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Foreword

The principal aim of the OECD Environmental Performance Review 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 report reviews the environmental performance of Finland since the previous review in 2009. Progress in achieving domestic objectives and international commitments provides the basis for assessing the country'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 Finland's historical environmental record, present state of the environment, physical endowment in natural resources, economic conditions and demographic trends.

The OECD is indebted to Finland's Ministry of the Environment for its co-operation in providing information and in organising the virtual review mission (18-22 January 2021) and policy mission (11 June 2021), as well as for facilitating contacts inside and outside government institutions. Thanks are also due to all government ministries and agencies, as well as to the non-governmental organisations, that participated in the virtual missions and/or provided information and comments.

The OECD is grateful to the representatives of the three examining countries, Gunnar Farestveit (Norway), Alowin Moes (Switzerland) and James Mabbutt (United Kingdom), for participating in the review.

The authors of this report are Ivana Capozza, Britta Labuhn, Eugene Mazur and Daniel Nachtigall (OECD Environment Directorate), under the co-ordination and guidance of Ivana Capozza. Aimée Aguilar Jaber supervised the chapter on climate change and well-being. Carla Bertuzzi provided statistical support, Annette Hardcastle and Fiona Smyth provided administrative support and Mark Foss copy-edited the report. Natasha Cline-Thomas provided communications support. Preparation of this report also benefited from inputs and comments from Brilé Anderson, Hélène Blake, Gérard Bonnis, Nils Axel Braathen, Simon Buckle, David Carey, John Dulac, Nathalie Girouard, Eija Kiiskinen, Rodolfo Lacy, Jussi Lankoski, Mariana Mirabile, Jonas Teusch of the OECD Secretariat, Sylvia Beyer of the International Energy Agency and Tatiana Samsonova of the International Transport Forum.

The OECD Working Party on Environmental Performance discussed the Environmental Performance Review of Finland at its meeting on 13 October 2021 and approved the Assessment and Recommendations.

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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, the Czech Republic, 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, Turkey 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: Euro (EUR)

In 2021, USD 1 = EUR 0.830

In 2020, USD 1 = EUR 0.878

In 2019, USD 1 = EUR 0.893

Cut-off date

This report is based on information and data available up to 10 September 2020.

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 Finland

2020 or latest available year (Numbers in parentheses refer to the OECD average)[1]

PEOPLE AND SOCIETY					
Population (million)	5.5		Population density per km^2	16.4	(36)
Share of population by type of region			Population annual growth rate, latest 5 years	0.2	(0.5)
Predominantly urban (%)	31	(48)	Income inequality (Gini coefficient)	0.27	(0.31)
Intermediate (%)	30	(28)	Poverty rate (% of pop. with less than 50% med. income)	6	(11)
Rural (%)	39	(24)	Life expectancy	82	(81)
ECONOMY					
Total GDP (National currency, billion)	241		Imports of goods and services (% of GDP)	39.5	(28.9)
Total GDP (USD billion, current PPPs)	285		Value added shares (%)		
GDP annual real growth rate, latest 5 years	1.9	(2.2)	Agriculture	2.7	(1.8)
GDP per capita (1 000 USD, current PPPs)	51.6	(46.5)	Industry including construction	28.0	(24.4)
Exports of goods and services (% of GDP)	39.0	(29.4)	Services	69.4	(73.8)
GENERAL GOVERNMENT					
Percent of GDP					
Expenditure	57	(41)	Education expenditure	5.6	(5.0)
Revenue	51	(38)	Health expenditure	7.1	(7.8)
Gross financial debt	82	(109)	Environment protection expenditure	0.2	(0.5)
Fiscal balance	-5.4	-(3.2)	Environmental taxes (% of GDP)	2.8	(1.5)
			(% of total tax revenue)	6.6	(5.0)
LABOUR MARKET, SKILLS AND INNOVATION					
Unemployment rate (% of civilian labour force)	7.8	(7.1)	Patent in environment-related technologies (% of all technologies, average of latest 3 years)[2]	13	(12)
Tertiary educational attainment of 25-64 year-olds (%)	46	(38)	Environmental management	8	(4)
Gross expenditure on R&D (% of GDP)	2.8	(2.5)	Climate mitigation technologies	9	(10)
ENVIRONMENT					
Energy intensity			Renewables (% of TES)	37	(12)
TES per capita (toe/cap.)	5.7	(3.7)	Road vehicle stock (vehicles/100 inhabitants)	88	(66)
TES per GDP (toe/1 000 USD, 2010 PPPs)	0.13	(0.09)	Mean population exposure to air pollution ($PM_{2.5}$), µg/m^3	5.6	(13.9)
Carbon intensity (energy-related CO_2)			Municipal waste per capita (kg/capita)	565	(538)
Emissions per capita (t/cap.)	6.5	(7.6)	Material productivity (USD, 2010 PPPs/DMC, kg)	1.5	(2.9)
Emissions per GDP (t/1 000 USD, 2010 PPPs)	0.15	(0.19)	Land area (1 000 km^2)	304	
GHG intensity[3]			% of arable land and permanent crops	7	(11)
Emissions per capita (t CO_2 eq/cap.)	9.6	(11.3)	% of permanent meadows/pastures	0.1	(23)
Emissions per GDP (t CO_2 eq/1 000 USD, 2010 PPPs)	0.21	(0.26)	% of forest area	74	(33)
			% of other land (built-up/other land)	19	(32)

Notes: 1. Values earlier than 2014 are not taken into consideration. Where the OECD aggregate is not provided in the source database, a simple OECD average of latest available data is calculated where data exist for a significant number of countries. 2. Patent applications for higher-value inventions that have sought protection in at least two jurisdictions. 3. Excluding emissions/removals from land use, land-use change and forestry.
Source: Calculations based on data extracted from the databases of the following organisations: OECD, Eurostat, International Energy Agency and the World Bank.

Executive summary

Finland should turn its ambitious strategies into effective and coherent action

Finland is a leader in environmental policy and sustainable development. It should be commended for its commitments to carbon neutrality by 2035 and to become a circular economy and fossil-free welfare society. However, Finland is not fully on track to meet all its goals. Greenhouse gas (GHG) emissions fell remarkably but need to decline faster. Waste generation, material consumption, intensity of forest use and nutrient pollution have continued to rise. Agriculture and a large forestry sector exert pressures on the country's biodiversity.

Finland can tap into abundant renewable energy resources, a sound environmental policy framework, its experience with using economic and voluntary instruments and a strong innovative capacity. Nonetheless, targeted policy measures are needed to encourage behavioural changes, boost investment and innovation, and steer the economic recovery from the COVID-19 crisis towards a green and just transition.

GHG emissions fell, but uncertainties remain on the path to carbon neutrality

Finland overachieved its climate mitigation commitments. Reaching the carbon-neutrality target by 2035 requires annual emission reductions more than 2.5 times higher than in the past decade. Carbon removal by forests is essential to achieve the target. However, trade-offs exist between forests' carbon sink potential and harvesting levels, including for biomass. Lowering energy demand would reduce the need for biomass and make carbon neutrality more likely to achieve. Finland's climate policy need to focus more on redesigning energy and transport systems to deliver on climate and well-being goals.

A flexible and zero-carbon electricity sector is key to decarbonise the economy

Finland has one of the least carbon-intensive energy and electricity mixes in the OECD. Biomass is the main renewable source. Finland aims to phase out coal by 2029 and to at least halve peat consumption by 2030. It could consider adjusting the coal and peat phase-out dates in view of the carbon-neutrality target. Finland should better assess the proposed measures to support affected communities, and set up mechanisms to ensure broad support for the transition.

Energy efficiency improved, but energy intensity remains comparatively high due to Finland's cold climate, low population density and relatively energy-intensive industry. Electricity demand has grown since 2015 and is expected to increase further with digitalisation and electrification of transport and heating. This calls for enhanced co-ordination across sectors. Finland is a frontrunner in the deployment of smart grids to enhance flexibility of the electricity system. A shift to a more decentralised grid would enable consumers to provide on-site generation, storage and demand response. This, in turn, would reduce the need for investment in plants and network infrastructure.

There is scope to reduce the carbon footprint of buildings and neighbourhoods

Finland provides some targeted financial support for deep energy retrofits of buildings but needs to put more emphasis on whole-building renovations. Mandatory energy saving targets or efforts to industrialise retrofits could significantly reduce costs. Increased use of non-combustion technologies (e.g. large-scale heat pumps and waste heat recovery) would reduce the need for woody biomass to fuel the country's extensive district heating network.

Some cities (e.g. Helsinki) aspire to become more compact to lower energy, transport and materials demand. Helsinki also applies the green factor method for the built environment, which aims to preserve sufficient green spaces to mitigate flood risk, store carbon and enhance liveability. The green factor method could be strengthened and extended to other municipalities.

Policies to reverse car dependency should be at the core of climate action

Finland's dispersed settlement pattern implies that road transport is by far the dominant transport mode. Vehicle and fuel taxation, biofuel mandates and support to electric vehicles encouraged the shift to lower-emitting vehicles and fuels. This helped cut emissions, but road transport remains a major GHG source. The roadmap on fossil-free transport suggests distance driven should not increase in the 2020s, which is welcome.

Finland needs to remove policies that encourage car ownership such as tax-free parking at the workplace; it should enable the introduction of congestion charges in Helsinki and other urban areas facing congestion problems, as well as consider distance-based road pricing for heavy goods vehicles. Finland should also reallocate road space to public transport and active mobility and steer spatial planning to increase accessibility.

Agreements on land use, housing and transport (so-called MAL) between the central government and municipalities of functional urban areas have enhanced co-ordination of urban and transport systems. Setting up metropolitan transport authorities, as done in Helsinki, would help strengthen integrated planning and co-ordinate public transport across neighbouring municipalities. Finland should build on its Mobility as a Service experiments to develop multi-modal networks across the country based on enhanced public transport. In addition, further supporting road transport electrification would allow to channel biofuels to aviation and shipping. However, stronger sustainability criteria for biofuels are warranted.

Finland needs to consolidate the good outcomes of air and water management

Air quality is among the best in the OECD, but there is scope to further reduce pollutants' emissions. Small-scale wood burning causes about half of pollution from fine particulate matter. The relatively old vehicle fleet and the high share of coal, peat and biomass burning are major sources of nitrogen oxides. Finland should consider regulating the use of studded tyres to reduce emissions from road dust. Limited funding has slowed down implementation of the National Air Pollution Control Programme 2030.

Water quality is generally good, but diffuse nutrient pollution from agriculture exerts pressure on surface water bodies. Some rivers and lakes and most coastal waters fail to achieve good ecological status. Economic incentives to improve nutrient management and recycling would help reduce nutrient losses. The efficiency of urban wastewater treatment is high. However, compliance of independent treatment systems with the required tertiary treatment standards should be better monitored.

Swift action is required to make Finland a circular economy leader

Finland needs to prioritise waste prevention and recycling, as well as promote new business models, to achieve the ambitious targets of the Strategic Programme to Promote a Circular Economy to 2035. Municipal waste is expected to continue to increase. The ban on landfilling of organic waste and a higher landfill tax have contributed to diverting waste from landfills. While all municipalities use pay-as-you-throw schemes, only a few differentiate charges to encourage separate collection. Waste recovery has grown but remains below 50% of treated municipal waste (the 2020 target). Both the circularity rate and the material productivity are among the lowest in Europe. The 2021 revision of the Waste Act aims to strengthen collaboration among service providers to improve efficiency of waste management.

Finland should do more to halt biodiversity loss

Finland has strengthened its biodiversity policy framework, but the status of biodiversity has not improved significantly. Lack of resources is among the causes. In response, in 2020 the budget for biodiversity protection was increased to a record-high level. The forestry sector is a driver of wood habitats degradation. The emphasis on bioenergy for climate mitigation will increase forestry activity and may add pressures. Financial compensations to private owners for protecting part of their land have helped restore some ecosystems. However, nature management on private lands needs to be strengthened, especially in commercial forests. Finland met the 2020 Aichi target on protected terrestrial and marine areas. Nonetheless, an expansion of protected land is warranted in southern regions, where pressures on land use are higher.

Environmental governance is based on transparency and collaboration with private operators, but a few regulatory gaps remain

High environmental awareness and easy access to high quality environmental information spur extensive public participation. Environmental impact assessment (EIA) and strategic environmental assessment (SEA) are well established and closely co-ordinated in land-use planning. However, Finland should expand the application of EIA to better cover forestry projects and ensure that SEA is adequately applied to local spatial plans.

Finland's regulatory culture is based on voluntary compliance and promotion of green business practices. A comprehensive set of compliance promotion measures is in place. Compliance monitoring and enforcement rely primarily on honest reporting of infringements by operators. Non-compliance is low. However, Finland should improve co-ordination between permitting and compliance monitoring authorities to allow more efficient use of human and financial resources.

The recovery plan is geared towards a carbon-neutral and circular economy

In response to the COVID-19 crisis, the government provided sizeable funding for investment in sustainable transport, clean energy infrastructure and energy efficiency, biodiversity protection, and research and development (R&D). Sustainable recovery criteria guided budget allocations. The green transition pillar of the Sustainable Growth Programme 2021-26 absorbs over half of the Recovery and Resilience Facility. The actual contribution of the programme to the green transition will depend on the design of the relevant measures and on the balance of resource allocation in the next annual state budgets. The scope of the programme may be too broad and not commensurate to available resources, which may hamper its effectiveness. Finland could reinforce its sustainable budgeting procedures. This will help better anchor the Sustainable Development Goals in decision making and resource allocations.

Finland's businesses are innovative and active in green markets

Finland is among the green innovation leaders in the OECD. The country has often pioneered the implementation of EU environmental policies, which has given its companies a first-mover advantage. National expenditure on R&D is high and the government plans to increase it further. Most R&D spending occurs in the business sector. However, public spending on environment- and climate-related R&D is relatively low. It should be increased and better support small and medium-sized enterprises. There is scope to improve collaboration between the basic research institutions and the business sector to bring innovative cleaner technology and products closer to the market.

The green industry is large and growing. Finland's businesses are active in investing in environmental management and in providing environmental goods and services. The accelerated deployment of new technology for a carbon-neutral and circular economy is projected to generate employment. Finland has expanded its environmental education system and made environmental competence a requirement for every profession. It needs to continue investing in up-skilling and re-skilling its labour force to support the green transition.

Green taxation can help Finland achieve its ambitious environmental goals

The government announced a "tax reform for sustainable development". Finland's carbon tax, the first in the world, is uniquely based on lifecycle GHG emissions. The rates of the carbon and energy taxes are high by international standards. Nonetheless, there is scope to reinforce carbon pricing. Emissions from road transport face high carbon prices, but less than half of emissions in other sectors are priced. This is partly due to the prevalence of biomass use, which is untaxed. Finland could better assess the potential net effect of taxing biomass on GHG emissions. It should also consider progressively increasing the effective carbon price to reach a target level by 2030. This would provide a credible trajectory of carbon prices to investors. In addition, a mix of vehicle taxation and road pricing would contribute to decarbonising transport, while offsetting the likely decline in fuel tax revenue due to vehicle electrification.

