedish Climate Policy Framework, the national targets include possibilities to attain parts of the targets through supplementary measures. Such measures may be used to achieve up to 8% of the 2030 target and 2% of the 2040 target. For the long-term target, such measures can be used for the remaining reductions down to zero. National targets are therefore presented in ranges. 2023: provisional data; LULUCF: 2022 data.
Source: SEPA (2024), Sweden's emissions and removals of greenhouse gases, June; SEPA (2024), GHG emissions projections and approximated data for 2023 reported under the Governance Regulation (EU 2018/1999), July; EEA (2024), EU ETS Data Viewer, May; MoCE (2024), Sweden's updated National Energy and Climate Plan 2021-2030.

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### Box 2.2. EU effort sharing: Targets and flexibilities

The EU Effort Sharing Regulation (ESR) 2021-2030 establishes national targets for the reduction of greenhouse gas emissions by 2030 in domestic transport (excluding aviation), buildings, agriculture, small industry and waste sectors. Across EU countries, national targets range from 10-50% emission reductions in ESR sectors by 2030 compared to 2005 levels. The overall national target is complemented with annual emission allocations (AEAs) for the years 2021 to 2030, with the number of allocations decreasing every year.

The ESR provides member states three set of flexibilities for achieving national targets:

- **Access allowances from the EU Emissions Trading System (EU ETS)**: Sweden can transfer up to 2% of its ETS allowances for offsetting emissions in effort-sharing sectors. Sweden has notified the European Commission that it intends to use the full amount of this flexibility for 2025-30. This totals around 5 Mt $CO_2$e. In exchange for this increased emissions budget within the ESR, Sweden is expected to miss out on auction revenue from emissions trading corresponding to just over SEK 1 billion per year.
- **Access to credits from the land-use sector**: If Sweden fails to meet the requirements under the land use, land-use change and forestry (LULUCF) regulation, emission allocations corresponding to the gap will automatically be deducted from the ESR. While reporting on LULUCF is marked by considerable uncertainty, the gap is projected to be 7-19 Mt $CO_2$e. This automatic transfer is not included in the assessment of progress towards ESR targets in the budget bill for 2025.
- **Banking, borrowing, buying and selling**: In years when emissions are below the AEAs, Sweden can bank surpluses for the future. This was done, for example, for the years 2021-23. It is not possible to project future exceedances, as the AEAs for 2026-30 will be determined in 2025. Members can also buy emission allocations from other EU countries. Countries' updated 2024 NECPs suggest that surplus emission allocations will be limited, and in turn, costly.

The second phase of the EU ETS (EU ETS-2), which enters into force in 2027, will expand the focus to cover buildings, road transport and process heat. This will increase the share of EU emissions covered by emissions trading from 40% to nearly 80%. For EU ETS-2, there will be no free allowances. Proceeds from the auction will be directed to a new Social Climate Fund that will support households affected by the climate transition.

Source: CPC (2024), 2024 Report of the Swedish Climate Policy Council; EC (2024), Commission Implementing Decision C(2024)4726; EC (2024), EU Climate Action Progress Report 2024; MoCE (2024), Sweden's updated National Energy and Climate Plan 2021-2030; SEPA (2024), The Swedish Environmental Protection Agency's basis for the Government's Climate Report 2024.

## 2.2. Governance for climate policy

### *2.2.1. A clear governance framework guides climate action*

Sweden has established itself as a leader on climate change for both international and EU climate negotiations. For example, internationally, Sweden is a member of the so-called High Ambition Coalition founded in 2014. This played an important role in supporting adoption of the Paris Agreement in 2015. During its EU presidency in 2023, Sweden also oversaw the negotiations on the major reform package Fit for 55. However, some recent policy shifts (Section 2.3.2) have cast doubt on Sweden's ability to meet climate targets.

Action on climate is guided by the three pillars of the climate policy framework approved by the Swedish Parliament (Riksdag) in 2017:

- **The Climate Act** specifies that the government shall: i) each year present a climate report to Parliament in its budget bill; ii) the year following ordinary parliamentary elections, draw up a climate policy action plan; and iii) ensure alignment between climate policy and budget policy goals.
- **Emission reduction targets** commit Sweden to reduce GHG emissions to net zero by 2045 at the latest compared to 1990 levels, followed by negative emissions. Interim targets for emissions covered by EU's ESR complement the long-term target (Table 2.1).
- **The Climate Policy Council**, an independent expert body, evaluates the alignment of the government's climate policy with goals established by Parliament and government, and identifies areas that require further action. This is complemented by an assessment of the government's four-year climate action plan.

Since 2022, the Ministry of Climate and Enterprise has overseen development of Sweden's climate and energy policy. The Swedish Environmental Protection Agency oversees policy implementation on climate. It is also tasked with monitoring and reporting Sweden's emissions to the United Nations Framework Convention on Climate Change (UNFCCC) and the European Union. The mandate of the Swedish Energy Agency changed in 2023 from promoting increased renewable electricity to focusing on the transition to 100% fossil-free electricity by 2040 (GoS, 2023).

### *2.2.2. The climate action plan lacks clarity on how targets will be achieved*

The coalition government that took office in 2022 has emphasised the importance of successful climate policy. To that end, it takes a long-term perspective grounded in legitimacy, trust, fairness and acceptance, putting in place conditions to enable action by the private sector and households. However, despite the numerous measures announced in the climate action plan, it lacks clarity on how to achieve targets. Some policy shifts increase emissions in the near term, placing a greater burden on rapid emission cuts in the future (CPC, 2024; SFPC, 2024).

The government is using the inquiry system to examine policy options. For example, an inquiry will examine policy measures for 2027-30 that would allow Sweden to meet its ESR commitments while minimising costs for households and maintaining a competitive private sector (MoF, 2024a). While the inquiry system facilitates an informed policy dialogue, it is lengthy. Some recommendations are only expected after the next election in 2027. This delays action and heightens uncertainty for both households and the private sector (SFPC, 2024).

As Sweden enters the next phase of its climate transition, the role of government in defining priorities, establishing the enabling environment and managing inevitable trade-offs becomes increasingly important (CPC, 2023). The decarbonisation of the industrial sector serves as an example. Emission reductions in energy-intensive sectors, such as iron and steel, require new technology and a skilled workforce. Since many industries are located in sparsely populated northern areas, complementary investments in basic social infrastructure (e.g. housing and public services) to attract a skilled workforce will also be needed. Contributions of individual companies to the transition depend on their ability to receive the necessary permits and access to the electricity grid in a timely manner.

### *2.2.3. Recent policy shifts are not consistent with broad support for ambitious climate action*

The business community is a strong supporter of the climate transition, illustrated by its active engagement in the government's Fossil Free Sweden initiative. The initiative aims to accelerate the climate transition by identifying both business opportunities and barriers to decarbonisation. Collaboration between

companies, industries, municipalities and regions has contributed to 23 roadmaps, representing over 70% of Sweden's GHG emissions. The roadmaps outline how climate neutrality can enhance competitiveness, including in hard-to-abate sectors such as steel and cement. The business community has cautioned the government against lowering climate ambition; if domestic policy does not match the climate ambitions of the private sector, companies warn they may have no choice but to relocate.

Other stakeholders have also called for a clear narrative on the government's approach to climate change. The Fiscal Policy Council has emphasised the need for a critical assessment of proposed measures relative to the risks of inaction. It has also highlighted the importance of championing the climate policy narrative with strong leadership to gain broad acceptance (SFPC, 2024). This is particularly important given the speed of the transition needed over the next two decades for Sweden to reach its 2045 climate target.

There is also broad public support for ambitious climate action. In a 2024 Eurobarometer poll, two- thirds of Swedish respondents answered that the government is not doing enough to tackle climate change. Over 70% ranked climate change as the most important societal concern (Eurobarometer, 2024). A survey by the Swedish Confederation of Professional Associations found that seven of ten members are concerned about climate change. Conversely, only one of ten think the current policy is ambitious enough. Meanwhile, eight of ten believe that policy could play a larger role in supporting Sweden's green transition (SACO, 2023).

In the past, broad public support for ambitious climate action combined with a strong political commitment have created a clear and predictable framework for action. However, the government's recent shifts on some key issues is eroding that predictability. Over the years, for example, Sweden's fuel industries have invested significantly in the development of biofuels. However, following the decision to reduce the blending obligation in the transport sector (Section 2.3.2), the share of biofuels on an energy basis has fallen substantially. This has led the industry to call for policy stability and predictability (Sweden's Fuel Industries, 2024a; 2024b).