Finland should address misalignment in the energy tax structure and reduce support to fossil fuels. Diesel faces a lower energy tax than petrol. Tax reductions and exemptions to certain energy sources or sectors (such as agriculture and mining) weaken incentives to save energy or switch to cleaner fuels. The tax rate on peat nearly doubled in 2021. However, peat continues to benefit from a beneficial tax regime, which should be removed.

Assessment and recommendations

The Assessment and Recommendations present the main findings of the OECD Environmental Performance Review of Finland. They identify 36 recommendations to help the country make further progress towards its environmental objectives and international commitments. The OECD Working Party on Environmental Performance discussed and approved the Assessment and Recommendations at its meeting on 13 October 2020.

1. Environmental performance: Trends and policy developments

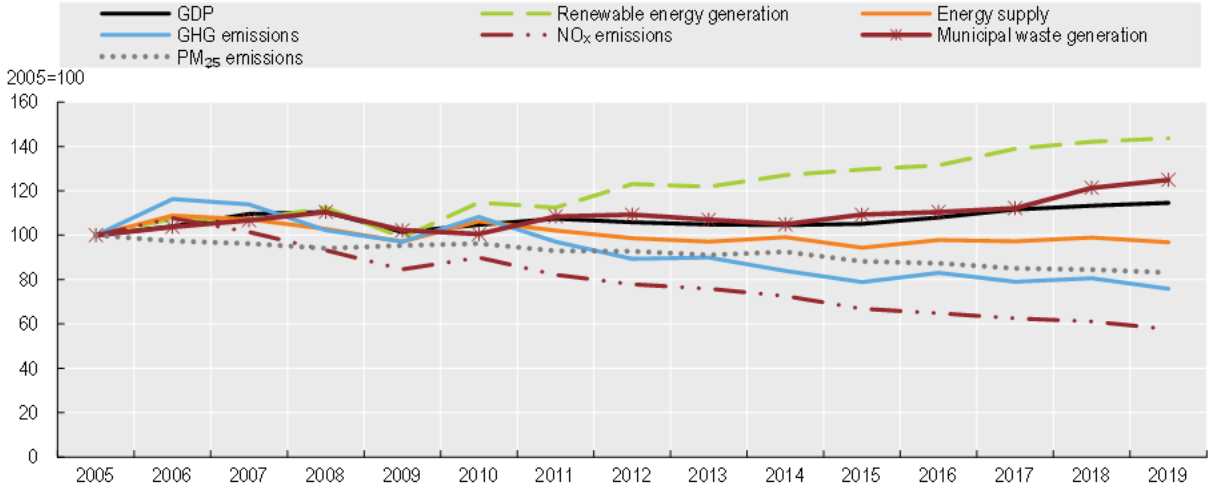
Finland aims to become a model country for environmental sustainability

Sustainable development is a central cross-cutting goal of Finland's Government Programme. The country should be commended for its commitments to become carbon neutral by 2035, to pioneer the world's first circular economy and to halt biodiversity loss. Much analysis is being developed on how these ambitious targets could be achieved. The challenge for the next decade will be to get the right policies in place, to secure sufficient resources and ensure buy-in from businesses and citizens. The generally high environmental awareness of the Finnish population, and its deep connection to nature, can support implementation of the country's environmental policy.

Despite marked progress in the last decade, Finland is not fully on track to meet all its ambitious goals. The country achieved visible reductions in the emission of greenhouse gases (GHGs) and air pollutants (Figure 1). Several factors contributed to this decline, including a shift from fossil fuel use to electricity and renewable energy sources, and improved vehicle technology. The long period of lacklustre economic performance following the 2008/09 global financial crisis also played a role. The economic recovery starting in the mid-2010s has slowed down progress. Waste generation has continued to grow, while recycling has not progressed as fast as hoped. Agriculture and Finland's large forestry sector exert pressures on the country's sensitive ecosystems and threaten its flora and fauna. As in other countries, the COVID-19 crisis has had some positive environmental effects such as a drop in GHG emissions in 2020. Nonetheless, targeted policy measures are needed to steer the economic recovery towards low-carbon and circular patterns and avoid a rebound of environmental pressures.

Figure 1. GHG and air pollutant emissions decreased, but municipal waste continued to grow

Selected economic and environmental trends, 2005-19



Note: GDP at 2015 prices and purchasing power parities.
Source: IEA (2021), *IEA World Energy Statistics and Balances* (database); OECD (2021), *OECD Environment Statistics* (database); Statistics Finland (2021), *StatFin* (database).

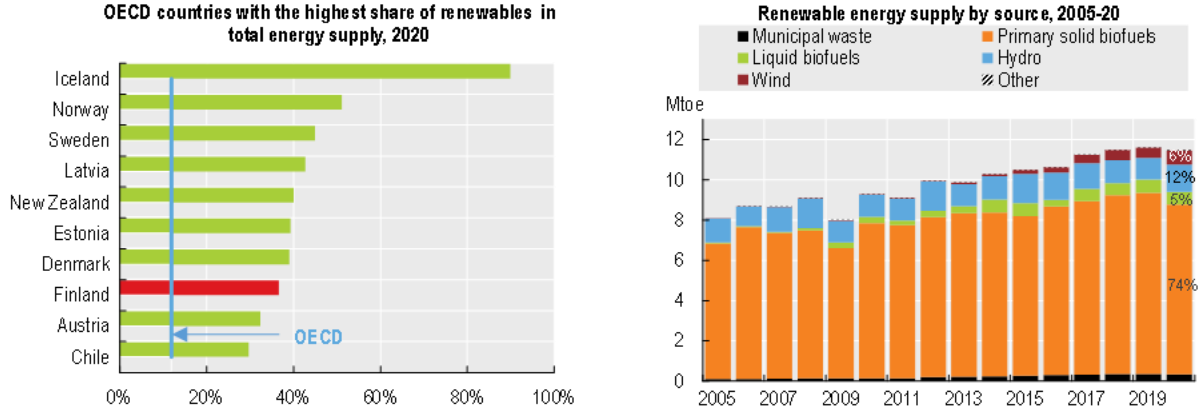
StatLink https://doi.org/10.1787/888934287699

Finland met its 2020 renewable energy, energy efficiency and climate targets[1]

Finland has one of the least carbon-intensive energy mixes among OECD countries. In 2020, renewables accounted for 37% of energy supply, up from 25% in 2010. Bioenergy (solid and liquid biofuels), largely from residues of the forest industry, is the main renewable source (Figure 2). The country exceeded its 2020 renewable energy targets under the European Union (EU) directive. If energy and climate policies are implemented as planned, Finland is projected to overshoot its EU 2030 target of 51% renewables in gross final energy consumption (MEAE, 2019). The share of fossil fuels in the energy mix declined steadily to 38% in 2020, or about half the OECD average. This decline will likely continue with the planned expansion of nuclear, phase-out of coal and reduced used of peat. Peat is the only domestic fossil fuel but is highly carbon-intensive. It accounted for 4% of energy supply in 2019.

Energy demand picked up with the economic revival in the second half of the 2010s. Both the energy intensity of the economy and energy consumption per capita are high compared to the OECD average. This is due to the cold climate, a low population density and a relatively large share of energy-intensive industries. The energy intensity of the economy improved over the past decade but more modestly than in many other OECD countries. Nonetheless, Finland met its 2020 energy efficiency targets under the EU Energy Efficiency Directive. The National Energy and Climate Plan envisages only a marginal decrease in final energy consumption over the next decade. Therefore, progress towards the 2030 energy saving target needs to be closely monitored (Section 4).

Figure 2. Renewable sources account for a large and increasing share of the energy mix



Source: IEA (2021), *IEA World Energy Statistics and Balances* (database).

StatLink https://doi.org/10.1787/888934287718

The remarkable decline in GHG emissions of the last 15 years allowed Finland to meet its 2020 mitigation commitments under the Kyoto Protocol and the EU climate policy (Section 4). In 2019, Finland set one of the most ambitious climate targets announced to date: to become carbon neutral by 2035 and carbon negative soon after that. This target requires additional measures to those in the pipeline, which are to be included in the revised cross-sector climate strategies. Maintaining the valuable carbon sink provided by Finland's forests and carbon-rich soils (e.g. peatlands and mires) will be crucial to reach the climate neutrality goal (Section 4).

Efforts to strengthen climate resilience are relatively advanced

Finland will be strongly affected by climate change, with mean temperatures projected to rise faster than average temperatures globally. Acknowledging its exposure to climate risks, the country was among the early movers to enhance climate resilience. Knowledge on the vulnerability and risks in specific sectors is generally good. Online and communication tools facilitate knowledge diffusion among businesses and society. The Climate Change Act (which was under revision at the time of writing) requires the development of a national adaptation plan at least every ten years. The first plan was published in 2014; a multi-stakeholder group monitors its implementation. Since 2017, environmental impact assessments need to include an assessment of climate risks. Thanks to these efforts, awareness of climate change impacts and adaptation needs has increased and climate resilience is generally well integrated into sectoral planning and activities. Several research projects to enhance knowledge about climate risks and adaptation opportunities are ongoing. However, uncertainty about concrete options, and their costs and benefits, as well as unclear division of responsibilities and insufficient co-ordination, remain obstacles to better manage climate-related risks on the ground (MoAF, 2020).

Air quality is good, but more could be done to reduce particulate pollution in urban areas

Air quality is among the best in the OECD and good air quality is nearly uniform across the country. In 2019, citizens' annual average exposure to fine particulate matter ($PM_{2.5}$) pollution was below the guideline value of the World Health Organization and 60% below average exposure in the OECD. The economic and health damage resulting from air pollution is lower than in most other OECD countries. Still, ambient PM pollution is estimated to have caused some 1 600 to 2 000 premature deaths in Finland each year in 2005-15.

The emission of air pollutants declined compared to 2010, mostly driven by more stringent EU requirements and a shift towards cleaner fuels. Finland is expected to meet its 2020 targets for all five air pollutants targeted under EU legislation, although there is a risk that ammonia emissions (caused by agriculture) will exceed the target.[2] The country seems on track to meet the 2030 targets using existing measures. However, $PM_{2.5}$ and ammonia emissions have declined more slowly in the second half of the 2010s, and are projected to decline slightly over the next few years. Nitrogen oxides (NO_x) emissions per capita and per unit of gross domestic product (GDP) remain high by OECD comparison, mainly due to a relatively old vehicle fleet and the high share of coal, peat and biomass burning. Hence, there is scope for further reductions of emissions. This can bring considerable health benefits to Finland, without affecting economic growth (OECD, 2021a).

The National Air Pollution Control Programme 2030 refers extensively to the co-benefit of climate policy in terms of lower air emissions (from the switch to cleaner fuels, technological improvements, modal shift in transport, etc.). The plan contains a long list of measures to reduce pollution from wood burning for home heating and saunas, as well as the use of studded tyres, and sanding or salting, for the winter maintenance of roads. Small-scale wood burning causes about half of $PM_{2.5}$ pollution and is projected to become the largest factor of premature deaths from air pollution in 2030 (MoE, 2019). However, due to funding limits, not all of the measures outlined in the national plan are being implemented.

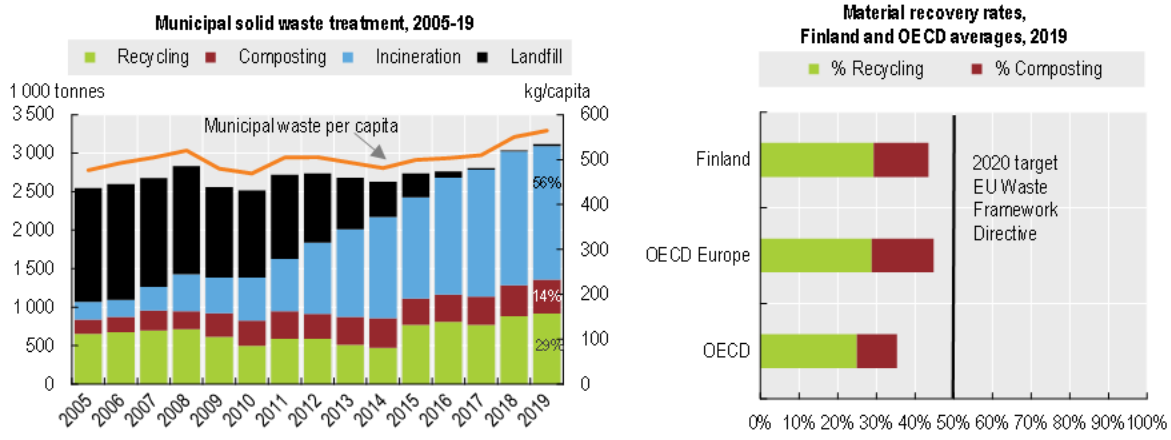
The reduction in traffic volume in densely populated areas will remain one of the most efficient measures to cut emissions from both road dust and exhaust, with important co-benefits for climate change mitigation (Section 4). It should remain a priority in Finland's efforts to improve air quality. At the same time, Finland should consider regulating the use of studded tyres in areas facing higher pollution levels, as done for example in Norway. Additional measures and resources also seem justified to accelerate replacement of inefficient fireplaces, space heaters and sauna stoves, given the considerable health benefits such investments would bring, especially in densely populated areas.

Accelerated action is needed to make Finland a circular economy leader

In early 2021, Finland launched the Strategic Programme to Promote a Circular Economy to 2035. The programme includes specific targets on domestic primary raw materials and resource production, among others. To achieve this, Finland needs to develop regulatory and incentive frameworks that support new business models but also prioritise waste prevention and recycling. Total waste generation has grown by about 20% and municipal solid waste (MSW) generation by 24% since 2010. Per capita MSW generation also grew (Figure 3) and is well above the OECD-Europe average. Finland missed its goal to reverse the trend of growing MSW generation by 2016. In the absence of strong policy measures, MSW volumes are expected to continue to increase alongside economic growth.

Finland has seen a massive shift from landfilling to incineration in the past decade (Figure 3). This was mostly driven by a ban on landfilling of organic waste adopted in 2016, supported by a tax on the landfilling of recoverable wastes. The share of waste recovery (i.e. recycling or composting) has grown, thanks to comprehensive extended producer responsibility schemes, efforts to expand separate collection in urban areas and a high level of awareness among the public. Even so, Finland fell short of the target set by both EU and Finnish legislation to recover at least half of MSW by 2020 (Figure 3). Both the circularity rate and the material productivity of the Finnish economy are low in international comparison.

Figure 3. Municipal waste prevention and recovery should remain a priority



Note: Nearly all incineration occurs with energy recovery. Estimation method of recycling waste changed in 2015 (left panel).
Source: OECD (2021), "Municipal waste, generation and treatment", *OECD Environment Statistics* (database).

StatLink https://doi.org/10.1787/888934287737

As in many countries, the fragmentation of waste management responsibilities, both in terms of institutional roles and collection operations, has been a key barrier to increasing recycling rates. Municipalities collect residential mixed wastes, but producer responsibility organisations collect residential recyclable wastes. The revision of the Waste Act, approved in mid-2021, aims to address inefficiencies by strengthening collaboration among different service providers. It also establishes a basic obligation for separate waste collection and requires door-to-door collection for selected properties (as opposed to the less efficient collection of household recyclables through drop-off points). These changes are expected to help improve separate collection and recovery rates.

The framework for waste charges remains unchanged. While all municipalities use pay-as-you-throw schemes, only a few provide incentives for separate collection (e.g. imposing higher collection fees for

unseparated waste). However, others have struggled to introduce such incentives in the face of vested interests among numerous local waste management companies.

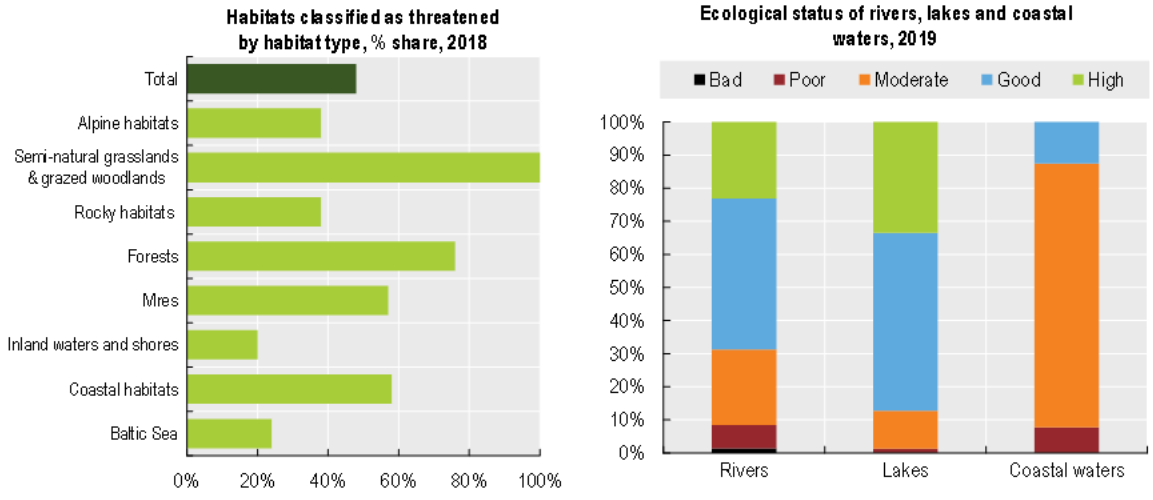
Full implementation of the National Roadmap to a Circular Economy (last updated in 2019), the 2018 National Waste Plan and the 2018 Plastics Roadmap will be needed for Finland to become a circular economy model within the next few years. As part of its waste and circular economy policy, the country plans to strengthen green public procurement; foster innovations; pay more attention to material efficiency in environmental permits; and expand the use of voluntary agreements and material efficiency audits. Green Deal voluntary agreements between the government and industry sectors can contribute to achieving circularity and climate neutrality goals (Section 2). Additional measures will be needed to promote circular business models and achieve the ambitious objectives of the Strategic Programme to Promote a Circular Economy to 2035. This could include encouraging ownership-free and sharing models; circular design, repair, sharing and reuse; labelling for longer lasting products; and new deposit-refund schemes.

Biodiversity remains at risk

Finland has not achieved its goal of halting biodiversity loss by 2020. The number of threatened species has been slowly increasing. Meanwhile, the state of habitats has not significantly improved over the past decade. In 2019, 12% of species and 48% of habitats were classified as threatened. The situation is particularly worrisome in southern Finland, where habitats are often fragmented and land-use pressures are greater than in the north.

Mires, forests and semi-natural grasslands are facing the largest pressures (Figure 4). Finland's large forestry sector has been responsible for the historical drainage of many mires and still constitutes the single largest pressure on wood habitats and species. Drainage of mires not only has negative consequences on biodiversity but also causes significant GHG emissions (Section 4). Peat extraction is permitted only in already drained or otherwise altered bogs; draining intact peatlands for forestry has been reduced. However, peatlands have continued to be converted to fields and peat production areas and limited progress has been made in restoring mires (MoE, 2017).

Figure 4. More efforts are needed to improve the status of habitats and water bodies



Source: Syke (2019), *Assessment of the Status of Finland's Waters*; Syke (2019), *Threatened Habitat Types in Finland 2018*.

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The National Strategy and Action Plan for the Conservation and Sustainable Use of Biodiversity 2012-20 has proven effective in raising awareness and helped advance the integration of biodiversity into sectoral policy making. However, the effectiveness of the strategy has been limited due to a host of factors. These include limited resources; insufficiently ambitious or poorly defined goals and policy measures; delayed implementation; and conflicting development goals. Finland makes limited use of economic instruments to raise revenue for biodiversity protection. In 2020, the government increased the budget for biodiversity protection to a record-high level, which will enable enhanced restoration measures. The development of the post-2020 biodiversity framework provides an opportunity to target efforts and resources more efficiently. Building on the success of the Climate Change Panel (Section 4), Finland should consider legally recognising the Nature Panel to strengthen its role in advising public institutions in assessing the potential and actual impact of policies on ecosystems.

Finland considers that it has met its commitment under the UN Convention for Biological Diversity to conserve at least 17% of land and at least 10% of territorial waters by 2020. Statutory protected areas on state-owned land cover about 13% of the country's land area, but nature conservation measures apply also to private land. As in many other countries, better connectivity and better representativeness of ecologically valuable areas would strengthen the effectiveness of the protected area network in conserving biodiversity. An expansion of protected land (especially forests) would be particularly welcome in southern Finland, where land-use pressures are larger and where the current share of protected land is smaller. The ongoing revision of the land-use planning law provides an opportunity to strengthen the connectivity of nature protection zones (Section 2).

Finland will furthermore need to strengthen nature management on private lands. The two main programmes to achieve this are the Helmi and the Forest Biodiversity Programme for Southern Finland, which compensate private land owners for protecting part of their land. Both programmes recently received substantial budget increases. However, despite ongoing efforts, the level of nature management in commercial forests is insufficient to halt the endangerment of species and habitats. The emphasis on bioenergy in Finland's climate change mitigation strategy will increase forestry activity and may add to pressures (Section 4). As demand for forestry products rises, the focus on bioenergy is also likely to increase the costs of compensating landowners for biodiversity protection. Identifying additional ways to promote better nature management in forests will therefore be vital to improve the conservation status of forest and woody habitats species and habitats.

Agriculture also exerts pressures on biodiversity, especially due to nutrients leached into ditches and water bodies. While organic farming covered 13% of agricultural area in 2019 (above the EU average), the main tool to reduce the impacts of agriculture on biodiversity is the agri-environmental payments under the EU Common Agricultural Policy (CAP). However, as in the rest of the European Union, these payments have had limited impact on agricultural practices. The ongoing CAP reform and Finland's implementation plan provide an opportunity to improve the effectiveness of agri-environmental measures in reducing impacts on biodiversity and water, as well as the carbon footprint of farming.

More needs to be done to reduce water pollution

In line with EU requirements, Finland has developed management plans for all Finnish river basins and a national strategy for its marine environment. The quality of groundwater is generally suitable for human consumption without any treatment, with only 2% of groundwater bodies not achieving good chemical status. Most surface waters comply with quality standards for chemical substances. However, nearly a third of rivers and more than 85% of coastal waters fail to achieve good ecological status. The ecological status of lakes is generally better than that of rivers (Figure 4), but many smaller lakes in agricultural areas suffer from eutrophication. Point-source pollution (e.g. from urban and industry sectors) is generally well controlled. However, some individual treatment systems, which cover 15% of the population, do not comply with the tertiary treatment standards required by legislation.

The most significant pressures on surface water bodies stem from diffuse nutrient pollution from agriculture. The nutrient surplus of agriculture has remained relatively unchanged since 2005, in the middle range of OECD countries. Better recycling of nutrients from manure would reduce reliance on chemical fertilisers and excess nutrients. At the same time, better manure management would reduce carbon dioxide (CO_2) emissions associated with their production, which is energy-intensive. Finland provides financial support for the use of manure for biogas consumption. Additional measures, including economic incentives, could help tackle nutrient pollution to soil and water bodies (Lankoski et al., 2018).

The pricing policy for water supply and sanitation (WSS) services enables recovery of most costs for public water supply and wastewater treatment. However, much of the WSS infrastructure is ageing and may be vulnerable to climate change risks (e.g. untreated storm water overflow). Water prices will eventually have to increase to finance the rehabilitation and modernisation of infrastructure (OECD, 2020a). Finland could consider sharing the infrastructure rehabilitation bill at the watershed level. This could help the country avoid exacerbating regional disparities in tariff levels. Since 2020, housing companies have been required to charge tenants for their actual water consumption (and not based on the household size). This creates incentives to reduce water demand and, in doing so, reduces the need for WSS infrastructure.

Recommendations on managing air, waste, water and biodiversity and adapting to climate change

Controlling air pollution

- Allocate adequate resources for the implementation of the National Air Pollution Control Programme 2030, focusing on measures targeting $PM_{2.5}$ pollution from small-scale wood burning and street dust.
- Consider implementing additional measures to mitigate emissions of road dust and from small-scale wood burning, including economic incentives (e.g. subsidies) to accelerate the renewal of older and less efficient stoves, as well as regulations on sauna stoves and studded tyres in areas facing high PM concentrations.

Improving waste management for a circular economy

- Make greater use of voluntary agreements and economic instruments to encourage recycling and material recovery; consider introducing a nationwide weight-based pay-as-you-throw system with differentiated fees for sorted waste; and consider including incineration plants into the EU Emissions Trading System as part of a broader policy package that encompasses the whole waste value chain.
- Develop regulatory and incentive measures to achieve the targets set in the 2021 Strategic Programme to Promote a Circular Economy, with a view to decoupling economic growth and material use and fostering the green transition.
- Continue to implement the Plastics Roadmap; identify the necessary additional and follow-up measures covering the entire value chain of plastic products.

Enhancing biodiversity conservation and sustainable use

- Develop a comprehensive action plan with concrete and measurable targets to guide biodiversity policy and actions to 2030; develop and regularly publish indicators to track progress in implementation and impact on biodiversity targets; ensure availability of sufficient financial and human resources to implement identified measures, and extend the use of economic instruments to raise finance for biodiversity management.

- Expand the area of protected forests (especially in southern Finland); strengthen and expand programmes to support landowners in protecting biodiversity on their land/forest (e.g. through larger retention of deadwood).
- Better target direct payments to farmers under the EU Common Agricultural Policy to promote climate, biodiversity and water quality goals.

Managing water quality and services

- Consider introducing new instruments to improve nutrient management and recycling, including taxation of nutrient surplus at farm level, as well as a nutrient cap-and-trade system between farms in the Baltic Sea watershed (to replace the national nutrient input ceilings); recycle the potential additional revenue to provide support to general agricultural services or to individual farmers based on farm size and type.
- Consider introducing uniform pricing for water supply and sanitation services at the river basin district level to finance the rehabilitation and modernisation of infrastructure while reducing disparity in water prices across municipalities.
- Improve monitoring and ensure compliance of independent wastewater treatment systems with tertiary treatment standards, by providing financial and technical assistance and strengthening enforcement.

Adapting to the impact of climate change

- Develop guidelines for assessing climate risks in projects or programmes and/or catalogues of mitigation options for priority sectors or groups, with a view to supporting the implementation of climate risk-reducing activities; strengthen collaboration between government and non-government actors to support adaptation in the private sector and among citizens.

2. Environmental governance and management

Finland has a well-functioning environmental governance system based on good international practices in the areas of permitting, compliance promotion and monitoring, as well as access to information and public participation. The country's traditional compliance culture relies predominantly on voluntary conformity to the rules and honest reporting of infringements by operators rather than on coercive measures. Finland has made progress in the implementation of most environmental recommendations of the 2009 OECD Environmental Performance Review (OECD, 2009). However, the high degree of independence of local authorities and the resource disparity across municipalities lead to a few gaps in the implementation of environmental assessment and land-use planning.

National and local environmental institutions collaborate well, but the regional structure is fragmented

Government programmes are structured around horizontal policy objectives, which leads to extensive collaboration between ministries. In 2010, a regional administration reform restructured several agencies into two cross-sectoral state authorities operating at the regional level. The reform separated the permitting and compliance monitoring functions of the predecessor regional environmental authorities. It integrated these functions into the respective administrative bodies covering several domains in addition to the environment (economic development, transport, etc.). The new structure has contributed to whole-of-government management at the regional level. However, it has increased the influence of economic interests on environmental decisions and dispersed environmental regulatory resources.

Municipalities serve both as permitting and supervising authorities on local environmental issues. The central government provides guidance to municipalities to harmonise practices in these areas across the country and ensure consistency. Agreements on land use, housing, and transport between relevant state authorities and Finland's larger metropolitan areas are another good example of vertical co-ordination. Seven ten-year agreements – for Helsinki, Tampere, Turku, Oulu, Jyväskylä, Kuopio and Lahti – were signed in 2020-21. Municipalities put forward specific goals and detailed plans for achieving them, while the central government participates in the required investments.

Environmental permitting uses advanced approaches…

In the last decade, Finland has undertaken several initiatives to streamline its environmental permitting system. It has reduced the number of environmental permits by adopting a registration system for smaller polluters based on sector-specific general binding rules. The notification regime has also expanded for lowest-impact activities regulated by municipalities. In addition, Finland has reduced administrative costs by introducing electronic permit applications and maintaining an information system that brings together information on environmental performance and compliance records of individual operators.

…but environmental assessment and land-use planning have implementation gaps

Environmental impact assessment (EIA) is essentially not applied to forestry projects, although this sector is the main cause of biodiversity loss in the country. The threshold for assessment is set so high in terms of the size of the forest, wetland or peatland area affected that almost every project falls outside its coverage. Furthermore, EIA and permitting are not directly linked, distinguishing the Finnish system from those of many other countries. Building, land extraction, water and environmental permits can be issued to projects that have received a negative environmental assessment. This may lead to the location of facilities, mineral mining operations and infrastructure in environmentally sensitive areas. This implementation gap is notable where EIA is conducted under sectoral legislation.

Finland has made progress by approving its first Maritime Spatial Plan 2030 in December 2020. The plan outlines opportunities for multipurpose use in the Gulf of Finland and the Bothnian Sea, accounting for interactions between land and sea areas. In recent years, the central government's role in regional planning has been substantially reduced, and more land-use planning powers were transferred to municipalities. The concerns raised by the 2009 OECD Environmental Performance Review persist with regard to insufficient enforcement of construction rules in coastal areas (OECD, 2009). Strategic environmental assessment (SEA) – part of the country's well-established regulatory tradition – is often reduced to general statements for local land-use plans. The government's planned comprehensive reform of the land-use planning system offers an opportunity to make the required improvements.

Compliance assurance relies on trust and engagement of the regulated community

The well-functioning Finnish compliance model places a heavy emphasis on compliance promotion, voluntary actions by businesses, reliance on self-monitoring and self-reporting by operators, and keeping coercive actions by enforcement authorities as a last resort.

Practically all inspections are announced to the operator in advance to ensure on-site presence of relevant enterprise staff. Since the operator must report all operating incidents anyway, inspectors do not see the sense of unannounced site visits. An increasing number of meetings between inspectors and operators do not involve site visits. Such regular discussions are based on mutual trust and are considered crucial for maintaining compliance. There are also a significant number of operator-requested inspections, a unique practice used by operators to demonstrate their environmental performance. Inspection reports are maintained in the Compliance Monitoring Data System. This system also contains links to all permitting

documentation and records of communication with operators, as well as data on materials use, production and pollution releases of individual installations.