## 2.3. Policy framework and measures for climate mitigation

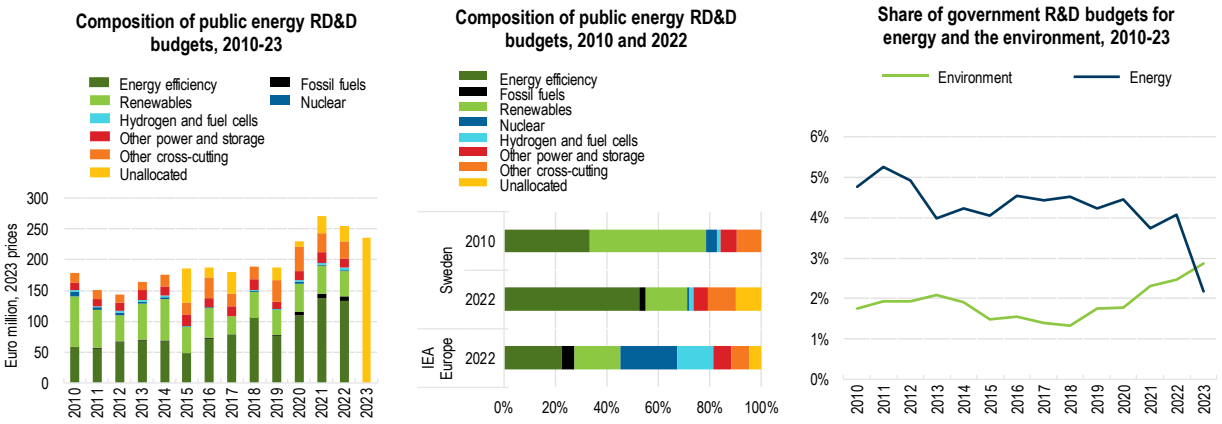
### *2.3.1. Various policy tools are in place to incentivise climate mitigation*

Sweden has a diverse mix of regulations, subsidies and pricing instruments (Chapter 1) that, combined with investments in infrastructure and innovation, support the climate transition. The EU ETS and Sweden's carbon tax are key elements. The Swedish government also seeks to incentivise private sector engagement through the Industrial Leap. This initiative aims to reduce emissions from industrial processes, contribute to achieving negative emissions through BECCS and support strategic projects for the industry transition. Similarly, the Climate Leap, established in 2015, provides investment support to both the public and private sector for local and regional mitigation. Support, for example, has been provided to electric vehicle charging infrastructure and the electrification of farm machinery and agricultural production processes.

#### *Sweden is a global leader on climate research, development and deployment*

Sweden is consistently ranked among the top environmental performers on the European Innovation Scoreboard and the European Eco-Innovation Scoreboard (EC, 2023a). This reflects high government spending on research, development and deployment (RD&D) related to the environment and energy. The budget on energy RD&D is mostly allocated to energy efficiency, renewable energy and cross-cutting technologies (Figure 2.4). In comparison with other European countries, Sweden has a low share of the public energy RD&D budget for nuclear. RD&D is complemented with high patenting activity, especially for climate mitigation (Figure 2.5).

## Figure 2.4. RD&D budgets are mostly allocated to energy efficiency and renewable energy




Source: IEA (2024), *Energy Technology RD&D Budgets* (database); OECD (2024), "Research and Development (R&D)", *OECD Science, Technology and Innovation Statistics* (database).

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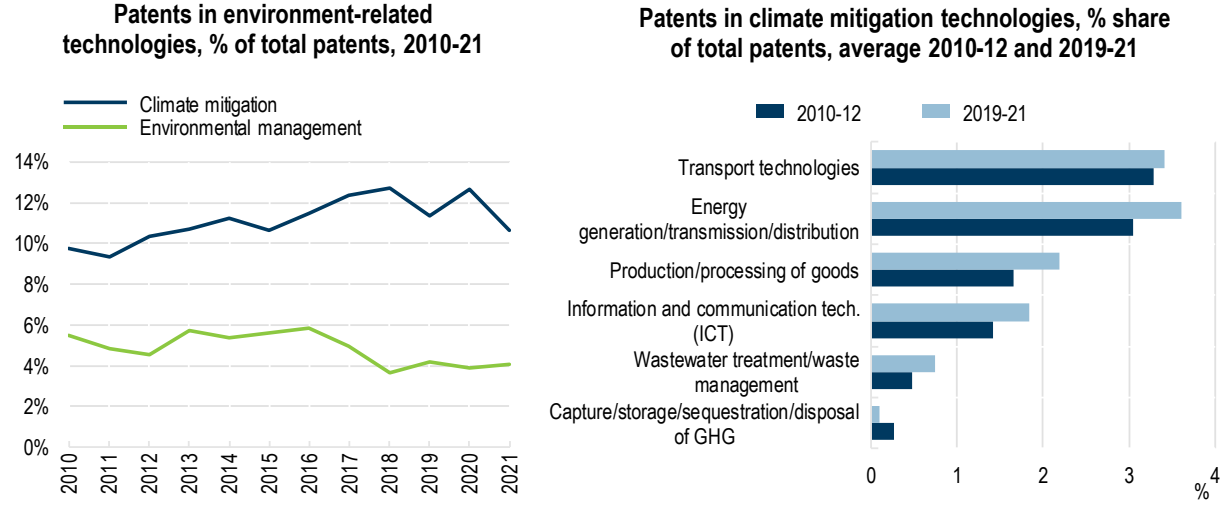
## Figure 2.5. Patenting activity is high for mitigation in particular




Note: Patent statistics are taken from the Worldwide Patent Statistical Database of the European Patent Office, with algorithms developed by the OECD. Data refer to patent applications filed in the inventor's country of residence according to the priority date. They apply solely to inventions of high potential commercial value for which protection has been sought in at least two jurisdictions.
Source: OECD (2023), "Technology and Innovation", *OECD Environment Statistics* (database).

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Research and innovation for climate are financed through various domestic and EU programmes and initiatives. For example, the Swedish Energy Agency manages the government's energy research and innovation programme in close collaboration with related policy measures and instruments. The Swedish National Research Programme on Climate, a ten-year programme established in 2017, supports collaboration between Swedish funders of climate research, nationally and internationally (FORMAS, 2022). For its part, Vinnova – Sweden's innovation agency – boosts the country's innovation capacity in support of sustainable growth.

Bridging the gap between RD&D, venture capital investments in climate tech start-ups and scale-ups tripled over 2019-23, contributing to enhanced industrial competitiveness domestically and within the European Union.

*Distributional impacts from climate action addressed through the social welfare system*

The climate transition is transforming Swedish society as evidenced by the renewed industrialisation of the northern areas. Transformations at such scales inevitably entail both economic benefits and costs. Sweden's climate strategy does not include an explicit focus on ensuring a just climate transition. Instead, social and economic impacts are addressed through Sweden's general welfare system. This system supports households going through structural changes like employment status or life circumstances. However, it may not adequately support households that experience increased costs, e.g. in the context of passenger transport or electricity use. Some compensatory measures are in place, such as tax reductions for green technologies or support for energy efficiency improvements (SFPC, 2024).

Through the EU Just Transition Fund, Sweden has identified industries with high emission intensities that will be affected by the transition. It has also singled out regions that will require additional efforts to address the social, economic and environmental implications of the transition (MoCE, 2024). In addition to research and innovation, this includes reskilling and upskilling of workers. The deadline for EU member states to submit their Social Climate Plan is June 2025.

### *2.3.2. Sectoral mitigation measures*

*Large increases in electricity demand are primarily met through planned increases in the supply of energy, with less emphasis on energy and resource efficiency*

Energy production and use accounted for 68% of GHG emissions in Sweden in 2022 compared with 74% in 2010 (Figure 2.1). In the updated NECP, the government concludes that Sweden will not meet the 2030 targets on renewable energy and energy efficiency set out in the updated EU Energy Directive. The electrification of society and industry is a key component to Sweden's climate strategy. While it contributes to reduced GHG emissions, it is achieved through large increases in energy use, contrary to the EU target on reduced primary energy consumption. Although the government may consider this is an acceptable trade-off in the pursuit of its climate targets, it will need to reconcile the planned increase in electricity production with EU requirements.

Demand for electricity is projected to increase from around 140 TWh to 160-201 TWh in 2030, and to 200-340 TWh in 2045. The level of increase will depend on the timing and extent of the transition, especially in the industry and transport sectors (SEA, 2023a). Three-quarters of the increased demand are projected to occur in Sweden's northern region of Norrland (Energiforsk and Profu, 2021). Reflecting evolving needs, the energy bill presented by the government in March 2024 proposes (GoS, 2024a): i) a planning target that provides the conditions to deliver the electricity needed for increased electrification; and ii) a security of supply target that ensures the electricity system can meet demand where it exists and in a timely manner.

**The pathway to decarbonising the energy system remains uncertain**

Renewable energy accounts for nearly half of Sweden's energy supply. The European Union has a binding renewable energy target of at least 42.5% in 2030, with endeavours to increase this to 45%. Member states do not have individual targets but must specify their national contributions to the EU target in their NECPs. EU guidelines recommend a target of around 76% by 2030 for Sweden. However, national projections show this target will not be reached with current measures (MoCE, 2024). Instead, the share of renewable energy is projected to reach 67% in 2030.

There is renewed political commitment to scale up nuclear energy. Factors driving this shift include a focus on energy security and resilience, and the geographical imbalance between energy demand and supply. Sweden aims to build the equivalent of at least two large-scale nuclear reactors by 2035. By 2045, the government foresees a considerable expansion will be needed that could correspond to ten large-scale reactors. The scale of expansion would be determined by the rate of expansion in the electricity system, the location of new consumption and production, the technology development of both new nuclear power and the potential of extending the operating time of existing reactors (MoF, 2024a).