Non-compliance is low: on average, 15% of inspections detect some sort of regulatory breach. If a violation is discovered during an inspection or reported voluntarily, the operator can present a plan of corrective actions to return to compliance. Administrative penalties, not to mention criminal prosecution, are rarely used. Even when a compliance notice is issued in case of inadequate corrective actions, it is regarded as a sanction in itself (as it is disclosed to the public) and rarely includes penalties. There is strong enforcement collaboration between regional and municipal environmental inspectors, the police, the border guard and customs through information exchange, co-operation groups and joint training programmes.

Finland has strict liability for damage to the environment: companies must cover the costs of rehabilitating any areas they have contaminated. However, when the liable party is insolvent or unknown, the remediation burden falls on the government. To address this issue, the Ministry of the Environment is looking to expand the scope of the mandatory environmental insurance (initially designed to cover compensation payments to private parties) to reimburse the government's remediation costs in such cases.

Promotion of compliance and green business practices is a core governance tool

Finland has implemented a comprehensive set of compliance promotion measures. These include technical assistance, regular dialogue with the regulated community, dissemination of guides on best practices and co-financing with business associations of environmental management studies. Inspectors often have discussions with operators on existing and potential compliance problems and possible solutions.

The government has, as of October 2021, concluded nine Green Deal voluntary agreements with business sectors, usually represented by a trade association, municipalities and other organisations. Many companies have developed their own initiatives within the framework of corporate social responsibility and have made sustainability commitments. The implementation of environmental management systems has grown by more than a third over the last decade.

The central government fully recognises the importance of green public procurement (GPP). In 2020, Finland launched a national public procurement strategy aiming to improve the effectiveness and sustainability of the use of public money. There are environmental criteria and guidance for procurement; a long list of products and services; and some evidence of the use of these criteria at the local level (Alhola and Kaljonen, 2017). However, there is so far no systematic monitoring of progress on GPP.

Transparency and environmental education foster broad public involvement

Finland has a well-established practice of public participation in legislative drafting. It is one of the EU countries with the highest online interaction between public authorities and citizens (EC, 2019). Non-governmental organisations (NGOs) enjoy substantial financial support from the government.

Finland's joint environmental administration portal is the source of most comprehensive environmental data. Environmental authorities maintain user-friendly websites and contain links to specific environmental information systems. Compliance records of private entities are also accessible to the public. The country is also making progress in giving the public broad access to geospatial data and environmental research.

Expanding its environmental education system, Finland has created new coursework and support materials, engaging a broad range of non-governmental actors. In 2018, sustainable development was made a compulsory component of vocational degrees. In addition, environmental aspects have been integrated into competence requirements for every profession. Multiple actors contribute to education and awareness on climate change, but ensuring co-ordination and long-term impact of their efforts is a challenge.

Environmental disputes are usually handled by administrative courts. Citizens have access to courts only if they are directly affected by the matter; in other cases, they have to complain to environmental authorities. To have standing, an NGO must be registered and fulfil certain requirements with regard to the geographic area of operation and purpose of the activity. For example, the NGO's area of operation should suffer from the environmental impact in question. These conditions may limit NGOs' access to justice in environmental matters.

Recommendations on environmental governance and management

- Improve co-ordination between permitting and compliance monitoring authorities to allow more efficient use of human and financial resources for environmental regulation.
- Expand the application of EIA to cover impacts on smaller forest, wetland and peatland areas; reinforce the impact of EIA conclusions on permitting decisions under sectoral legislation.
- Strengthen the central government's oversight of the integration of environmental considerations into local land-use planning, particularly in coastal areas; ensure appropriate application of SEA to local master plans and detailed plans.
- Introduce financial responsibility provisions to cover environmental remediation in cases where the liable party is insolvent or unknown.
- Develop tools to monitor and report progress on GPP, linking it to other environmental policy priorities.
- Remove restrictions on standing of citizens and NGOs in environmental cases in administrative courts to make it easier for them to act in defence of public interest.

3. Towards green growth

Sustainable development is high on Finland's political agenda, but implementation gaps persist

Finland has a solid policy framework to achieve the Sustainable Development Goals (SDGs). It topped the SDG Index ranking in 2021 (Sachs et al., 2021). Finland established innovative institutional mechanisms to support and monitor their national implementation and engage civil society. The national sustainable development strategic framework, reviewed in 2016, is aligned with the SDGs. In 2021, the National Commission on Sustainable Development started developing a 2030 Agenda roadmap. The government's 2021 sustainability roadmap translates the Government Programme's goal of a "socially, economically and ecologically sustainable society" into specific objectives. Since 2018, state budget proposals have included a sustainable development chapter. This provides a qualitative assessment of the budget contribution to the SDGs and identifies the state expenditure and revenue that are relevant to the carbon-neutrality goal.

However, Finland should move from good goal-setting and strategy-making to effective and coherent implementation. More needs to be done to truly anchor the SDGs in decision-making processes, especially related to budgets. There are no systematic *ex ante* and *ex post* assessments of the environmental and social consequences of policy packages and resource allocations. Finland could build on policy evaluation and scientific evidence to create consensus around policies, reconcile trade-offs and move towards a systemic transformation of the economy.

There is also a need to further integrate sustainable development into development co-operation and to increase the level of official development assistance (ODA). After years of cuts, the ODA budget increased to 0.47% of gross national income (GNI) in 2020, below the commitment of a 0.7% ODA/GNI ratio. Only a quarter of Finland's bilateral allocable aid focuses on the environment and the goals of the Rio Conventions, well below many OECD donors (OECD, 2021b).

The recovery plan is geared towards a carbon-neutral and circular economy

A swift and well-targeted policy response helped limit the health and economic effects of the COVID-19 pandemic. The Finnish economy shrank by 2.8% in 2020, less than on average in the Euro Area. The economy is projected to return to pre-pandemic levels at the end of 2021 and to continue growing by 2.7% in 2022 (OECD, 2021c). Fiscal support was sizeable, amounting to about 3.8% of GDP in 2020 and 2.4% of GDP in 2021. Most of this support aimed specifically to cope with the pandemic and prepare for economic recovery (MoF, 2021a). The Minister of Environment established an independent working group to elaborate sustainable recovery criteria, which were used to guide budget allocations.

Between the inception of the crisis and mid-2021, Finland allocated 58% of recovery spending to "green measures", which is high by international comparison (O'Callaghan et al., 2020). Measures included funding for public transport and active mobility; clean energy infrastructure, energy efficiency and charging stations for electric vehicles (EVs); investment in national parks and forest biodiversity; and support to research and innovation. In mid-2021, the government started implementing the Sustainable Growth Programme 2021-26, which builds on four pillars: green transition, digital economy, employment and skills, and access to health and social services. The programme encompasses the Recovery and Resilience Plan (RRP) funded by the Recovery and Resilience Facility (RRF) (EUR 2.1 billion in 2021-23 or about 1% of Finland GDP). According to the government, the green transition pillar is allocated over half of the RRF, which is well above the 37% EU benchmark. Measures for digitalisation (e.g. to facilitate remote working) and research and development (R&D) can also contribute to the green transition. The RRP is expected to reduce annual GHG emissions by 6% by 2026 (MoF, 2021b). However, the RRP pays relatively little attention to biodiversity and the bioeconomy (Green Recovery Tracker, 2021).

To be eligible for funding, most projects in the RRP need to be climate-friendly and/or meet the "do no significant harm" principle. However, how this assessment will work in practice is still unclear. The actual contribution to the green transition goal will depend on the design of the relevant measures and on the balance of resource allocation in the government budgets until 2026. There are concerns that the scope of the RRP is too broad and not commensurate to available resources, which may hamper its effectiveness.

Continuous focus on eco-innovation, green markets and skills is key for Finland's green transition

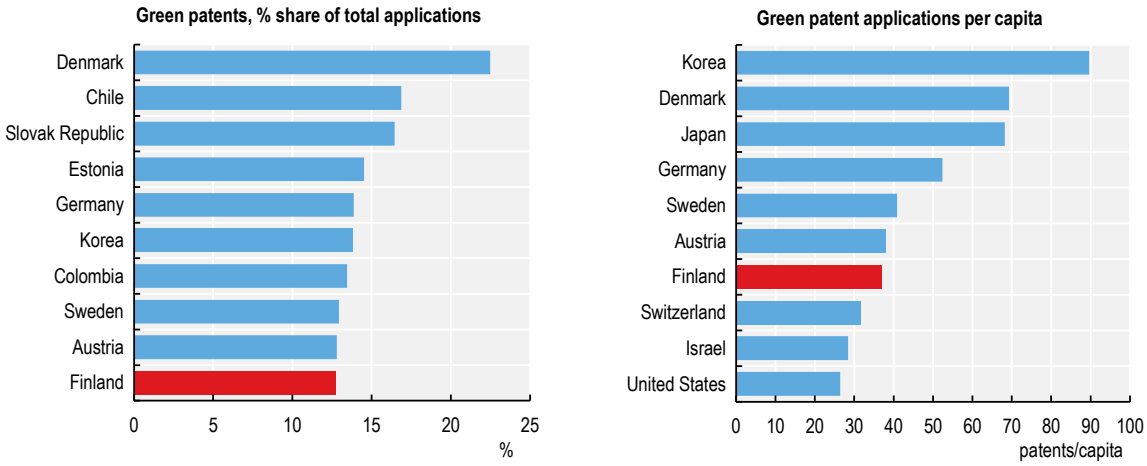
Finland's policy framework places high emphasis on innovation for the circular and carbon-neutrality transition. National expenditure on R&D is about 2.8% of GDP, above the OECD average, and the government announced a target of 4% of GDP by 2030. Most of the public energy R&D outlays target energy efficiency and renewables. However, environment- and energy-related R&D accounts for 5.5% of public R&D budgets, a relatively low share among OECD countries. This reflects the fact that most R&D spending occurs in the business sector. Despite a marked decline in public and business R&D expenditure in the aftermath of the global financial crisis, Finland remains an OECD leader in terms of patent applications for environment-related technology (Figure 5). The country has often pioneered the implementation of EU environmental policies, which has given Finnish companies a first-mover advantage (Hjelt et al., 2020).

There is scope to improve collaboration between the basic research institutions and the business sector, particularly small and medium-sized enterprises (SMEs), to bring innovative cleaner technology and

products closer to the market. To this aim, the newly established Finnish Climate Fund (a state-owned company) provides funding for industry-scale demonstration projects of climate and digital technology solutions. In 2018, the institutions promoting innovation, exports and investment were merged into Business Finland, a one-stop shop that implements innovation support programmes and aims to facilitate collaboration. The agency has provided considerable R&D funding for investment in low-carbon solutions. Energy-related projects accounted for one-third of Business Finland's total innovation funding in 2006-19 (Hjelt et al., 2020). While Finnish SMEs are more innovative than on average in the European Union, there is a gap in innovation investment and capacity between them and large companies. Most public support to private R&D is directed to SMEs. However, this could better target investment in environmental and low-carbon technology, which can pose a higher financial burden.

Figure 5. Finland is among the green innovation leaders in the OECD

Green patent applications, average 2016-18, top-ten OECD countries



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 and apply solely to inventions of high potential commercial value for which protection has been sought in at least two jurisdictions.
Source: OECD (2021), "Patents in environment-related technologies: Technology indicators", *OECD Environment Statistics* (database).

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In addition to applying GPP (Section 2), Finland is the most advanced EU country in implementing public procurement for innovation (PPI). In 2020, the government launched an action plan to reach 10% of PPI in all public procurement by 2023. This aims to stimulate demand for innovative goods and services, including in the environment field, thereby encouraging industries to produce them commercially on a large scale.

Finland's businesses are particularly active in providing environmental goods and services. Most environmental protection investment is carried out by business, and more so than on average in the European Union. The share of environmental protection investment in total investment of corporations is one of the highest among the European countries of the OECD. The proportion of SMEs offering green products or services is one of the highest in the European Union. The environmental goods and services (EGS) market has grown faster than the rest of the economy. It contributed nearly 8% to the Finnish economy in 2019, more than in all other EU countries. The sector is dominated by the management of energy resources, minerals and forest resources. The energy sector is also the single largest source of EGS-related jobs.

Finland has made progress in facilitating investment related to climate change, energy transition and sustainable transport. However, additional investment will be needed for the climate-neutrality and circular transition. The General Government Fiscal Plan 2022-25 allocates 3.1% of 2022 budget expenditure to measures targeting the carbon-neutrality goal (which will gradually decline to 2.1% in 2025). Public financial support should target investment that would not occur otherwise, with a view to enhancing cost-effectiveness of public spending and leveraging private investment.

The transition to a carbon-neutral and circular economy will bring significant opportunities to create jobs. The accelerated deployment of new technology is projected to lead to increased exports and manufacturing, with positive impacts on the economy and employment (MEAE, 2020). Skills shortages are a barrier to innovation and to the uptake of digital and clean technology (OECD, 2020b). Finland has an effective system to identify the skills required to address future labour market needs. Circular economy is included in education curricula at all levels. The country needs to continue investing in up-skilling and re-skilling its labour force to support the deployment of clean technologies. New green jobs are expected mainly in sectors with traditionally limited female representation, such as forestry and clean-tech. Women need encouragement to participate more in science, technology and engineering studies.

Green taxation can help Finland achieve its ambitious environmental goals

Finland has a long tradition of using green taxes. In 2019, environmentally related taxes raised revenue equal to 2.8% of GDP, well above the OECD average. However, the government recognises the country's ambitious environmental goals call for a reassessment of the tax structure. The 2019 Government Programme announced a "tax reform for sustainable development" to support the country's carbon neutrality, circular economy and nature protection goals, while maintaining tax revenue. This is in line with several recommendations from the 2009 OECD Environmental Performance Review about reviewing taxes and subsidies and increase the cost-effectiveness of economic instruments (OECD, 2009). Until 2021, the reform has focused on energy and transport taxation. The government also announced plans to reform mining taxation and promote the circular economy by tax means.

As in many other countries, the bulk of environmentally related tax revenue comes from taxes on energy products and vehicles. Taxation of pollution and natural resource use is limited to the landfill tax, some product charges, a noise charge on aircraft, and fishing and hunting licensing fees. Further extending the use of environmentally related taxes can help accelerate the green transition, while reducing the tax burden on labour. This would also help achieve fiscal consolidation once the recovery from the pandemic is firmly in place.

Energy and carbon taxes set a price on CO_2 emissions, but weaknesses remain

In 1990, Finland became the first country to put an explicit price on carbon. Today, the carbon tax applies relatively uniformly across sectors. It is uniquely based on lifecycle GHG emissions. In other words, it considers emissions occurring when the fuel is used but also those occurring during the production and disposal process. This approach eliminates the need for special tax discounts for liquid biofuels. The carbon tax nominal rate is among the highest in the OECD. The energy tax rates on transport and heating fuels were raised in 2020/21 and are high by international standards. This means the effective tax rates imposed on CO_2 emissions from energy use in both the transport and non-transport sectors are among the highest in the OECD (OECD, 2019). As such, they provide relatively strong incentives for energy savings and GHG emission reductions across the economy. Tax rates should be regularly adjusted to maintain their incentive function and revenue.

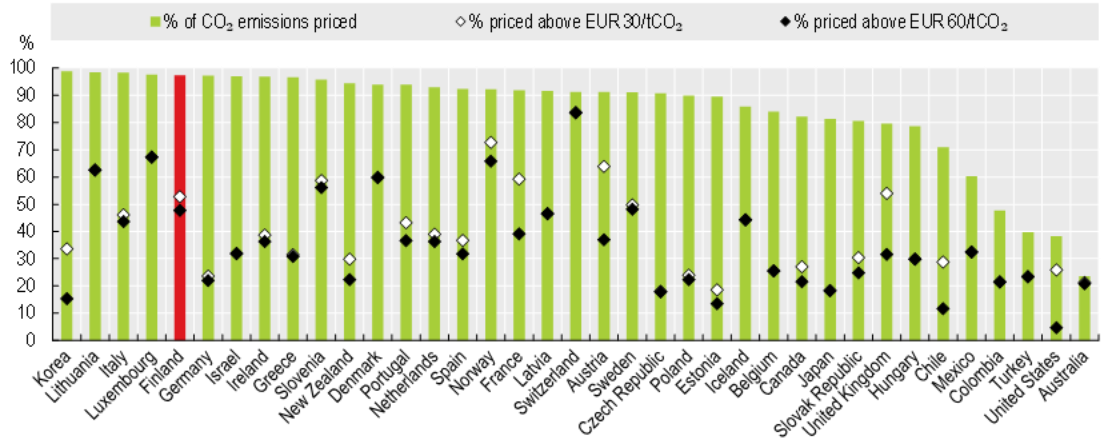
Nonetheless, there is scope to continue moving towards a more stringent carbon pricing policy. Less than half of Finnish CO_2 emissions are subject to a carbon price (via taxes and emission trading) above EUR 60/tCO_2. This is a mid-point estimate of carbon costs today (Figure 6). Indeed, the percentage drops from less than half to less than a quarter if emissions from solid and liquid biofuels, which face zero or

lower taxes, are also considered. While emissions from road transport face high carbon prices, nearly three-quarters of emissions from residential and commercial energy use are unpriced, reflecting the prevalence of biomass for heating in this sector. Finland could better assess the potential net effect of taxing solid biofuels on GHG emissions and revenue. As recommended by Parry and Wingender (2021), Finland should consider progressively increasing the effective carbon price to reach a target level by 2030 (e.g. EUR 125 per tonne of CO_2), as part of a broader tax reform.

Some weaknesses remain in the energy tax structure. As in most OECD countries, diesel faces a lower energy tax than petrol, despite diesel's higher local air pollution effects. Higher taxes on diesel vehicles aim to compensate for lower rates on diesel fuels (see below). In addition, tax reductions and exemptions to certain energy sources or users weaken incentives to save energy, switch to cleaner energy carriers and reduce emissions. Notably, despite recent tax increases, peat benefits from a separate, beneficial energy tax regime, which is not justified on environmental grounds. If peat were subject to the same tax model as other energy sources, its tax level would be nearly six times as high.

Figure 6. There is scope for further strengthening carbon pricing

Share of energy-related CO_2 emissions priced in OECD countries, 2018



Note: The figure excludes emissions from the combustion of biomass.
Source: OECD (2021), "Environmental policy: Effective carbon rates", *OECD Environment Statistics* (database).

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Finland has long granted tax refunds for agriculture and energy-intensive industries. As part of the ongoing energy tax reform, the government started reducing the tax refund for energy-intensive industries in 2021, with a view to a complete phase-out by 2025. To partly compensate companies, the electricity tax for industry (as well as for certain other users) was reduced to the EU minimum rate in 2021. The two reforms are expected to support decarbonisation through electrification, and to be budget-neutral. With the same purpose, data centres, heat pumps and electric boilers generating heat for district heating (DH) networks will be transferred to the lower electricity tax category in 2022. Finland also reduced the energy tax discount for fossil fuels used in combined heat and power (CHP) plants. The combined effect of taxation and allowance prices within the EU Emissions Trading System (ETS) provides incentives to CHP, and especially to biomass use in these plants.

As part of its energy tax reform, Finland could do more to reduce support to fossil fuel use. Expenditure on fossil fuel support equalled 0.55% of GDP and USD 268 per capita in 2019 (OECD, 2021d). Nearly all

support measures are tax expenditure resulting from reduced energy tax rates to lower the cost of energy consumption. As recommended by the working group on energy tax reform, Finland should gradually remove tax expenditures for peat, agricultural fuels and mining activities (MoF et al., 2021). As a first step, the government nearly doubled the tax rate on peat in 2021. It also plans to introduce a carbon floor price for peat to help reach the target of halving peat use by 2030.

A mix of vehicle taxation and road pricing would contribute to decarbonising transport

Carbon dioxide emissions from transport declined in the early 2010s but stagnated in the second half of the 2010s. Vehicle registration and ownership taxes are linked to CO_2 emissions, encouraging citizens to purchase lower-emission vehicles. EVs have been exempted from the registration tax since October 2021. A special vehicle ownership tax (the *motive power tax*) applies on cars powered by means other than petrol engines. This tax aims primarily to rebalance the effect of lower energy taxes on diesel, natural gas and electricity compared to petrol. However, it does not reflect the marginal environmental cost of fuel use. A purchase subsidy for EVs was in place between 2018 and 2021, and is expected to be prolonged. In addition, a scrapping bonus for the purchase of new low-emission passenger vehicles, electric bicycles or a seasonal pass for public transport was granted in 2020-21 (Section 4).

The vehicle tax structure and the EV purchase subsidy have influenced the pattern of new car sales. The share of internal combustion engine cars has declined, while that of hybrid and electric cars has risen markedly since the mid-2010s. Overall, the average CO_2 intensity of newly registered cars declined steadily over the past decade, but it is still some 20% above the EU fleet-wide target for 2021. In addition, the share of diesel cars in the stock rose until 2019, due to the large share of used (imported) diesel cars. The passenger car fleet is older than on average in the European Union and in the other Nordic countries. Old diesel vehicles are a major driver of air pollution. Additional measures (fiscal and others) therefore seem needed to accelerate the uptake of EVs and the decarbonisation of the transport sector (Section 4).

The taxation treatment of company cars and commuting expenses aim to avoid distorting choices between means of transport, but they still tend to encourage the use of cars for commuting to work. Parking space provided by the employer is not taxed, which is a hidden subsidy to the use of cars for commuting. In 2021, Finland reduced the taxable value of the in-kind benefit for company-owned EVs. While this can help further boost sales of EVs, it is a costly way to reduce transport-related CO_2 emissions (MoF, 2021c). There are plans to extend this benefit to non-electric low-emission company cars. These benefits provide an incentive for employees to receive part of their salary in the form of a vehicle, albeit “clean”. This encourages car ownership and, in turn, car dependency and associated social costs (Section 4).

Finland does not charge for road use. It is one of only three European countries not to have either distance-based or time-based road charges for heavy goods vehicles. In 2021, a working group on transport taxation concluded that fuel taxation is the most effective means to reduce CO_2 emissions. However, it acknowledged that revenue from fuel taxes will likely decline over the next decade as EVs replace combustion engine vehicles.

While introducing a nationwide road pricing system would be an appropriate tool to maintain revenues and to address other externalities related to vehicle use, it would also entail excessive administrative costs (MoF, 2021c). A mix of vehicle taxation and localised road pricing (e.g. congestion charges in selected urban areas) would provide revenue; it would also moderate the potential increase in vehicle use as the average cost of driving declines with the progressive electrification of the fleet. Analyses for the Helsinki region indicate that congestion pricing would help achieve sustainable mobility goals (HLS, 2016), but legislative barriers need to be overcome. The government plans to introduce legislation enabling congestion charging in city regions.

Recommendations on green growth

Greening economic recovery

- Accelerate the implementation of sustainable development or green budgeting procedures, by establishing a transparent system to track how expenditure contributes (positively and negatively) to meeting environmental goals; to this end, build adequate capacity in administration and enhance co-ordination across government branches; ensure a systematic *ex ante* and *ex post* assessment of the environmental and social impact of policy packages and resource allocations.
- Maintain the commitment to the green transition in allocating resources to the Sustainable Growth Programme until 2026 and possibly beyond; establish a sound monitoring framework, with measurable indicators, to track implementation of the programme and its effectiveness.
- Follow through on plans to increase R&D spending to accelerate investment in innovation at business level; further increase and better target environment-related R&D support to SMEs; assess the effectiveness of the policy to promote public procurement for innovation in fostering low-carbon and circular solutions.
- Continue to offer education, skill and entrepreneurship training programmes to prepare workers for the labour market needs of a low-carbon and circular economy; encourage women to undertake science, technology and engineering studies with a view to increase their participation in the green and clean-tech industry.

Greening the tax and subsidy system

- Set a trajectory of future effective carbon prices to 2030, as part of a broader fiscal reform that addresses potential adverse impacts on households and competitiveness; introduce annual surcharges on fuels to fill the gap between the yearly target price and the prevailing effective carbon price (given by the combination of energy and carbon taxes and the ETS allowance price).
- Address misalignments and inefficiencies in the energy tax system and strengthen carbon pricing, notably by:
  - phasing out the preferential tax treatment of peat
  - phasing out energy tax reductions for fuels used in agriculture
  - increasing the energy tax on diesel so it at least reaches the petrol tax rate (per litre)
  - establishing a formal mechanism to adjust the energy and carbon tax rates to maintain their incentive function and fiscal revenue
  - assessing the option of extending the energy and carbon tax structure (based on lifecycle GHG emissions) to solid biofuels.
- Redesign tax incentives to steer a transition towards sustainable mobility, by removing tax-free parking at the workplace, removing the tax incentive for company-owned EVs and other low-emission cars, introducing distance-based road pricing for heavy goods vehicles, and enabling the introduction of congestion charges in Helsinki and other urban areas facing congestion problems.

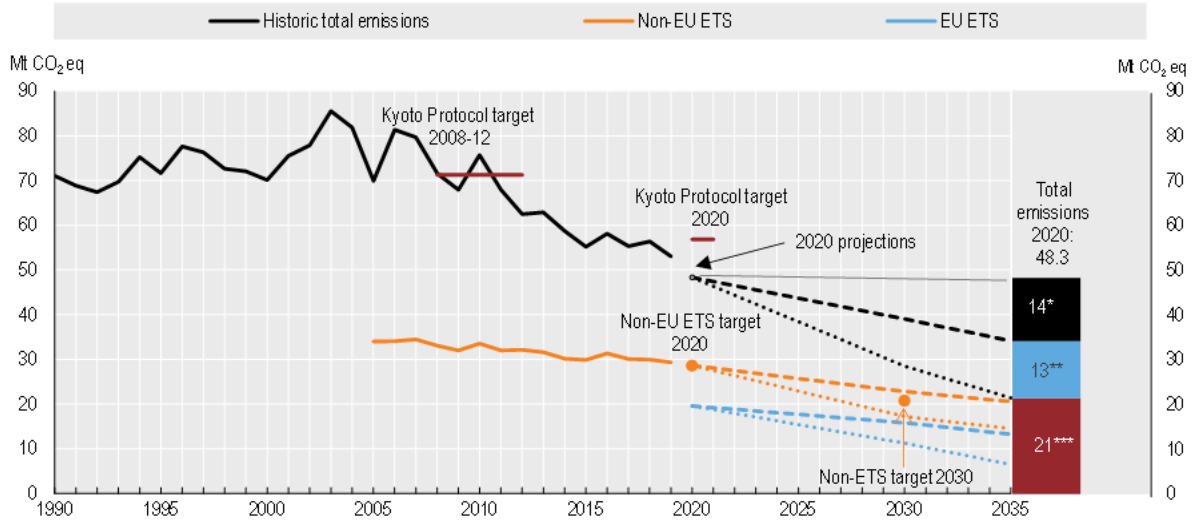
4. Climate change and well-being

Finland's GHG emissions have fallen in the last decade

Finland met its national and international climate mitigation goals, including the targets of the Kyoto Protocol (Figure 7). According to preliminary data, the country is positioned to achieve the target of reducing emissions outside the EU ETS (i.e. mostly from transport, buildings and agriculture) by 16% by 2020 compared to the 2005 level. Finland expects to meet the 2030 target of cutting non-ETS emissions by 39% from 2005 through domestic measures and flexibility mechanisms.

Figure 7. Finland met its past climate targets, but achieving carbon-neutrality by 2035 will be challenging

GHG emissions and projections



Note: Dashed lines refer to national projections with existing measures; the dotted lines refer to national projections with additional measures. * Emissions reductions by 2035 with current development and policy measures; ** Emissions reductions by 2035 with additional measures; *** Remaining emissions in 2035 to be neutralised by carbon sink.
Source: Country submission; EEA (2021), *Member States GHG Emission Projections* (database); EEA (2021), *ESD and ETS Data Viewers* (database); Statistics Finland (2021), *National Inventory Report to the UNFCCC.*

StatLink https://doi.org/10.1787/888934287813

Finland's GHG emissions declined by 24% between 2005 and 2019. Emissions decreased in all sectors but agriculture. The energy industry and manufacturing sectors showed the largest decline due to a shift from fossil fuels and peat to low-carbon energy carriers (electricity, biofuels). The decline was driven by supportive policies (carbon pricing and renewable support and mandates), as well as by the modest economic growth that followed the great financial crisis (Section 1). The energy industry and transport account for more than half of emissions. According to preliminary data, GHG emissions decreased by 9% in 2020 compared to 2019. This reflects a warmer winter and a further shift away from fossil fuels in power generation, as well as reduced transport activity due to the COVID-19 pandemic (MoE, 2021).

Finland aims to become carbon neutral by 2035, but key uncertainties remain

Finland should be commended for its ambitious goal to become carbon neutral by 2035 and to be the "world's first fossil-free welfare society". The climate neutrality target is widely supported across the political system. Finland will include the target in the update of the Climate Change Act, expected to be passed in 2022. Reaching the target would require annual emission reductions of 5.6%, more than 2.5 times the rate observed between 2005 and 2019. With current and planned measures, it is estimated that the country will miss the target by 13 $MtCO_2eq$. The government has developed sector-specific decarbonisation roadmaps in co-operation with relevant stakeholders. At the time of writing, Finland was updating its key cross-sector climate strategies, i.e. the Medium-term Climate Change Policy Plan (KAISU) and the climate and energy strategy, and was preparing a strategy for the land-use sector. In September 2021, the government decided on the policy measures to be included in these key strategies to close the gap between existing measures and the carbon neutrality target.