In 2023, Sweden replaced its target of 100% renewable electricity generation by 2040 with a target of 100% fossil-free electricity production. The same year, legislative changes removed the limit on the number of nuclear reactors in operation and allowed nuclear reactors to be built on new sites (Sveriges Riksdag, 2023). In 2024, a national nuclear power co-ordinator was appointed to work with relevant actors to accelerate establishment of new nuclear reactors. Other proposed changes target three areas:

- **Legislation**: to remove the ban on restarting closed reactors and to develop new regulation to facilitate installation of small modular reactors
- **Processing**: to shorten and simplify licence processes and fast track processing for nuclear power in environmental licensing
- **Cost**: to review and substantially reduce the application fee for new nuclear power reactors and issue state guarantees for investments in new nuclear energy.

Given the long lead times, high cost and technical uncertainty of expanding nuclear capacity, the government's renewed focus must consider the full range of costs and benefits. Estimates of levelised cost of energy (operation, maintenance and investment) indicate that nuclear is always more expensive than wind or solar energy in Sweden. In the short term (up to 2035), onshore wind has the lowest levelised energy costs of around 30-35 SEK öre/kWh (GoS, 2024a; Holmberg and Tangerås, 2022; SEPA, 2024a). This is followed by large-scale solar power (around 40 SEK öre/kWh) (Holmberg and Tangerås, 2022). The levelised costs for nuclear energy are more difficult to estimate but are in the range of 49 SEK öre/kWh to 1.6 SEK/kWh. The picture is similar across Europe, except that offshore wind is projected to become cheaper than onshore wind (IEA, 2023a).

Experience has also shown the state must take on a large share of the financial risk of new nuclear capacity. Globally, the state owns around 45% of nuclear capacity; the sector benefits from large subsidies. Most ongoing construction is also implemented through public entities or involves public finance. A government inquiry concludes that Sweden will also need public support to bridge the gap between private investors' business interests and the socio-economic benefits of new nuclear power (MoF, 2024b). To overcome this challenge, a financing and risk-sharing model has been proposed that comprises the following (MoF, 2024b):

- **state loans** issued by the National Debt Office to lower the cost of capital
- **a price hedging agreement**, through a contract-for-difference with the government
- **a risk- and gain-share mechanism** that ensures investors receive a minimum return on equity, while avoiding excess profits.

With such a financing and risk-sharing model, a nuclear power programme of 5 000 MW installed power (equivalent to around four large reactors) would increase national debt by SEK 300 billion (2023 prices) if no cost overruns occur. This cost would rise to around SEK 450 billion (2023 prices) with 50% cost overruns. In the former scenario, public debt may decrease somewhat in the long term due to a gradual increase of interest rates on the state loans and since state loans are expected to be refinanced with private loans (MoF, 2024b). In the latter, public debt will be higher in the long term. Whereas new nuclear capacity would lower the volatility of electricity prices, its impact on system costs (e.g. operational and production costs), on investments in other energy sources, or for businesses and households is inconclusive (MoF, 2024b).

The future of small modular reactors also remains uncertain. By early 2024, no design had been fully certified for construction in developed countries. Given all technologies play a role in reaching the EU climate neutrality objective by 2050, the European Commission established the European Industrial Alliance in 2024. The Alliance aims to accelerate development, demonstration and deployment of small modular reactors in the early 2030s (EC, 2024a).

Social acceptability is also a factor when it comes to wind energy. In 2021, municipal administrations stopped 78% of all wind power projects. Factors include opposition of local residents, conflicting land claims, perceived inequalities of economic benefits and geographically uneven deployment (Lindvall, 2023). Some adjustments in profit-sharing from wind power projects could improve their social acceptability (OECD, 2023a; SFPC, 2024). The budget bill for 2025 proposes financial compensation to communities for local development initiatives and to residents living within a certain distance of new developments.

Offshore wind accounts for a negligible share of Sweden's renewable energy. While there is considerable interest by developers, the Swedish Armed Forces have to date vetoed almost 90% of all offshore wind projects due to security concerns. The government is examining how to improve the permitting process for offshore wind. Proposed amendments to the maritime spatial plans should consider the multiple, and potentially conflicting, uses of marine areas, while protecting the most ecologically sensitive areas (OECD, 2024b). Costs are another constraint. Unlike many of its European counterparts, Sweden does not offer revenue stabilisation. In 2023, an exemption offered to developers to pay for grid connections was also removed.

The government considers expansion of fossil-free hydrogen to be key to the decarbonisation of several industrial sectors, such as iron and steel production, and of other emissions, such as heavy transport (GoS, 2024a). For hydrogen to provide a viable alternative to the climate transition, it must rely on large amounts of fossil-free electricity. The Swedish Energy Agency estimates that investments in hydrogen by the industrial sector could increase demand for electricity by 22-100 TWh by 2050 (GoS, 2024a). In line with the EU hydrogen strategy, hydrogen should therefore only be considered where more energy or cost-effective alternatives are not available.

Given the scale and speed of the transformation required of the energy system, the government plays an important role to ensure the enabling system that facilitates the transition is in place. Two key enablers are improved permitting processes, and enhanced grid and network capacity:

- **Permitting processes** are a barrier to the acceleration and scale-up of renewable energy. For example, it takes on average nine years to secure the necessary permits for land-based wind projects, which is among the longest in Europe (OECD, 2023a). The share of approved permits has also been falling over time. The government recognises the need to speed up and streamline the process, undertaking numerous inquiries to explore potential improvements. The EU Renewable Energy Directive also encourages members to designate renewable acceleration areas, i.e. areas considered particularly suitable for construction of renewable energy production facilities, a process under way in Sweden (SEA, 2024a).
- **Power, grid and transmission capacity** delay the transition. Many industries wishing to electrify or scale up their operations are unable to access the grid in a timely manner. In July 2024, Sweden approved amendments to the Environmental Code and the Electricity Act to shorten and streamline the permitting process for the expansion of electricity networks. The government wishes to regulate so that overhead high-voltage lines rather than underground installations become the default option (SEPA, 2024a). However, this choice has not been welcomed by all. To improve public acceptance of the overhead option, the government has commissioned an investigator to review possible approaches to compensate affected communities (GoS, 2024a).

### Energy efficiency is improving, but overall energy use is projected to increase

Under the revised EU Energy Efficiency Directive, Sweden has committed to reduce primary energy consumption by 2030 to 41.2 million tonnes of oil-equivalent (Mtoe) and final energy consumption to 30.1 Mtoe. This would be down from 42.5 Mtoe and 31.0 Mtoe, respectively, in 2022 (MoCE, 2024). Both commitments are less ambitious than the reductions required to achieve the collective EU target (EC, 2024b). Sweden estimates the EU scenario does not consider the need to increase energy consumption to enable electrification and climate transition in its industrial sector. The EU Energy Efficiency Directive further encourages member states to achieve cumulative end-use savings for 2021-30 that for Sweden translates into 237 TWh. Sweden is not expected to reach this target and is analysing instruments that could fill the gap (MoCE, 2024).

Sweden also has a domestic target of 50% more efficient energy use by 2030 compared with 2005. This is a cross-sectoral target expressed in terms of energy supplied relative to GDP. Between 2005 and 2022, energy intensity decreased by 38% (MoCE, 2024). With the revised EU Energy Efficiency Directive, the planned electrification of society and the shift in policy focus to 100% fossil-free electricity production, the government has acknowledged the need to revise its national energy efficiency target. In doing so, Sweden is encouraged to ensure the new target aligns with binding EU energy targets.

In 2022, the industrial sector accounted for 38% of total final energy consumption (MoCE, 2024). This is due in large part to Sweden's energy-intensive industries, such as pulp and paper and iron ore. For decarbonisation of the industry sector, energy input is generally high for electricity generated through processes with thermal losses (such as nuclear power) compared to renewable energy sources (such as hydro, wind or solar). The EU Directive commits member states to reduce overall energy use independent of the energy source. Consequently, the sharp increases in demand for electricity in the industrial sector mean that other sectors, including transport and building, will need drastic energy efficiency improvements.

The transport sector accounted for 24% of final energy consumption in 2022, and still relies heavily on fossil fuels, even if this is changing (see below). Households accounted for 23% (MoCE, 2024). Electricity is the largest source of energy in the residential sector, accounting for half of total final energy consumption. With its combined focus on energy efficiency, heat recycling and renewable heat, Sweden has played an instrumental role in defining a modern district heating system. Moreover, Sweden is a leader in combined heat and power plant technologies. The building sector is also subject to several policies and measures. This includes the Swedish Building Regulations with a strong focus on energy efficiency, energy declarations and broader measures such as the energy and carbon tax. A strategy for energy-efficient renovation, for example, aims to address barriers to implementation, including split incentives and lack of information (MoI, 2020).

Enhanced energy demand and supply flexibility also contribute to energy efficiency and an improved balance of the energy system. On the supply side, flexibility can be improved through investments in electricity and heat storage and in energy efficiency technologies related to energy systems. Greater flexibility in demand can be achieved through investments in technologies that raise resource and operational efficiency; enhanced energy efficiency standards; or in opportunities arising from digitalisation and electrification. Equally, clear price signals can incentivise flexible use. The government has identified lack of data and effective data management, as well as lack of standards for data communication, as obstacles to greater flexibility in energy supply (GoS, 2024a).

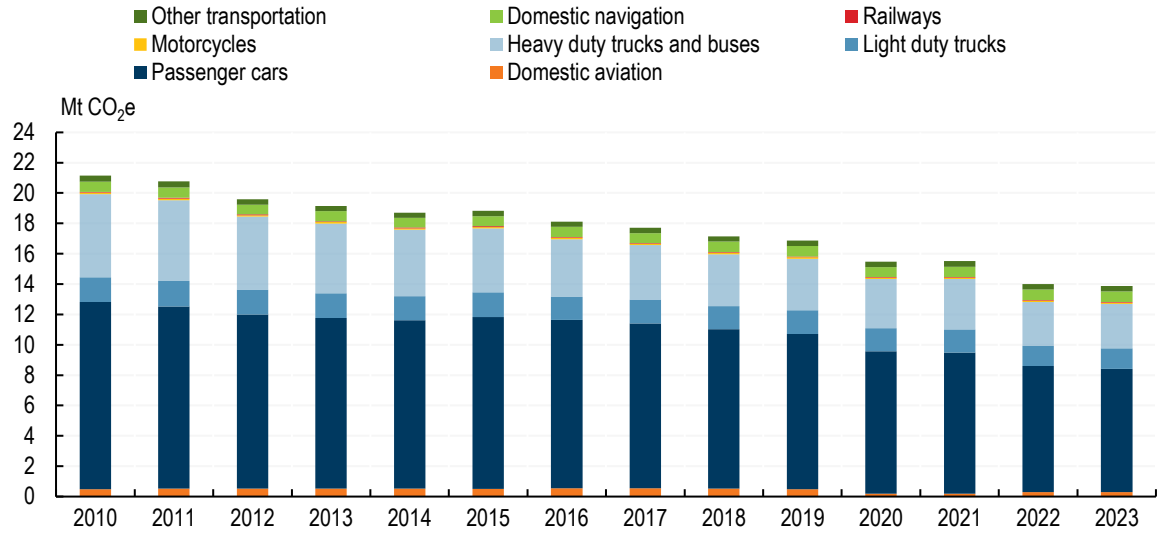
### *Recent policy changes contribute to a short-term increase in transport emissions*

Despite an increase in the number of kilometres travelled, emissions in the transport sector decreased by 34% over 2010-23. The decreased emissions were due in part to vehicle fuel efficiency improvements, increased electrification of the sector and the high biofuel blending requirement in place until 2023 (SEPA, 2024b). Road transport accounts for around 90% of emissions (Figure 2.6). Progress, however, is

considerably short of the domestic target of 70% emission reductions by 2030, a target the government plans to review. To achieve this target, emissions will have to decline on average just under 1 Mt $CO_2e$ per year (SEPA, 2024b). Instead, policy changes introduced by the government in 2023 are expected to increase transport emissions in 2024.

## Figure 2.6. GHG emissions from transport have substantially decreased over the past decade

Domestic transport GHG emissions, 2010-23




Note: 2023 data are preliminary.
Source: SEPA (2024), National Inventory Report 2024; SEPA (2024), Sweden's emissions and removals of greenhouse gases, June.

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In 2023, in keeping with an important election promise to reduce the cost of transport fuels, the government reduced the obligation to blend biofuels into petrol and diesel from 7.8% and 30.5%, respectively, to 6% for both (MoF, 2023). This change was initially planned for 2024-26. Whereas previous blending requirements were projected to halve emissions in the sector by 2030, the policy change was projected to increase emissions by about 3 Mt $CO_2e$ in 2024 (SEPA, 2024a).

In 2024, the government announced the blending requirement for both petrol and diesel would increase to 10% from July 2025. Further adjustments enable suppliers of renewable electricity to public charging stations to receive credits that they can sell to fuel suppliers. These suppliers, in turn, can use those credits to fulfil the reduction obligation (GoS, 2024b) in line with the EU Renewable Energy Directive. To address the expected increases in fuel prices, fuel taxes will be reduced and targeted support provided. If the measures are fully implemented, the government estimates they will reduce ESR emissions by 2.6-2.9 Mt $CO_2e$ over 2025-30 (MoF, 2024a). The measures proposed in the budget bill for 2025 (except fuel tax reductions), will improve the conditions for achieving the 2030 target and narrowing the gap to the 2045 target. However, they do not appear to be enough to meet the domestic transport target (MoF, 2024a).[3]

The changes to the blending requirement create policy uncertainty. Moreover, the use of biofuels in mitigating emissions has limitations. Most biogenic content blended into Swedish fuels is from imported feedstock (SNAO, 2023). The relative cost advantage of a biofuel blending over other ways of reaching the climate goals (e.g. accelerating electrification of the transport sector or scaling up efforts in the forestry sector) has been questioned (SNAO, 2023). In comparison, biofuels are expected to play an important role

in the transition of other parts of the transport sector that are harder to electrify, including long-distance sea transport and aviation.

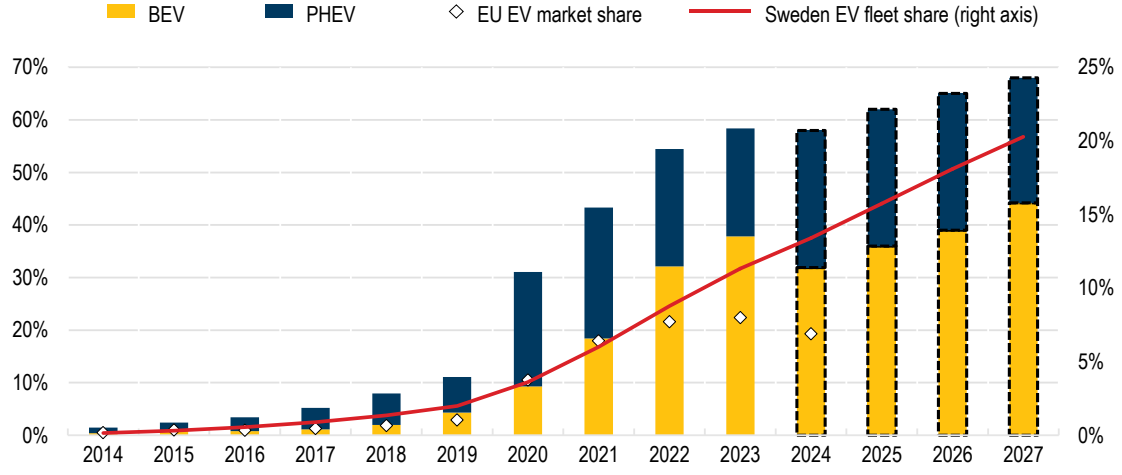
The forthcoming reduction in the petrol fuel tax comes in addition to tax changes already introduced by the government (Chapter 1). These tax changes have eroded the proportionality of $CO_2$ taxation. Given the important role of the transport sector in meeting Sweden's ESR target, the required emission reductions may be difficult to achieve with petrol and diesel prices below SEK 18-20 per litre (Hassler, J., 2023). Rather than addressing distribution impacts through lower fuel costs, analysts have suggested other forms of support to affected households, e.g. a climate bonus (Hassler, J., 2023). An increase in the vehicle tax (malus) would have a similar impact, since low-income households may be less able to afford a large, new fossil-fuelled car.

In 2023, battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) accounted for 60% of the sales share and for 11% of the passenger car fleet. To accelerate electrification of the sector, the government introduced a bonus in 2011 for the purchase of electric and other low-emission vehicles (Svensk Kollektivtrafik, 2023a). The bonus mainly benefited businesses and city dwellers (SNAO, 2020). This was removed in 2022 as the costs of owning and driving a low-emission car were approaching that of a petrol and diesel car (MoF, 2023).

Based on the Norwegian experience, once the electric vehicle market has reached a level of maturity, uptake will continue regardless of national policies due to increased price competitiveness (Box 2.3). A premium was introduced in 2024 for car owners replacing an old car with the purchase or lease of an electric car. An additional premium targeted at groups in need of support (e.g. those living in sparsely populated areas) has been proposed (MoF, 2024a). While the registration of new BEVs dropped in 2024, it is expected to increase again with the forecasted improvement of the Swedish economy (Figure 2.7). To increase convenience and reduce range anxiety for prospective buyers, the government has proposed to increase and extend investments in charging infrastructure until 2030 for both light and heavy-duty electric vehicles. It will focus on areas where expansion to date has been slow. However, lack of connection capacity in local and regional networks is delaying installation of new charging infrastructure (GoS, 2024a).

## Figure 2.7. Registrations of electric cars have soared in recent years but are slowing

Market share and fleet share of battery and plug-in hybrid electric cars, Sweden, 2014-23 and projections 2024-27




Note: BEV: battery electric vehicles. PHEV: plug-in hybrid electric vehicles. EU 2024: as of June.
Source: EAFO (2024), European Alternative Fuels Observatory; Trafikanalysis (2024), Short-term forecasts for the Swedish road transport fleet.

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### Box 2.3. Lessons from the Norwegian electric vehicle transition

Norway's experience illustrates that for a market to mature, domestic policy must be complemented by a product that consumers want to invest in. Norway has had policy incentives in place since the 1990s. However, sales of electric vehicles only took off after the technical qualities and design of international car producers improved (e.g. improved battery technology and reduced battery production cost), and tailpipe emissions standards were tightened in the United States and European Union. In July 2024, battery electric vehicles accounted for 92% of new registrations, whereas alternative fuelled light-duty vehicles accounted for 25% of the car fleet.