The carbon neutrality target and Long-term Low Emissions Development Strategy (LT-LEDS) rely on carbon removal of forests to offset emissions from hard-to-abate sectors. There are trade-offs between forest harvesting levels, including for solid biomass, and the forests' potential as a carbon sink (FCCP, 2019). Adding up future demands for biomass from key sectoral roadmaps would not be consistent with delivering the required carbon absorption capacity in 2035. Lowering energy demand through systemic and behavioural changes in addition to technological improvements would reduce the need for bioenergy and bio-based materials. This would increase the potential of forests to store carbon and thus the likelihood of achieving the carbon neutrality target. As Finland's LT-LEDS shows only modest energy reductions, exploring a low energy-demand scenario could be beneficial (OECD, 2021e). The LT-LEDS could also include indicative and flexible sectoral reduction targets to provide more clarity and accountability on sectoral abatement (Aguilar Jaber et al., 2020).

Finland needs to bring all cross-sector strategies and sector-specific decarbonisation roadmaps together in a coherent way to achieve the carbon neutrality target effectively. In a welcome step towards a whole-of-government approach, the government established the Ministerial Working Group on Climate and Energy Policy, which includes representatives from several ministries, to identify additional measures needed to achieve the target. Finland increased resources to the Finnish Climate Change Panel in 2020. However, the Panel could be given more responsibilities (e.g. monitoring progress to targets and providing recommendations to close the gaps), as well as commensurate resources, to further strengthen independent advice.

Finland has an excellent framework for well-being through its SDG framework (Section 3). The government announced that "Solving the sustainability crisis will require prompt, systemic changes in society." This is a welcome approach, broadly in line with the OECD well-being lens process (OECD, 2021f). However, as with all countries, Finland's climate policy has mainly focused on decarbonising system parts, such as vehicles or buildings. Finland would benefit from adopting a well-being lens by systematically aligning the climate mitigation and sustainable development agendas through *system redesign*. System redesign implies shifting the policy focus from parts towards systems as wholes. In this way, it supports transitioning towards systems that are sustainable by design and that unleash the potential for emission reduction, while delivering on well-being goals (OECD, 2021e).

Going for a high accessibility and low emissions transport system

Transport-related GHG emissions declined in the first half of the 2010s. They have since fluctuated around 2015/16 levels before declining by 8% in 2020 due to the COVID-19 pandemic (MoE, 2021). Most transport emissions originate from the road sector. Vehicle and fuel taxation, together with biofuel mandates, encouraged the shift to more fuel-efficient vehicles and alternative fuels that drove emissions down. Finland aims to reduce transport-related GHG emissions by at least 50% by 2030 compared to 2005. While

previous existing and planned measures fell short of this target, Finland's roadmap on fossil-free transport is likely to achieve the target. However, uncertainties remain.

Systemic change would reduce the challenges of decarbonisation while also increasing safety and health outcomes, improving use of public space and, thus, quality of life. More proximity between people and places, and better access to activities and services, would reduce car dependency, notably in urban and suburban areas where 55% of the country's population live. Finland would benefit from putting further emphasis on reversing car dependency and encouraging people to avoid unnecessary trips or long distances and to shift towards sustainable transport modes (e.g. walking, cycling, public transport) (OECD, 2021e).

Placing policies to reverse car dependency at the core of climate action

In a welcome move, the roadmap on fossil-free transport suggests halting the increase in vehicle-kilometres of cars in the 2020s, which is also put forward in the National Transport System Plan. Finland's modal split of car use (constant over time) and car ownership (increasing over time) are above the EU average and rates of other Nordic countries. These are indicators of high levels of car dependency, which is associated with social costs (e.g. health costs from air pollution, accidents, congestion), but also significant emission reduction potential from systemic change.

Municipal governments play a key role to encourage sustainable transport through land use and zoning regulations and system planning. Some Finnish cities started to use road management tools (e.g. reallocating road and parking space, parking fees, regulation of on- and off-street parking). These efforts need to be more widespread. Policies that encourage car ownership (e.g. tax-free workplace parking, minimum parking requirements) need to be removed.

Finland needs to build on its pioneering role in Mobility as a Service (MaaS) to develop multi-modal networks across the country. However, further exploration of the practicalities is necessary (e.g. to overcome silo thinking based on individual transport modes of public and private actors). The MaaS model allows public and private operators to collaborate on seamless mobility. Using smart technologies, they can offer a sustainable multi-modal transport system (e.g. public transport, bike and car sharing, micro mobility). Fully unlocking the benefits of MaaS needs to go hand-in-hand with creating the right conditions, including infrastructure for sustainable modes and road management tools, to develop multi-modal networks across the country. Otherwise, MaaS risks limiting benefits to places like Helsinki, while exacerbating low-occupancy vehicle travel in other areas.

Finland has enhanced co-ordination of urban and transport systems through agreements between the central government and multiple municipalities of functional urban areas concerning land use, housing and transport (MAL). The central government concluded MALs with the four largest metropolitan areas (Helsinki, Tampere, Turku and Oulu) from 2020 to 2031 and initiated MALs with three other areas (Jyväskylä, Lahti and Kuopio) in 2021. In Helsinki and other urban areas, the MAL aims at developing a dense urban core connected to district centres of neighbouring municipalities with mixed land use through sustainable modes of transport (co-funded by the central government). This is a welcome approach that shifts from single-use neighbourhoods towards mixed-use, creating proximity. The Helsinki metropolitan region has established a metropolitan transport authority (HSL), which is key to co-ordinate public transport across neighbouring municipalities.

Improving vehicle technology and decarbonising fuels remain important but face challenges

Policies to decarbonise system parts are expected to deliver most of transport-related emission reductions in Finland through EVs and biofuel mandates. The roadmap for fossil-free transport aims to have 700 000 EVs by 2030 (or some 25% of the car stock in 2020). This compares with around 60 000 EVs in 2020, fewer than Sweden or Norway on a per capita basis. A relative target – in terms of share of the

EV stock in the target year – would be more in line with the objective of reducing car ownership and dependency. Finland introduced a purchase subsidy for EVs in 2018 for cars worth less than EUR 50 000 and extended the subsidy through 2022. The subsidy and the CO_2-based vehicle taxation spurred EV sales (Section 3). In 2020-21, Finland also provided a scrapping bonus for the purchase of new low-emission passenger vehicles. The scrapping bonus could also be used for purchasing electric bicycles or a seasonal pass for public transport, with a view to encouraging the use of sustainable modes of transport. Finland actively promotes public charging infrastructure through public tenders. At the time of writing, it was exploring the option of obliging petrol stations to provide charging points for EVs. Public charging hubs that enable charging for a variety of users and charging methods would support the shift towards multimodality.

Finland increased the biofuel blending obligation for fuel suppliers from 4% to 20% over 2010-20, halting the growth of petrol and diesel demand. It will increase this share to 30% by 2030. While it is welcome that Finland plans to include non-biological fuels such as hydrogen in this fossil-free fuel quota, there is no plan to include electricity from EVs. EVs could be included in the obligation and trade allowed between fuel distributors and electric charging operators. Stronger focus on transport electrification would reduce the demand for the limited supply of biofuel feedstock and second generation biofuels. Biofuels could be channelled to harder-to-abate sectors (e.g. aviation and shipping). Some biofuels may also raise issues of biodiversity, land-use change and related emissions. In contrast to some other European countries, Finland classifies Palm Fatty Acid Distillate as residue rather than as co-product. This reduces the EU sustainability requirement concerning the traceability of the feedstock (T&E, 2020).

Further decarbonising electricity is key to decarbonise other sectors

Electricity demand decreased between 2005 and 2015 but has since been increasing. While demand is expected to increase further due to digitalisation and sector integration (e.g. electrification and production of electrofuels), the scale of the increase depends on the climate strategies in end-use sectors. This requires enhanced co-ordination in system planning, aligning transport infrastructure (e.g. EV charging points) and heating infrastructure (e.g. heat pumps in DH networks) with network planning and resource adequacy assessment.

Systemic change, notably the shift from a centralised to a more decentralised grid, would enable consumers to play a larger role through on-site generation, storage and demand response as envisioned by the Smart Grid Working Group. This, in turn, would empower consumers while reducing energy bills and investment in plants and network infrastructure, reducing trade-offs with biodiversity.

Substituting coal and peat by low-carbon technologies is key

The share of low-carbon electricity generation (renewables and nuclear) increased from 66% to 85% over 2005-20, among the highest shares in the OECD. This helped reduce CO_2 emissions from power generation by 33%. Wind and biomass replaced coal and peat in power plants thanks to the EU ETS, fuel and carbon taxation and renewables support. Nuclear accounted for 34%, but this share will increase when a new nuclear power unit will come on line in 2022, more than a decade behind schedule and three times over its original budget. This highlights the uncertainties of nuclear power to decarbonise the power sector regarding timeline and cost.

Finland aims to phase out coal in energy generation by 2029 and to at least halve peat consumption by 2030. It could consider adjusting the coal phase-out date in view of the carbon neutrality target. Peat is a local energy source, employing 2 000-2 500 full-time equivalent workers (0.1% of total employment). While the macroeconomic impact of phasing out peat extraction can be expected to be small, it will affect some local rural economies. The Working Group on Peat proposed improvements for peat industry operators in 2021, tapping funds from the EU Just Transition Fund. Finland could appoint a commissioner to engage with all relevant (local) stakeholders or set up a multi-stakeholder commission to ensure broad support for the transition.

Many proposals, such as emphasis on peatland restoration, are welcome. Others need to be evaluated against their effectiveness in reducing GHG emissions from peat, as well as alternative use of public funds to promote business and job opportunities in other sectors. For example, the idea of keeping peat consumption at a moderate rate and offering a one-off compensation package to shut down peat production needs more analysis.

Finland is on track to deploy large amounts of wind capacity. Most of the planned onshore wind projects will be financed privately. In a positive move, the government stopped financial support for mature technologies, redirecting public funding to less mature technologies for generation and flexibility. Most onshore wind is, however, located far from major consumption centres. This means it will eventually require transmission network upgrades. More granular spatial pricing would provide incentives for locations closer to centres of consumption. Offshore wind benefits from property tax breaks. Further support may be needed to spur deployment of offshore wind farms.

Enhance flexibility through demand response and sector integration

Increasing shares of wind power in Finland will increase demand for flexibility. Finland's primary flexibility source is interconnections to neighbouring countries. Flexibility through smart grids, including demand response, is well developed. The country was a frontrunner in smart meters (completing roll-out in 2013). As these meters reach the end of their lifetime, a roll-out of the next-generation devices would enable many customers, including low-income households, to engage in demand response more cost effectively. Finland has also been a pioneer in enabling participation of small customers in electricity markets through aggregators and has the most favourable regulations for prosumers in the European Union. Finland implemented the datahub, a centralised information exchange system, which will reduce market entry barriers of new energy service companies. In 2020, the government removed double taxation for storage, which will help increase investment in large-scale or behind-the-meter storage.

Sector integration could add further flexibility potential while decarbonising end-use sectors. Electrification of transport and heating in Finland is lower than in Norway and Sweden (NER, 2019). Finland is planning to transfer large-scale heat pumps and electric boilers for DH to the reduced electricity tax rate to speed up electrification in 2022. The rate will be set at the EU minimum rate. This is welcome; the reduced rate should be extended to public EV charging stations to provide incentives for electrification. Reform of the tariff structure of distribution system operators (as proposed by the Smart Grid Working Group) would be an additional incentive.

Increasing energy performance of buildings through renovation is insufficient

Finland's building stock is responsible for 20% of total final energy consumption. Between 2005 and 2019, climate-corrected energy consumption per square metre for space heating in Finland decreased by 15%. This was less than the average rate of decline in Europe and in some other Nordic countries. Finland's long-term renovation strategy aims to reduce emissions from buildings by 90% by 2050 through several measures. These include renovating buildings, phasing out fossil fuel use and demolishing underused buildings in regions with decreasing population. The strategy envisions increasing the share of nearly-zero energy buildings (NZEBs) from 10% in 2020 to between 82% (multi-family buildings) and 100% (single-family buildings) by 2050. However, Finland's definition of NZEB is less demanding than one recommended by the European Commission for Nordic countries (Kurnitski, 2018).

Achieving low energy-demand neighbourhoods with high shares of NZEBs by 2050 requires deep retrofits, i.e. whole-building renovation that reduces energy use by more than 50%. In a welcome move, Finland requires major renovations to fulfil the same energy performance standards that apply to new buildings. High costs are a key barrier to deep retrofits. Finland provides targeted financial support for those renovations and plans to implement dedicated one-stop shops. Clarifying subsidies for deep retrofits beyond 2022 would help prevent short-term market distortions and improve long-term planning of relevant

stakeholders. Mandatory energy saving targets or efforts to industrialise retrofits, following the Dutch/EU Energiesproong model, could significantly reduce costs. Finland should continue promoting joint procurement of building elements (e.g. rooftop solar photovoltaic [PV]) and joint renovation projects with a view to reaching scale to industrialise retrofits. It could also explore alternative financing mechanisms for deep retrofits such as through energy service companies or on-bill financing to address high up-front costs.

As in all countries, some of Finland's fiscal incentives (e.g. income tax deductions and financial support for building parts such as oil heating) have encouraged shallow or staged deep retrofits rather than deep retrofits of existing buildings as a whole. Voluntary energy efficiency agreements with rental housing companies, in place since 2002, could be more ambitious. The agreements' energy saving target for 2017-25 is at least 7.5%, i.e. less than 1% annual reduction. The required annual energy savings for apartment blocks according to the renovation strategy need to be 2.5% between 2020 and 2030. Yet, other measures in the renovation strategy (e.g. financial incentives) are expected to make up for the gap.

Deep retrofits in line with the renovation strategy are expected to create 12 000 full-time jobs. Finland offers lifelong learning opportunities in vocational and public education facilities to upgrade skills for improving energy efficiency in buildings and holistic retrofits. However, the workforce needs better training to keep up with the necessary skills.

Finland is a frontrunner in tackling the lifecycle emissions of new buildings. The country plans to include carbon limits on buildings' lifecycle emissions before 2025. Cities such as Helsinki already incorporate the carbon footprint of buildings as a criterion in the allocation of building plots.

More emphasis on non-combustion technologies to decarbonise heat is needed

Finland's heat supply has increasingly decarbonised in recent years. In rural areas, electric heat pumps have started to replace electric heating and oil heating. Oil heating will be phased out by the beginning of the 2030s. In urban and suburban areas, Finland has an extensive DH network. Almost 70% of DH production is based on CHP, which improves supply-side energy efficiency. Biomass (39%), fossil fuels (30%) and peat (15%) accounted for the major part in the DH fuel mix in 2019.

The government supported the early switch of CHP plants to biomass and non-combustion technologies, including heat pumps and storage. More emphasis on non-combustion technologies would reduce the use of woody biomass, thereby helping to address the trade-offs with biodiversity and the health of soils. DH operators increasingly tap other heat sources, including waste heat recovery. Bilateral agreements set out conditions of third-party access as the DH market is unregulated. Finnish law does not guarantee or regulate third-party access to DH networks, which adds uncertainty to third-party heat providers.

Although DH is a major technology for deep decarbonisation, DH companies face financial challenges to maintain the infrastructure for several reasons. First, energy efficiency improvements are expected to reduce heating demand. Second, rising DH prices (in part due to fossil fuel prices) have led some customers to switch to electric heat pumps. Hybrid systems combine DH with large-scale electric heat pumps and water thermal storage. Such systems could enable DH companies to generate new revenue streams by participating in electricity markets and providing flexibility. Hybrid systems are commercially viable in most places and Finland could consider supporting these systems where they are not.