The costs of Norway's approach in supporting the electric vehicle market in reaching maturity have been significant. Reduced revenues from car-related excise duties amounted to about 0.1 percentage points of GDP per year. Further, the efficiency of the approach has been questioned. Tax breaks and the related behavioural responses imply an abatement cost of EUR 1 370 per tonne of $CO_2$ for battery electric cars and EUR 640 and EUR 200 per tonne for light and heavy-duty commercial vehicles. The cost of emission reductions through the tax concessions is estimated to be around ten times the EU ETS quota price.

However, subsidies for electric vehicles have had other positive effects that should be considered. For example, the subsidies helped reduce some negative externalities from car use such as reduced noise and air pollution. Over time, they also help take fossil-fuelled vehicles off the road and instigate a tipping point towards electrification of the car fleet.

Source: OECD (2023), OECD Economic Surveys: Sweden 2023.

The private vehicle fleet includes an estimated 4.4 million fossil-fuelled cars, many of which will still be on the road by 2030. The large volume of fossil-fuelled cars highlights the importance of minimising private vehicle use. In 2023, public transport accounted for 31% of all motorised journeys (Svensk Kollektivtrafik, 2023b). Over half of all personal trips (to work, school, or for services and shopping) are done by car, compared to around a third by active transport methods (e.g. cycling and walking). In 2023, the government reallocated SEK 750 million in the budget from railway maintenance to road maintenance. This could contribute towards greater reliance on private vehicles rather than encouraging travellers to use public transport.

In 2024, the Fiscal Policy Council strongly criticised the government for its lack of strategy for reaching domestic and EU emission targets for 2030 (SFPC, 2024). While recent policy shifts and proposals aim to meet those targets, Sweden still lacks a clear plan for how different mitigation measures will support the proposed transition for the sector. Sweden is encouraged to explore other measures, including the role of enhanced transport efficiency, with public transport playing a critical role; accelerated electrification of the sector with direct targets for electrification; and increased energy efficiency in vehicles and ships (Svensk Kollektivtrafik, 2023a). In addition to contributing towards Sweden's national climate mitigation target for the transport sector, it will prepare the sector for inclusion in EU ETS-2 in 2027, and the EU zero $CO_2$ emissions target by 2035 for all new cars and vans (OECD, 2023a).

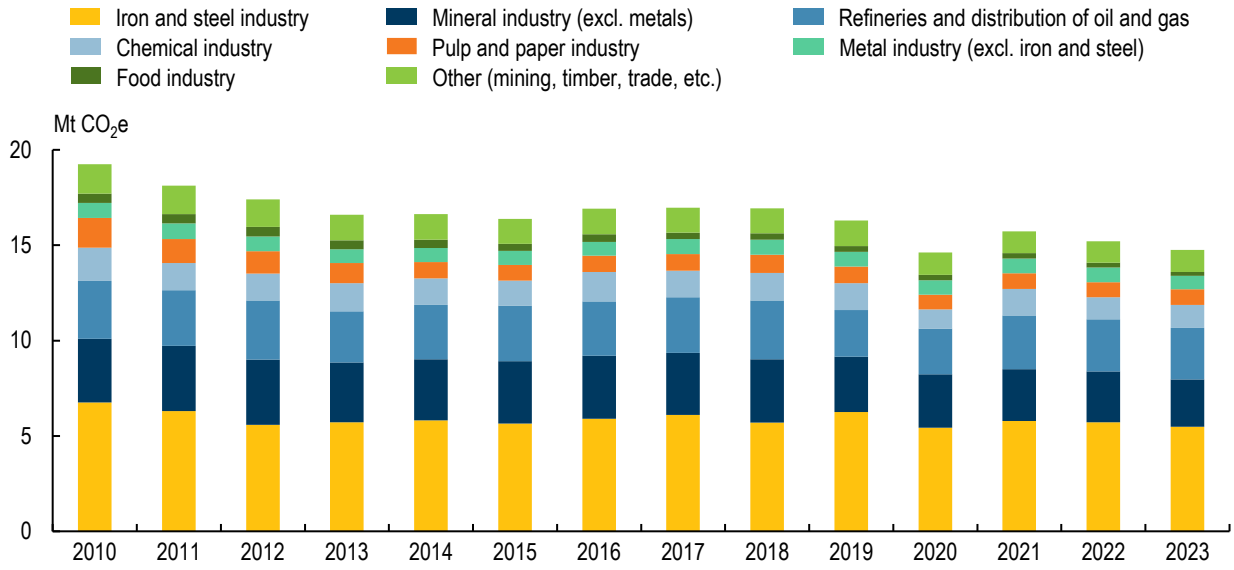
#### *The industrial sector is benefitting from R&D, but transformation of the sector is challenging*

The industrial sector is one of the hardest sectors to decarbonise. Still, it is playing a key role in reducing emissions and strengthening Sweden's competitiveness internationally (GoS, 2024a). Historically, emissions from the sector have fluctuated with production volumes and economic growth. In 2023,

emissions were 23% lower compared with 2010. Metal (iron and steel) production accounts for the largest share of emissions in the sector.

### Figure 2.8. GHG emissions have decreased in all industries

Breakdown of GHG emissions by industry, 2010-23




Note: 2023 data are preliminary.
Source: SEPA (2024), Sweden's emissions and removals of greenhouse gases, June.

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Since 2010, emission reductions have largely been due to increased electrification, the use of biofuels and enhanced energy efficiency. Strong public support for research and development has propelled Swedish companies to the forefront of technological developments (OECD, 2023a). To date, most research has been driven by industry and led by private organisations, with Vinnova serving as the public sector counterpart. The Industrial Leap has also provided an important source of funding. Fossil Free Sweden, a government initiative from 2015, works with the business sector and government to identify obstacles and opportunities for accelerating the climate transition. This has resulted in 23 roadmaps that outline the climate commitment of business sectors, as well as policy proposals for how all actors involved – companies, industries, municipalities and regions – can support the transition. Examples include roadmaps for fossil-free steel and cement.

Further emission reductions will require technological developments in the iron and steel industry, large investments in new process technology and more electricity, including for hydrogen production. However, with overall demand for electricity projected to double by 2045, several potential externalities should be considered. These include the risk that progress by the sector will contribute to increased electricity prices (OECD, 2023a). Further, when such technological innovations have benefited from government support, some technologies can be favoured over potentially more efficient approaches. Closed-loop carbon recycling, for example, contributes to resource savings and emission reductions but remains far from commercialisation (OECD, 2023a). Maintaining technological neutrality in the public support provided is therefore important.

The commitment by the industrial sector to transform its production processes has contributed to the development of new skills and opportunities, and in turn economic growth. This is especially true in the northern regions where many industrial companies are located (OECD, 2023a). Future progress, however, will be determined in part by the ability of industrial facilities to connect to the electricity grid. Another important determinant will be the availability and development of the right skills. This is true both for the industrial facilities and for public services. Services such as housing and infrastructure, for example, are crucial for a region that has suffered from changing demographics and lagging productivity growth (OECD, 2023a).

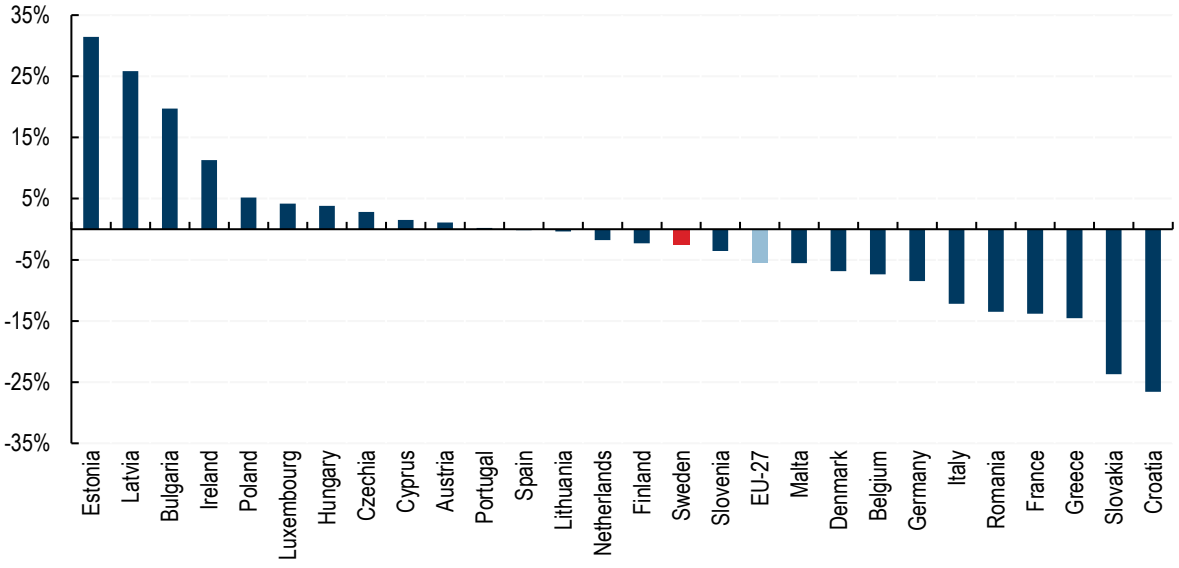
The labour market needs of the transition have only recently become a government focus. In the northern part of the country, public employment services are collaborating with the sector, as well as with education and training institutions, to respond to projected labour shortages from the transition (OECD, 2023b). However, such collaboration is not in place in other parts of the country. Further, the focus to date has primarily been on skill needs for electrification, battery development and mining. Limited attention has been paid to the implication of the climate transition on related jobs and industries (OECD, 2023b). The central government is well placed to co-ordinate the numerous actors involved in assessing skill needs and in developing training and educational measures supportive of the climate transition. Indeed, given the scale of the challenge, these cannot successfully be scaled-up without government support (OECD, 2023b).