Looking at the neighbourhood and city level can increase levers of climate action

New housing developments are needed to reduce pressure on urban housing prices and improve housing affordability. Some Finnish cities aim to become more compact through densification while enhancing mixed land use. This approach is associated with lower energy and materials demand, higher potential for tapping multiple sources of heat (e.g. through recovering waste energy streams) and higher proximity, all of which reduce emissions.

Helsinki (e.g. carbon-neutral Helsinki 2035 action plan) prioritises densification through new building developments in urban infills close to public transport hubs. This approach minimises car dependency, while extending green spaces. In so doing, it limits trade-offs between densification and well-being. Helsinki also applies the green factor method for the built environment. This ensures sufficient green spaces to mitigate flood risk, store CO_2, and enhance the well-being and health of citizens. The green factor method could be mainstreamed to other jurisdictions. However, its effectiveness could benefit from more ambitious targets and improved monitoring and evaluation, notably regarding the diversity of green infrastructure (Juhola, 2018).

Recommendations on climate change and well-being

Enhancing coherence of climate mitigation policy

- Strengthen cross-sector co-ordination and embed the carbon neutrality target into the framework of sustainable development; explore GHG emission mitigation scenarios characterised by low energy demand; further emphasise system redesign and behavioural change.
- Improve projections and assessment of the bioeconomy – including the forest industry and use of domestic bioenergy – and of its impact on the potential of carbon removal and on biodiversity; develop a clear strategy for demand and supply of biofuels.

Ensuring a high-accessibility and low-emission transport system

- Reduce car dependency by removing policies that encourage car ownership (e.g. tax-free workplace parking, minimum parking requirements), mainstreaming road management tools (e.g. reallocating road and parking space) and urban redesign (e.g. mixed land use); continue developing multi-modal networks (e.g. through MaaS) to unlock the mitigation potential of shifting towards more sustainable modes.
- Develop metropolitan transport authorities across the country to better co-ordinate transport across municipalities; extend the purview of new and existing ones, e.g. by enhancing capacity for strategic planning or broadening the scope towards other sustainable transport modes.
- Continue to financially support the deployment of public and smart charging stations for EVs; increasingly target support to public charging hubs that enable charging for a variety of users (e.g. shared and private cars, e-bikes, e-scooters) and speed (slow and fast charging), with a view to promoting the shift towards multimodality.
- Apply strong sustainability criteria to domestic and imported liquid biofuels, as well as raw materials for biofuel production; include electricity from EVs into the fossil-free fuel obligation, with a view to accelerating transport electrification and channelling liquid biofuels towards harder-to-abate sectors, e.g. heavy freight, aviation and shipping.

Decarbonising the electricity sector

- Announce a clear phase-out date for peat extraction to provide certainty for stakeholders; strengthen assessment of the cost and benefits of the proposed measures to support workers and communities in the transition out of peat, with a view to maximising alternative business and job opportunities; consider setting up a commissioner or a multi-stakeholder commission to promote dialogue with all relevant stakeholders and ensure consensus about the transition.
- Consider more fine-grained spatially electricity pricing to provide incentives for deploying wind farms closer to consumption centres, and strengthen financial support for offshore wind.

- Improve sector integration by integrated energy system planning, reforming electricity tax rates to support electrification of transport, and improving regulation of distribution system operators (e.g. removing barriers to third-party provision of flexibility, updating tariff design).

Improving the energy performance of buildings and neighbourhoods

- Continue to promote deep retrofits, including through one-stop shops, mandatory energy savings targets, strengthened voluntary agreements with housing companies and industrialisation of deep retrofits, following the Energiesproong model; continue to promote joint procurement of building elements and joint renovation projects; explore alternative financing mechanisms for deep retrofits (e.g. through energy service companies or on-bill financing).
- Further strengthen financial support for non-combustion technologies (e.g. large-scale electric heat pumps) in the decarbonisation of DH networks, including through hybrid systems; further develop mitigation strategies beyond the dwelling level (e.g. promoting compactness, mixed land use and green spaces at the neighbourhood or city level) to unlock the residential sector's potential to reduce energy demand and emissions, recycle waste heat, store carbon, enhance climate resilience and deliver well-being; improve the green factor method and mainstream it across Finland.

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Notes

[1] See Section 4 for details on climate mitigation.

[2] Final official estimates of 2020 emissions of air pollutants were not available at the time of writing.

Annex 1. Actions taken to implement selected recommendations from the 2009 OECD Environmental Performance Review of Finland

Recommendations	Actions taken
Chapter 1. Environmental performance: Trends and recent developments	
Air management	
Explore the potential of economic instruments, such as emission trading, nitrogen emission taxation and road pricing; ensure that they are consistent with existing instruments, such as road fuel taxes and vehicle taxes, so as to improve economic efficiency and environmental effectiveness.	There are no economic instruments specifically targeting air pollution. Road pricing is not in place. Some economic instruments, such as carbon and energy taxes, can help reduce air emissions. The annual vehicle circulation tax penalises diesel vehicles, which generally emit more particulate matter (PM) and nitrogen oxides (NO_x) per litre used.
Pursue efforts to reduce NO_x emissions, to meet the NO_x reduction objectives for large combustion plants, and be prepared to respond to more stringent limit values by 2020, as part of the forthcoming EU Emissions Ceilings Directive.	Finland implemented the requirements of the EU Large Combustion Plants Directive and of the Industrial Emissions Directive. These include the inclusion of minimum NO_X emission limit values and use of best available techniques in licensing. Vehicle standards apply to control NO_x emissions from vehicles.
Explore the potential ancillary benefits of the new climate and energy policies, particularly on NO_x and particles.	The National Air Pollution Control Programme (NAPCP) 2030 highlights synergies between policies to mitigate climate change and control air pollution. Among the measures to reduce air and greenhouse gas (GHG) emissions are a fuel shift in road transport towards electricity, natural gas and biofuels; a shift from private car use to active mobility and public transport; and energy efficiency improvements in buildings and industry.
Reduce the health impact of particulate emissions from road transport and small-scale wood combustion in urban areas.	In addition to EU regulations (e.g. more stringent emission standards for vehicles and small-combustion units as per the EU Ecodesign Directive), the NAPCP 2030 lays out measures to reduce the health impact of PM emissions. These include information campaigns on health effects from small-scale wood burning; guidance on the correct use of fireplaces; and studying the feasibility of standards for sauna stoves and of voluntary requirements with stove manufactures. Research projects have been conducted to reduce emissions from wood-fired sauna stoves, which are not subject to the EU Ecodesign Directive.
Waste and resource management	
Promote market mechanisms for waste sorting and recovery; in particular, adjust the waste tax to respond to the National Waste Plan priorities; extend the tax to cover private industrial landfills.	The landfill tax was extended to private industrial landfills in 2011. In 2016, the tax rate was increased to EUR 70 per tonne and a ban on landfilling of most biodegradable and organic wastes was introduced. In 2019, a national waste material marketplace ("Materiaalitori") was established to promote markets for waste-derived products. All municipalities use pay-as-you-throw waste charges, where the charge is based on bin volume and emptying frequency of bins. A few municipalities set lower charges for sorted waste. Some municipalities levy an additional "eco-charge" to recover costs associated with a separate waste collection and recycling infrastructure and service.
Further reduce material intensity through "cradle to cradle" and 3R approaches, and systematically promote Extended Producer Responsibility schemes for separate waste collection and recovery.	The 2014 revision of the packaging and packaging waste decree strengthened requirements for packaging waste collection systems organised by producers. The revised Waste Act, approved in mid-2021, requires municipalities and waste producers to establish agreements on the organisation and collection of packaging waste; it also establishes a basic obligation for separate waste collection, as well as a requirement for door to door collection of biowaste and packaging waste for multi-apartment buildings and public and private operators generating municipal solid waste. Waste that has been separately collected for preparation for re-use or recycling

	shall not be disposed of in landfill or be incinerated.
Improve waste management infrastructure; in particular, develop the capacity for recovery of biowaste, carry out further studies and build consensus on waste incineration with combined heat and power recovery.	In 2017, there were nine waste incineration plants in operation. The current waste incineration capacity is estimated to be sufficient to treat all mixed waste generated in the country. Some municipal composting plants built since the 1990s are approaching the end of their useful life. According to the National Waste Plan to 2023, composting plants will be replaced with new biogas facilities or other more advanced treatment technologies. Capacity for biological treatment of municipal waste should grow by between 180 000 and 220 000 tonnes (or build three to four new facilities of the same size as the biogas facility in Helsinki Region).
Extend the scope of energy efficiency agreements to include material efficiency.	Material efficiency audits were launched in 2010. Since the beginning of 2020, Business Finland has covered up to 50% of audit costs.
Biodiversity conservation and sustainable use	
Set up long and short-term, quantitative and outcome-oriented, national and regional targets to guide implementation of the National Biodiversity Strategy and Action Plan; periodically assess achievements.	The National Strategy and Action Plan for the Conservation and Sustainable Use of Biodiversity includes targets and measures to 2020. The government commissioned an assessment of the implementation of the objectives and measures of the strategy and action plan to inform the development of the post-2020 strategy.
Set up a national peatland strategy to guide efforts for their conservation and management, including peatland exploitation for energy use; complete management plans for all Ramsar sites.	First-time ditching of peatlands for peat production is prohibited by law. Peat extraction is permitted only in already drained or otherwise altered bogs. Finland plans to halve the use of peat by 2030.
Enhance protection of marine areas in the Baltic Sea; finalise the ongoing inventory of marine biodiversity, develop EIA, and conduct risk assessments for ship routes in the Baltic Sea.	Marine protected areas covered 12% of Finland's territorial waters in 2021. The Finnish Inventory Programme for the Underwater Marine Environment collects data on the occurrence of underwater marine biotopes, species and communities. The National Marine Strategy, updated every six years, includes an assessment of the state of the marine environment, objectives, a monitoring programme and a programme of measures.
Enhance protection of rare and threatened forest habitats; link any support to private forest owners to otherwise unremunerated but beneficial public services.	The Forest Biodiversity Programme for Southern Finland (METSO) promotes voluntary forest protection by compensating private landowners that protect their forests.
Take measures in the farming sector to reduce nutrient loading in coastal waters in the context of the Common Agricultural Policy reform, the Nitrates Directive and the HELCOM Baltic Sea Action Plan; in particular, consider introducing more targeted agri-environmental measures.	The River Basin Management Plan sets more stringent nutrient reduction targets for coastal waters than the HELCOM Baltic Sea Action Plan, except for phosphorus in the Gulf of Finland. Part of the subsidies of the EU Common Agricultural Policy 2014-20 to Finnish farmers support actions to reduce leakage of nutrients to water bodies. A nutrient recycling programme has been ongoing since 2012. Finland provides financial support to direct manure to biogas production.
Chapter 2. Environmental governance and management	
Pursue the reform of environmental permitting to streamline and simplify procedures while enhancing the consistency and effectiveness of enforcement actions.	Finland reduced the number of environmental permits by introducing registration and expanding the notification system for small polluters. At the state level, it created a co-ordinated, one-level network of permit offices and reduced the administrative costs by introducing electronic permit applications. Municipalities have retained their permitting functions.
Strengthen co-ordination of land use planning between municipalities and state authorities; ensure effective enforcement of land-use plans in coastal areas.	The central government's Centres for Economic Development, Transport and the Environment (ELY Centres) participate in the preparation of regional land-use plans. They also oversee local master planning and local detailed planning, including planning in coastal areas. Agreements on housing, land use and transport (MALs) between relevant state authorities and municipalities in larger metropolitan areas are another tool for vertical co-ordination.
Fully use environmental permitting procedures to promote waste prevention, including better definitions of waste prevention measures and the development of guidelines for site inspections.	The legislation includes a requirement to consider material efficiency in defining conditions of environmental permits. In 2012, the Ministry of the Environment (MoE) published a guide on material efficiency in the environmental permitting process.
Promote corporate environmental reporting, including from small and medium-sized enterprises.	In 2020, the Finland Chamber of Commerce launched a programme on corporate social responsibility (CSR). Finnish Business and Society – the largest Nordic CSR network with over 300 members – helps businesses develop CSR expertise through trainings, events, consultancy, tools and studies.

Further improve access of the general public to pollution and compliance information on a geographical and sectoral basis.	Finland's joint environmental administration portal is the source of most comprehensive environmental data. The MoE and the Finnish Environment Institute (SYKE) websites also present rich environmental information and relevant scientific reports. Information on environmental compliance by private entities (inspection reports) is publicly available.
Further develop high quality teaching material and learning methods in environmental education; establish specialised courses on the environment and sustainable development at all education levels with stronger links to environmental research and innovation; enhance co-operation between different actors in formal and non-formal education for the coherent implementation of national strategies on education for sustainable development.	Finland has created new environmental education coursework and support materials, engaging a broad range of non-governmental actors. In 2018, sustainable development was made a compulsory component of vocational degrees. Environmental aspects have been increasingly integrated into competence requirements for every profession. The Finnish National Agency for Education has been strengthened to support the co-ordination of sustainable development education.
Chapter 3. Towards green growth	
Review the linkages and possible synergies among environmental policy programmes, including time-bound targets and objectives, within the framework of Finland's sustainable development strategy.	In 2014, the Finnish National Commission on Sustainable Development adopted a long-term sustainable development vision titled "The Finland we want by 2050 – the society's commitment to sustainable development". In 2016, the strategy was reviewed to be aligned with the Sustainable Development Goals (SDGs). In 2021, the National Commission on Sustainable Development started working on a 2030 Agenda roadmap that will define how Finland will promote achievement of the SDGs nationally, in the European Union and globally. Since 2017, Finland has developed shorter-term implementation plans for the SDGs that cover respective government terms. Since 2018, the government budget proposals have included a sustainable development chapter. This provides a qualitative assessment of the budget contribution to the SDGs and identifies the state expenditure and revenue relevant to the carbon-neutrality goal. The Finnish Expert Panel on sustainable development has proposed a framework for sustainability transformation across different sectors and policy domains.
Strengthen environmental efforts (e.g. investments, technological innovation), in the context of Finland's efforts to stimulate its economy.	The Sustainable Growth Programme 2021-26 builds on four pillars: green transition, digital economy, employment and skills, access to health and social services. The green transition pillar receives over half of Finland's quota of the EU Recovery and Resilience Facility (EUR 2.1 billion in 2021-23). Most green measures target the energy, buildings and transport sectors. The programme also includes approximately EUR 700 million in funding for research, development and innovation activities.
Undertake an "ecological tax reform", as indicated in the government 2003-07 policy documents, to review and revise prices, taxes and subsidies in the relevant sectors (e.g. energy, transport, agriculture, industry).	Tax reforms between 2008 and 2011 better linked energy and vehicle taxes to carbon dioxide (CO_2) emissions. The government's 2019 programme announced a "tax reform for sustainable development". This will involve changes in energy, transport and mining taxation; promotion of the circular economy by tax means; and study of a consumption tax based on CO_2 emissions.
Review and revise the taxation of energy products, as part of the preparation and implementation of the new Climate Strategy.	Since 2012, the CO_2 tax for transport fuels has been based on lifecycle emissions. The same approach was extended to fuels for heating and machinery in 2019. In 2019, the government announced an overhaul of energy taxation to help achieve a carbon-neutral economy by 2035. It started with raising tax rates on transport fuels in 2020. The government implemented other tax changes in 2021. These include the increased tax rate on heating fuels, including peat; reduced tax discounts on paraffinic diesel and fossil fuels used in combined heat and power generation; and the gradual phase-out of the industrial energy tax rebate system by 2025, while reducing the electricity tax for industry, agriculture, data centres and mining in 2021.
Review the use of economic instruments to increase their environmental effectiveness and economic efficiency.	The government has commissioned different studies to evaluate energy taxation, transport taxation, road pricing and other economic instruments.
Continue to aim at internalising externalities and implementing the polluter pays and user pays principles to integrate further environmental concerns into energy, agriculture, industry and transport policies.	See above.
Further promote eco-innovation through green procurement, environmental labelling and the active involvement of businesses and	Business Finland is the agency implementing innovation support programmes and facilitating collaboration among businesses, research