### *Emission reductions in the agricultural sector have been minimal over the past decade*

GHG emissions from agriculture mainly consist of methane and nitrous oxide from animal feed digestion, manure processing and nitrogen transformation in soil. The emission intensity of the Swedish agricultural sector is below the OECD average, but at levels comparable to other Nordic countries (EC, 2024c). The limited reduction of emissions in the agricultural sector is not unique to Sweden, but common across many EU countries (Figure 2.9). Sweden's 2017 National Food Strategy aims to increase domestic food production while achieving relevant environmental objectives, and generating growth and employment. This focus on domestic production and the inevitable GHG emissions associated with biogenic processes highlights the importance of a complementary focus on environmental and climate objectives.

## Figure 2.9. Agricultural GHG emissions have fallen less than in the European Union

Percentage change of agriculture emissions, by EU member state, 2005-22




Source: EEA (2024), "EEA greenhouse gas", *Data Viewer*.

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Agricultural emissions face low carbon prices or are not priced (Chapter 1), and most climate measures are voluntary. Emission reductions to date have been attributed to increased efficiency (e.g. higher milk production per dairy cow), less livestock (cows and pigs, in particular) and decreased emissions from agriculture soil, due especially to reduced use of nitrogen-mineral fertiliser (SEPA, 2024c). However, the composition of emissions across the different components of the agricultural sector has remained unchanged since 2010. Enteric fermentation and agricultural soils accounted for 50% and 40% of emissions in 2022, respectively.

The government considers that further emission reductions in the sector will be difficult. It believes more reductions could affect its competitiveness, and potentially result in emissions leakage. This is one reason for the inclusion of supplementary measures in the climate policy framework (GoS, 2023). A roadmap, produced by agricultural businesses in collaboration with Fossil Free Sweden, estimates the potential for $CO_2$ emission reductions at around 655 000 tonnes. Of these, around 80% would be achieved by replacing farm machinery fossil fuels with renewable sources of energy (Fossil Free Sweden, 2020). The remainder would be achieved by heating agricultural premises with renewable energy.

The EU Common Agricultural Policy (CAP) is the principal economic policy instrument supporting mitigation measures in the agricultural sector. For 2023-27, the CAP does not include any quantitative climate targets. However, novel to this round is the introduction of national strategic plans. Sweden's CAP Strategic Plan, approved by the European Commission, specifies that Sweden will use 30%, around EUR 1.3 billion, of the EU financial contribution to support environmental and climate objectives, including carbon sequestration (EC, 2023b; GoS, 2023). The plan specifies that support will be provided for investments, innovation, method and competence development that help increase productivity, resource efficiency and GHG mitigation. It will also compensate for carbon sequestration through catch crops, intermediate crops, wetlands and precision farming (GoS, 2023). However, financial allocations to the climate objective (16%) and the share of agricultural area under supported commitments to reduce emissions or to maintain or enhance carbon storage (22%) seem low compared to the respective EU averages (29% and 35%) (EC, 2024d).

The Climate Leap prioritises the agricultural sector, providing more than 800 grants between 2015 and 2022, totalling SEK 2.2 billion. This included support for electrifying farm machinery and production processes, switching from fossil fuels to renewable sources of energy, and producing biogas and anaerobic digestion. A climate premium for environmental vehicles also contributes to decarbonise the sector through the financial support it provides for the purchase of agriculture work machines powered either by electricity or biofuels. Broader instruments, such as the Environmental Code, the Animal Welfare Act and environmental quality objectives also help reduce emissions, even when this is not their primary purpose. As an example, regulation of manure management for environmental quality objectives affects the emission of methane and nitrous oxide (MoCE, 2022).

As Sweden explores additional mitigation measures, it may wish to explore what aspects of the Danish agricultural tax could be transferable to the Swedish context (Box 2.4). As the European Commission is considering pricing GHG emissions from agriculture (EC, 2023c), Sweden should explore all options available and pilot potential measures. A complementary focus could be on further reducing food loss and waste and influencing consumer behaviour and preferences. Globally, halving food loss and waste by 2030 has the potential to reduce agricultural GHG emissions by 4%. In the European Union, almost a quarter of all meat production is estimated to be lost or wasted (OECD/FAO, 2023).

### Box 2.4. The world's first carbon tax on the agricultural sector introduced in Denmark

The Danish government presented a proposal for a Green Denmark in June 2024 that addresses both climate and broader environment commitments. The agreement was negotiated by a "Green Tripartite" comprising the government, the Agriculture and Food Council, the Danish Society for Nature Conservation, the Food Federation, the Metal Workers' Association, the Confederation of Danish Industry and Danish municipalities.

Central to the agreement is the world's first carbon tax on agricultural emissions. The tax will enter into force in 2030 at an initial rate of DKK 300 per tonne of $CO_2$e, increasing to DKK 750 per tonne of $CO_2$e in 2035. With a tax deduction of 60%, this corresponds to effective tax rates of DKK 120 (around EUR 16) per tonne $CO_2$e in 2030 and of DKK 300 (EUR 40) per tonne $CO_2$e in 2035. Revenues from the livestock tax will be redirected to investments in climate technology, green initiatives and production transition aimed at farmers most affected by the tax and who face difficulties in adapting. Further, a tax on emissions from carbon-rich lowland soils of DKK 40 per tonne of $CO_2$e will be effective from 2028 (2022 prices). The tax aims to increase the incentive for landowners to participate in rewetting projects. Landowners who have already had their lowland soil rewetted are not subjected to the tax. Instead, the tax only affects landowners who do not wish to participate in a rewetting project when there is an existing project agreement or when they are part of an ongoing feasibility study. The tax rates and deductions will be reviewed in 2032. A potential increase in the tax on carbon-rich lowland soils will be negotiated in 2027.

The tripartite negotiations were informed by an expert group that presented three models for carbon tax on agriculture based on a GreenREFORM climate-economic model for the Danish economy. The proposed models included carbon prices ranging from DKK 250 and DKK 750, with projected emission reductions ranging from 2.4 Mt $CO_2$e and 3.2 Mt $CO_2$e. The compromise aims to strike a balance between achieving climate and environmental objectives and managing distributional impacts. The proposal has been praised for its broad stakeholder engagement. At the same time, environment and climate organisations have criticised the delayed entry into force of the carbon tax. Some also consider the effective tax rates of DKK 120-300 per tonne of $CO_2$e as too low, given that other sectors will face a carbon tax of DKK 750 per tonne of $CO_2$e.

Source: GoD (2024), Agreement on a Green Denmark.

*Lower emissions from the waste sector but higher emissions from waste incineration with energy recovery*

GHG emissions in the waste sector dropped by over 50% between 2010 and 2022 (Figure 2.1). Legislative and policy measures that have contributed to reduced emissions include the expansion of methane recovery from landfills, reduced landfill disposal of organic material and increased levels of waste incineration with energy recovery (Chapter 1). GHG emissions associated with waste incineration, which are accounted for in the energy sector, more than offset the reduction in emissions in the waste sector over 2010-22. However, the 2023 climate action plan does not include any measures to reduce waste incineration or phase out the use of fossil-based plastics (CPC, 2024). The tax on incineration was removed in 2023 (Chapter 1).

### *2.3.3. Development co-operation maintains a strong focus on climate change, but the approach has changed*

Sweden has a reputation as an ambitious and influential actor on sustainable development. It has a strong focus on peace and conflict prevention, gender equality, environmental sustainability and climate change (OECD, 2019). In 2023, the government published a reform agenda that directs development co-operation towards freedom, empowerment and sustainable growth. It further specifies that the share of development assistance to be channelled through core support to multilateral organisations will be limited to enhance the effectiveness of the support provided, while the proportion of support channelled through civil society organisations will increase (MFA, 2023a). A complementary strategy for trade, investment and global competitiveness aims to stimulate trade and the participation of Swedish businesses in international procurements (MFA, 2023b).

Over 2021-22, 26% of total bilateral allocable aid focused on climate change (the DAC average was 31%) with a greater focus on adaptation (25%) than on mitigation (14%) (OECD, 2024c). The 2023 climate action plan, as well as the reform agenda, call for expanded and more effective climate aid, included through more focus on energy efficiency and effective emission reductions (including fossil-free energy) in major emission countries, including middle-income countries (MFA, 2023a). The increased focus on middle-income countries is consistent with the priority of linking development with trade and on official development assistance being a catalyst for private sector engagement.

## 2.4. Plans and goals for promoting supplementary measures

All net-zero scenarios recognise the need for removing emissions from the atmosphere to meet the climate targets of the Paris Agreement. Some emissions are either difficult or costly to mitigate with available knowledge and technology. Examples include emissions from the cement or metal industries or the elimination of methane and nitrous oxide emissions from biological processes. Sweden's climate policy framework specifies that supplementary measures can account for up to 15% of emission reductions by 2045 (Table 2.1). The limit aims to ensure that the primary focus remains on rapidly reducing emissions (excluding LULUCF). Three types of supplementary measures are highlighted:

- **Increased uptake of $CO_2$ by forests and agricultural land as a result of additional measures**: Trees cover more than two-thirds of Sweden's land area, providing opportunities for supplementary measures that affect terrestrial carbon sequestration. Forests, soils and wetlands are among the ecosystems that could contribute to increased carbon sequestration.
- **Carbon capture and storage from the combustion of biomass (i.e. $CO_2$ of biogenic origin, BECCS)**: The use of biomass as raw material for the pulp and paper industry means that Sweden has significant sources of biogenic $CO_2$ emissions. The use of biomass residue in the energy sector also contributes to large point emission sources.
- **Verified emission reductions and removals through investments outside Sweden's borders**: In compliance with Article 6 of the Paris Agreement, the framework for countries to mitigate climate change through market-based co-operation,[4] verified emission reductions and removals in other countries must go beyond those that the host country would already have taken. Further, the mitigation outcomes must not be double counted. Flexibilities within EU commitments also enable member states to trade emission allowances.

All three groups are complex and characterised by long lead times, further highlighting the importance of limiting reliance on supplementary measures to meet climate targets. Moreover, there are numerous uncertainties and risks to their eventual contributions to Sweden's climate targets (Box 2.5). To bring clarity on their respective feasibilities, the government has emphasised the urgent need to demonstrate progress.

For example, if BECCS is to significantly contribute to negative emissions by 2045, it has been recommended that the first plants must become operational in the 2020s (GoS, 2020).

### Box 2.5. The uncertainties and risks of supplementary measures must be factored into planning

All supplementary measures are associated with uncertainties and risks. One clear risk is that individual projects do not materialise or deliver the scale of negative emissions planned. The uptake of measures in the land use, land-use change and forestry sector, for example, can be influenced by the incentives provided, as well as changes in the demand for related products. Similarly, natural disturbances, accelerated and intensified by climate change, such as drought and forest fires, also affect the outcomes of the measures taken.

Another risk is that an entire category of supplementary measures cannot deliver the scale of negative emissions envisioned. This could happen, for example, if international negotiations on an Article 6 rulebook delay Sweden's implementation of co-operative mitigation activities abroad or if EU regulation changes the accounting of emission sources or sinks. Other commercial, technical, legal and political risks that reduce the feasibility of negative emissions measures need to be explored and understood.

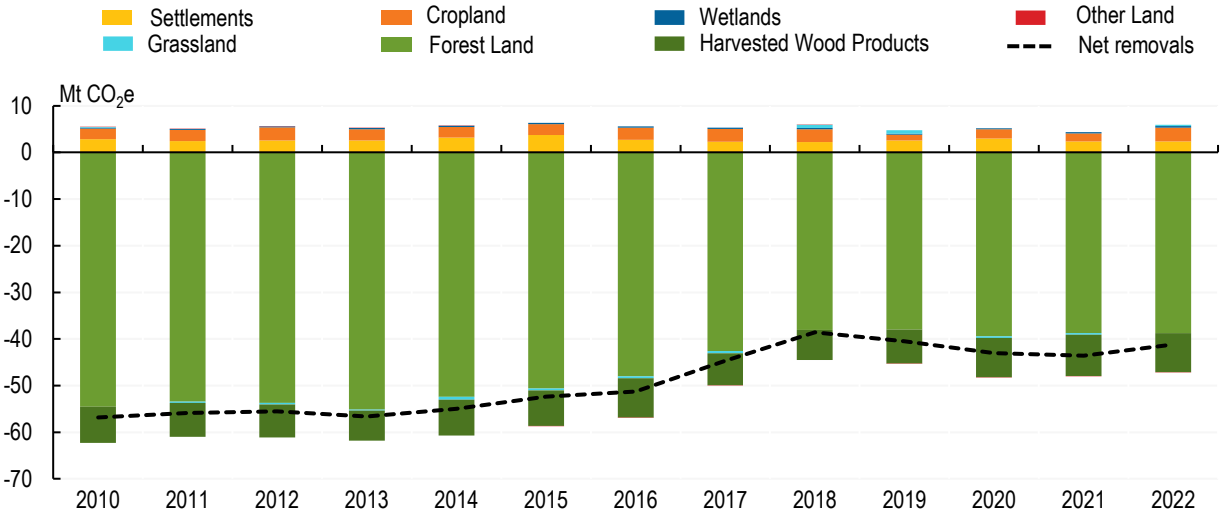
Source: GoS (2020), The road to a climate-positive future, SOU 2020:4.

#### *2.4.1. Increasing carbon sinks in forests is challenging, particularly in a changing climate*

Forests and woodlands account for almost 70% of Sweden's land area. Sweden has high net carbon removals from LULUCF, but the level of sequestration is declining (Figure 2.10). Increased harvesting, decreased forest growth and lower sequestration of carbon by ageing forests contribute to this trend. Some inter-annual variation is inevitable due to storms and drought. Recent infestations of spruce bark beetle have further contributed to fewer net removals (Wikberg et al., 2023). In a changing climate, such natural disturbances are projected to increase in frequency. This highlights the importance of spreading the risk by taking a diversity of measures that preserve and increase carbon sinks (SFA, 2023).

## Figure 2.10. GHG removals from LULUCF have declined

GHG emissions and removals from LULUCF by source, 2010-22




Source: SEPA (2024), National Inventory Report 2024.

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In the context of Sweden's climate target, the LULUCF sector is only considered as a supplementary measure. Under the EU LULUCF Regulation, Sweden is obliged to increase by 2030 annual net carbon removals by nearly 4 Mt $CO_2e$ compared to the average of 2016-18 (Table 2.1). However, Sweden is not on track (Figure 2.3). A review of various LULUCF measures on carbon sequestration concludes that Swedish forests and harvested wood products will continue to serve as carbon sinks over the next hundred years. However, it also notes that net carbon removals will decrease over time. Research suggests that different measures (Box 2.6) can contribute to enhanced sequestration to varying extents in different parts of the country. However, the impact of a changing climate on forest growth and health will be an important unknown variable. For example, data show that forest growth has decreased in recent years, with summer drought identified as a potential reason (SFA, 2023). If the frequency of summer droughts increases, the potential contribution of the different measures may be overestimated.

### Box 2.6. The potential contributions of different LULUCF measures vary

A study by the Swedish Forestry Agency identifies a series of measures to increase the carbon sink in Swedish forests:

- **Reducing harvesting rates by 10% compared to current levels** could increase the carbon sink in the short term (30 years) and long term (80-100 years) by just under 10 Mt $CO_2$e per year until 2100.
- **Longer rotation periods by increasing the youngest age for final felling by 30%** could increase the carbon sink with 7.5 Mt $CO_2$e per year until 2100.
- **Doubling the size of set-aside in production forest land** is not projected to increase the carbon sink if current felling volumes from the remaining cultivated forest areas remain constant. Instead, it could reduce the carbon sink by 1.3 Mt $CO_2$e per year until 2100.
- **Reducing game-grazing damage from elk and deer in young forests from 12% to 5%** could increase the carbon sink with 5.3 Mt $CO_2$e per year until 2100, but further research is required.
- **Increasing the forest area fertilised with nitrogen 4.5 times compared to current level** could increase the carbon sink by around 2 Mt $CO_2$e per year until 2100. This limited impact is in part due to the expected challenges of this measure given the conflicts it poses with other ecosystem services (e.g. water quality and pasture for reindeer).
- **Increasing three-fold the area regenerated with birch compared to current practice** could reduce the carbon sink by 6.2 Mt $CO_2$e per year until 2100 due to lower tree growth in birch forests. Further research is required to better understand the enhanced resilience of broadleaves to natural disturbances.
- **Increasing the share of productive forest area managed with continuous cover forestry (patch cutting and selective cutting) from the current level of 4% to 25%** is not projected to contribute to significant changes in the carbon sink.

Note: The study examines the contribution of each measure on carbon sinks; it does not consider the social and economic impacts, such as potential job losses, often in small remote areas. Further, the study assumes that the volume of felling remains constant and at the level of felling intensity in the business-as-usual scenario (i.e. if felling decreases in some parts of the country, an increase is assumed in other parts to maintain the same total felled volume). It does not consider the potential impact of measures on the substitution to other materials or fuels with potentially higher climate impacts. Nor does it consider the risk of increased forest harvesting in other countries, and thus carbon leakage.
Source: SFA (2023),"Effect of some forestry measures on the carbon sink in Sweden".

The Swedish Forest Protection Act (1979), and subsequent amendments, focus on two main and equally important goals. First, a production goal calls for effective and responsible use of forests and forest lands to produce sustainable yields. Second, an environmental goal calls for the preservation of the natural productive capacity of forest land, including biodiversity and genetic variation in forests (SEPA, 2019). Further, a flexible forest management approach shares responsibility among all actors in the sector to collectively meet the dual objectives. As most productive forests are privately owned, the potential impact of this flexibility is large.

Emissions from drained peatlands are high and the rewetting of these lands, from agricultural or forestry land, is estimated to have a high potential for carbon removals (EC, 2023d). The restoration of wetlands also contributes to strengthened biodiversity, water management and reduced eutrophication. The government has increased the budget allocation for wetland restoration. This builds on efforts over the past few years to rewet drained lands. Of these efforts, around half have taken place in protected areas with a focus on improving conditions for biodiversity (SEPA, 2024a).

To meet the target of the LULUCF sector, additional measures must be taken. Today, few policy instruments directly address emissions and removals in the LULUCF sector (SEPA, 2024a). The government tasked a cross-party inquiry in 2022 to propose a strategy with intermediary targets, policies and measures for Sweden to reach its international and EU obligations on both biodiversity and LULUCF. The proposal was expected in February 2025 (GoS, 2022). In 2024, an investigation was launched to review the national forest policy in light of developments within the European Union, but also to consider measures for long-term sustainable and competitive forestry (GoS, 2024c). Sweden may also consider lessons learnt in other countries, including New Zealand where land-use change and forestry are included in its ETS (NZMFE, n.d.).

### *2.4.2. The risks associated with technological measures to promote negative emissions should be carefully considered*

Sweden is pioneering technology developments for carbon capture use and storage (CCUS), especially BECCS. The focus is on large point sources of biogenic emissions, including the pulp and paper industry, waste incineration plants, and the electricity and district heating sector. Based on the current landscape of operating support for BECCS in Sweden, an estimated 1.7-2.6 Mt $CO_2$ could be captured by 2030 (IEA, 2024), with the potential to increase to 3-10 Mt $CO_2$ by 2045 (GoS, 2020). For each part of the CCS chain – capture, transportation and storage – technologies are available, but their levels of maturity vary. All CCUS projects are at the planning phase, with some investment decisions expected in 2024. However, decisions for around half remain uncertain (IEA, 2024).

For CCS deployment to occur at scale, both regulatory and economic support are needed. Legal barriers include complex permitting processes for the construction of CCS facilities, and a regulatory focus on facilities that capture emissions from either biological or fossil origin, but rarely both (Nordic Energy Research, 2022). A public inquiry is examining how to shorten and simplify permit processes for existing companies wishing to change their practices, as well as for new companies wanting to enter the market (MoF, 2023).

The government also provides direct financial support. To date, this has primarily been through the Industrial Leap. Funding targets industries with process-related emissions, research institutions and universities, with the focus ranging from research and feasibility studies to investments (GoS, 2023). By 2023, the Industrial Leap had supported around 20 Swedish facilities in undertaking BECCS feasibility studies and pilots (GoS, 2023). One Swedish project has also received support from the European Union, through the Innovation Fund and Horizon Europe.

In 2024, a support scheme in the form of a reverse auction for biogenic $CO_2$ was also put in place. The scheme allows companies to put forward bids on how much biogenic $CO_2$ they can capture and store, and at what cost. The companies (one or more) requesting the lowest amount of support per tonne of biogenic $CO_2$ removed win the auction. They receive financial support for investment and operating costs, according to their bids, for 15 years. The initiative is open to companies that i) operate in Sweden and emit biogenic $CO_2$; and ii) implement projects with a capacity to capture and store at least 50 000 tonnes of biogenic $CO_2$ per year. The government can commit up to SEK 36 billion (around EUR 3 billion) over 2026-46 (GoS, 2023).

Emissions that are captured and permanently stored do not count towards the allocated emission rights under the EU ETS. Therefore, facilities covered by the EU ETS can partly motivate CCUS deployment with reduced compliance costs. However, the price of emission allowances in the EU ETS is likely too low to stimulate CCUS investment decisions (ICAP, 2023). The beneficiaries of the reverse auction can sell carbon credits tied to the negative emissions in voluntary carbon markets. Such a sale would reduce the government support provided by 90% of the selling price. Further, the buyer of the negative emission credits must transparently disclose that they contribute to the achievement of Sweden's climate goals.

Despite the large financial commitment, the number of recipients of the auctioning scheme will be limited. Given the difficulty in developing viable business models for BECCS in the short term, it will be important to explore alternative incentive measures with broader application. One example is the provision of tax credits for captured carbon, an approach taken in the US Inflation Reduction Act. In a global assessment of 400 announced CCUS projects, over half are part of a CCUS hub or cluster that bring down transport and storage costs. However, the development of such hubs requires planning and permitting co-ordination across industries (IEA, 2023b; Dechezleprêtre, Mulligan and Vitkova, forthcoming), and for Sweden, also across national boundaries.

Sweden's domestic capacity for geological storage is unknown. Initial assessments identified two potential areas suitable for storage: one in the southeastern Baltic Sea and a second south-west of Skåne (SGU, 2023). Their suitability is being further examined with results expected in 2026. In the near term, Sweden relies on the possibility of storing carbon abroad with Memoranda of Understanding reached with Norway and Denmark. Similar agreements are foreseen with other countries, including the United Kingdom and the Netherlands (SEA, 2023b).

Individual companies must identify counterparts that can transport and store the carbon. The maturity of technologies for transportation, such as pipelines, is already well established in other contexts; the maturity of technology in ocean transport, however, is lower (Dechezleprêtre, Mulligan and Vitkova, forthcoming). Innovative storage solutions have increased in recent years. Internationally, legislative and regulatory frameworks still need to clearly set out the legal requirements and responsibilities in case of leakage during transportation or at the geological storage site (Dechezleprêtre, Mulligan and Vitkova, forthcoming). Through the EU Directive on geological storage of $CO_2$, Sweden has already taken measures to address some of these risks. Together with five other European countries – Denmark, Finland, France, Germany and the Netherlands – Sweden has also called for a better EU regulatory framework for cross-border transport of captured $CO_2$.

As the sector develops, careful attention must be paid to associated risks. For example, the efficiency of CCUS technology in capturing carbon and the additional energy required in the process (capture, transport and storage) are still poorly understood (EASAC, 2022). Current technologies are best suited for point emission sources with high concentrations of $CO_2$, which is the case for most facilities in Sweden. For emission sources in remote locations or with low concentration of $CO_2$, the economics of CCUS pose challenges.

### *2.4.3. There are barriers to increasing verified emission reductions and removals outside Sweden's borders*

In meeting its domestic climate targets, Sweden can, among other things, use Article 6 of the Paris Agreement to co-operatively implement mitigation actions in other countries, and support a higher overall mitigation ambition. The government is also planning to purchase emission allocations from other EU countries in support of Sweden's 2030 EST and LULUCF commitments.

Sweden has played an active role in the climate negotiations on Article 6. Collaborations have been established with partner countries to implement co-operative mitigation activities that can contribute to climate objectives of both Sweden and the host country. Through such collaborative approaches, Sweden can acquire emission reductions and removals, so-called Internationally Transferred Mitigation Outcomes (ITMOs).

Sweden has signed Memoranda of Understanding with Zambia, Nepal, Rwanda and the Dominican Republic, as well as a bilateral agreement with Ghana. Discussions are ongoing with other countries. Sweden is also working with international organisations and multilateral development banks to facilitate implementation of Article 6 collaborations. Sweden is already implementing pilot activity in Ghana, with more co-operative approaches in the pipeline. To advance understanding of the international rules for

Article 6, Sweden has also signed a Memorandum of Understanding with Switzerland to pilot international transfers and reporting of emissions removals (SEA, 2024b).

There are multiple barriers to Sweden growing its pipeline of Article 6 activities. These include limited host country capacity, long project lead times and risks due to ongoing Article 6 negotiations, and an evolving rulebook. The Article 6 market is still nascent, so the transaction costs of engaging in these markets are high. Furthermore, each project has risks such as not achieving expected mitigation impacts. Host countries may also wish to stop authorising mitigation outcomes. This creates considerable uncertainty around the scale of ITMOs that Sweden could acquire, and therefore how this will contribute to the 15% quota of supplementary measures.

Finally, in the EU context, the availability of emission allocations is unclear. In the past, emission allocations were available from the more recent EU members with lower emission reduction targets. However, the availability of such allocations is becoming scarcer as the stringency of EU climate and energy policy increases. Updated 2024 NECPs indicate that surplus emission allocations will be limited (Rudberg, 2013).

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## Notes

[1] Electricity and heat generation, energy-intensive industries and aviation within the European Economic Area.

[2] Buildings, agriculture, waste, small industry and domestic transport, excluding aviation.

[3] Official updated SEPA projections with measures implemented after March 2024 will be available in 2025.

4 Article 6 establishes international rules for countries to voluntarily co-operate to mitigate climate change and achieve their NDCs. As part of its supplementary measures, Sweden implements projects under Article 6.2, a framework for countries to co-operate bilaterally. The host country (e.g. Ghana) needs to authorise verified emission reductions or removals from these activities before they can be transferred to the buyer country (e.g. Sweden) as an Internationally Transferred Mitigation Outcome. Article 6.2 gives participating countries considerable flexibility to design and execute co-operative approaches.

# OECD Environmental Performance Reviews: Sweden 2025

Sweden successfully decoupled major environmental pressures from economic growth over the past decade. The country ranks well on many environmental indicators. However, a number of environmental targets are not expected to be met by 2030. Despite significant reductions in greenhouse gas emissions, recent policy shifts have created uncertainty.

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