other stakeholders, and consider how environmental policy instruments could be designed to better promote innovation.	and public organisations. It has launched several programmes to promote investment and innovation in low-carbon solutions, the bioeconomy, circular economy and cleantech sectors. Energy-related projects accounted for one-third of Business Finland's total innovation funding in 2006-19. The Finnish Climate Fund (a state-owned company) provides funding for industry-scale demonstration projects of climate and digital technology solutions. In 2020, the government launched an action plan to reach 10% of public procurement for innovation (PPI) in all public procurement by 2023. The 2013 Decision on the Promotion of Sustainable Environmental and Energy Solutions in Public Procurement set green public procurement (GPP) targets for the central, regional and local governments. Targets include energy consumption in public buildings, low-emission vehicles and organic food served in public institutions. There are environmental criteria and guidance for 16 procurement areas. In 2018, a strategic partnership of eight organisations (including SYKE, the Association of Finnish Local and Regional Authorities and Business Finland) established KEINO – a competence centre for sustainable and innovative public procurement.
Promote policies that enhance employment opportunities associated to environmental goods and services, including "green" procurement, nature conservation and environment-related tourism.	See above for green procurement. An inter-ministerial working group was tasked with proposing ways to help the transition of workers out of the peat industry. Proposed measures include a programme to support entrepreneurship in the bioeconomy and nature management. Finland plans to use the EU Just Transition Fund (about EUR 750 million in 2021-27) to finance investment in training and infrastructure to strengthen the local economy and support the local workforce.
Increase the level of official development assistance (with UN target of 0.7% of GNI in mind) and its share devoted to environment; contribute to strengthening the capacity of recipient countries to absorb possible increases in financial flows (e.g. through CDM projects).	The level of official development assistance fell between 2014 and 2018 but rebounded in 2019 and continued to grow in 2020. It was 0.47% of gross national income in 2020. In 2019, Finland committed 25% of its total bilateral allocable aid in support of the environment and the Rio Conventions.
Chapter 4. Climate change and well-being	
Strengthen energy efficiency efforts with particular emphasis on the building sector, and capture the multiple related benefits.	A 2018 regulation requires all new buildings to be nearly-zero energy buildings (NZEBs). Major renovations must fulfil the same energy performance standard that apply to new buildings. In 2017, the MoE published a roadmap to low-carbon construction. The 2020 long-term renovation strategy aims to reduce GHG emissions from buildings by 90% by 2050 through energy efficiency renovations and fossil fuel phase-out. The strategy sets targets for the share of NZEBs by 2050. Several fiscal incentives and grants are available for energy efficiency improvements in buildings; phase-out oil of heating; and deep retrofits. Specific subsidies target retrofitting residential buildings with humidity damage or indoor air problems, as well as for improving the living conditions of elderly or disabled people. Voluntary energy efficiency agreements with rental housing companies have been in place since 2002. Energy performance certificates are mandatory when selling or renting a building or a part thereof. Finland piloted joint building ventures that combine multiple renovation projects in the same neighbourhood.
Ensure coherence of recent and forthcoming transport system plans with land use plans, at regional and local levels, with a view to improving traffic management and promoting environment-friendly transport.	The National Transport System Plan for 2021-32 aims to integrate transport and land-use planning. Several cities have developed long-term strategies for spatial and transport planning. The Helsinki Region Transport System Plan provides a long-term vision of the transport system in the Helsinki region while outlining short-term actions (e.g. infrastructure investments for public transport, facilitating active mobility, parking policies, congestion pricing). The government concluded voluntary agreements on land use, housing and transport (MALs) with the municipalities of the four largest urban regions and with three other urban regions. MALs aim to enhance co-ordination of urban and transport systems. They focus on developing a

	dense urban core connected to district centres of neighbouring municipalities through sustainable modes of transport. Finland has been promoting the Mobility as a Service (MaaS) model, which offers a sustainable multimodal transport system enabled through smart technologies. MaaS pilot projects were launched in different areas, notably in the Helsinki Metropolitan Area.
Implement EU environmental sustainability criteria for the production of biofuels; carry out a cost-benefit analysis to determine the relative value of biofuels, fossil and other alternative fuels.	The 2013 Act on Biofuels and Bioliquids and its subsequent modifications impose sustainability criteria for biofuels in accordance with the 2009 and 2018 Renewable Energy directives. It also defines national measures to verify sustainability. Only biofuels that meet the sustainability criteria can be used to fulfil the blending obligations and benefit from lower excise duties.

Source: OECD Secretariat based on country submission.

Part I. Progress towards sustainable development

Chapter 1. Key environmental trends

Finland continued to decouple some environmental pressures from economic activity, including emissions of greenhouse gases and air pollutants. However, pressures such as waste generation, material consumption, intensity of forest use and nutrient losses to water bodies have continued to rise. This chapter provides an overview of Finland's environmental achievements since 2010, and its remaining challenges. It reviews progress in moving towards a low-carbon, climate-resilient and circular economy, improving air quality and management of water resources, and reducing pressures on biodiversity.

Recommendations on managing air, waste, water and biodiversity and adapting to climate change

Controlling air pollution

- Allocate adequate resources for the implementation of the National Air Pollution Control Programme 2030, focusing on measures targeting $PM_{2.5}$ pollution from small-scale wood burning and street dust.
- Consider implementing additional measures to mitigate emissions of road dust and from small-scale wood burning, including economic incentives (e.g. subsidies) to accelerate the renewal of older and less efficient stoves, as well as regulations on sauna stoves and studded tyres in areas facing high PM concentrations.

Improving waste management for a circular economy

- Make greater use of voluntary agreements and economic instruments to encourage recycling and material recovery; consider introducing a nationwide weight-based pay-as-you-throw system with differentiated fees for sorted waste; and consider including incineration plants into the EU Emissions Trading System as part of a broader policy package that encompasses the whole waste value chain.
- Develop regulatory and incentive measures to achieve the targets set in the 2021 Strategic Programme to Promote a Circular Economy, with a view to decoupling economic growth and material use and fostering the green transition.
- Continue to implement the Plastics Roadmap; identify the necessary additional and follow-up measures covering the entire value chain of plastic products.

Enhancing biodiversity conservation and sustainable use

- Develop a comprehensive action plan with concrete and measurable targets to guide biodiversity policy and actions to 2030; develop and regularly publish indicators to track progress in implementation and impact on biodiversity targets; ensure availability of sufficient financial and human resources to implement identified measures, and extend the use of economic instruments to raise finance for biodiversity management.
- Expand the area of protected forests (especially in southern Finland); strengthen and expand programmes to support landowners in protecting biodiversity on their land/forest (e.g. through larger retention of deadwood).
- Better target direct payments to farmers under the EU Common Agricultural Policy to promote climate, biodiversity and water quality goals.

Managing water quality and services

- Consider introducing new instruments to improve nutrient management and recycling, including taxation of nutrient surplus at farm level, as well as a nutrient cap-and-trade system between farms in the Baltic Sea watershed (to replace the national nutrient input ceilings); recycle the potential additional revenue to provide support to general agricultural services or to individual farmers based on farm size and type.
- Consider introducing uniform pricing for water supply and sanitation services at the river basin district level to finance the rehabilitation and modernisation of infrastructure while reducing disparity in water prices across municipalities.

- Improve monitoring and ensure compliance of independent wastewater treatment systems with tertiary treatment standards, by providing financial and technical assistance and strengthening enforcement.

Adapting to the impact of climate change

- Develop guidelines for assessing climate risks in projects or programmes and/or catalogues of mitigation options for priority sectors or groups, with a view to supporting the implementation of climate risk-reducing activities; strengthen collaboration between government and non-government actors to support adaptation in the private sector and among citizens.

1.1. Introduction

Finland is one of the most northern countries in Europe with over one-third of its land extending north of the Arctic Circle. Nearly three-quarters of land are covered by forests, which support a strong forestry industry. Known as the Land of the Thousand Lakes, Finland also has vast freshwater resources, in addition to a long coastline along the Baltic Sea and many of Europe's peatlands. The Finnish population, which enjoys a generally high level of well-being, has a deep relationship to nature and the countryside.

Finland's environmental performance over the past decade has been mixed. The country made important progress in reducing greenhouse gas (GHG) emissions, reduced the emission of air pollutants and virtually ended the landfilling of household waste. However, pressures on Finland's sensitive natural environments remain high. Agriculture continues to cause nutrient leakage into water bodies and coastal zones, while forestry is putting pressure on wood habitats and species. The poor status of wetlands is another area of concern. The government attributes high importance to environmental protection and aims to align the economy with the principles of sustainable development. Finland committed to become carbon neutral by 2035, to pioneer the world's first circular economy and to halt biodiversity loss.

This chapter provides an overview of the main environmental trends observed in Finland. It highlights the country's progress in the last decade towards its national and international goals, as well as remaining challenges for green growth and sustainable development. Where possible, trends are compared with those of other OECD member countries.

1.2. Promoting sustained and inclusive economic growth

1.2.1. Economic performance and structure of the economy

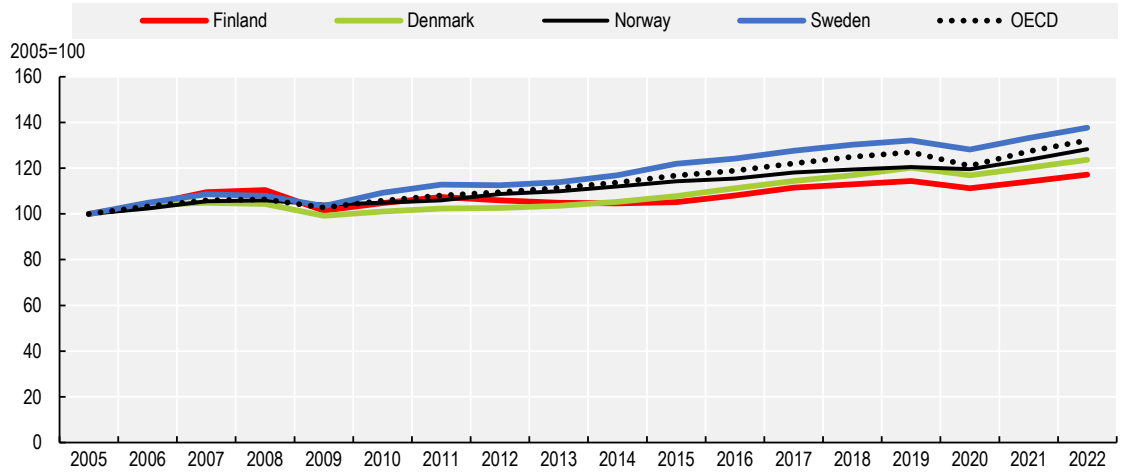
After a long period of lacklustre economic performance following the global financial and economic crisis, robust economic growth resumed in 2015/16. This was partly driven by comprehensive structural reforms, as well as by an agreement between social partners on wage moderation. Gross domestic product (GDP) growth remained healthy until the COVID-19 pandemic, albeit lower than in other Nordic countries (Figure 1.1). A swift and well-targeted policy response helped limit the health and economic effects of the COVID-19 pandemic. However, the Finnish economy fell into a deep recession in the first quarter of 2020 (Chapter 3). GDP declined by 2.8% in 2020 but is expected to recover in 2021 and continue growing in 2022 (OECD, 2021a).

Finland's open economy has a prominent industry sector, which accounts for 28% of value added. The largest industrial sectors are wood and paper products, and manufacture of electronic and optical products. The service sector accounts for nearly 70% of value added, less than on average in the OECD (Table of Basic Statistics). The primary sector (agriculture, forestry and fishing) accounts for slightly less than 3% of

value added, 1.5 times more than on average in the OECD. This is linked to the large forestry industry. Finland is highly integrated into the global economy, with larger exports and imports in terms of GDP than on average in the OECD (Table of Basic Statistics).

Figure 1.1. Finland's economy has grown less than that of regional peers

Real GDP index, 2005-22



Source: OECD (2020), *OECD Economic Outlook No. 109: Statistics and Projections* (database).

StatLink https://doi.org/10.1787/888934287832

Public finances had been robust in the years before the pandemic. However, in 2020, the deficit jumped to more than 5% of GDP, while debt surged to over 80% and is projected to increase further. These increases were due mostly to measures implemented in response to COVID-19 (OECD, 2021a). In addition, the health care expenditure associated to a rapidly ageing population is putting pressure on public finances. Prior to the outbreak of the pandemic, the government had committed to spending more on education, employment, infrastructure and climate policies, while maintaining a balanced budget in the medium term. Achieving this will require higher employment rates, more efficient public administration and public expenditure, and fewer unwarranted tax expenditures, including environmentally harmful subsidies (Chapter 3) (OECD, 2020a).

1.2.2. Population and well-being

Finland's population of 5.5 million people grew moderately over the past decade. It is expected to reach 6 million inhabitants by 2060. However, population ageing is expected to accelerate in the coming years and decades. With a population density of 16 inhabitants per square kilometre, Finland is one of the most sparsely populated and "rural" countries in the OECD (Table of Basic Statistics). The density per square kilometre varies, however, from 2 inhabitants in northern Finland (Lapland) to 185 in the south (Helsinki-Uusimaa) (OECD, 2021b). Regional inequalities (in terms GDP per capita) are smaller than in most other OECD countries. Finland experiences a strong migration from rural to urban areas (MoE, 2017a).

Finns enjoy one of the highest levels of well-being in the OECD. GDP per capita is above the OECD average (Table of Basic Statistics), although significantly lower than in Denmark, Germany and Sweden. According to the OECD Better Life Index, Finns perform in the top 20% in education and skills, subjective well-being, environmental quality, personal security and social connections (OECD, 2020b). Life expectancy has increased by nearly two years over the past decade. Finland is a top-performing country

in terms of the quality of its education system. Some 46% of adults aged 25-64 have completed tertiary education, higher than the OECD average (Table of Basic Statistics). The COVID-19 pandemic and its economic consequences have accentuated income inequality. However, income inequality remains low by international comparison thanks to high redistribution through taxes and transfers (OECD, 2020a).

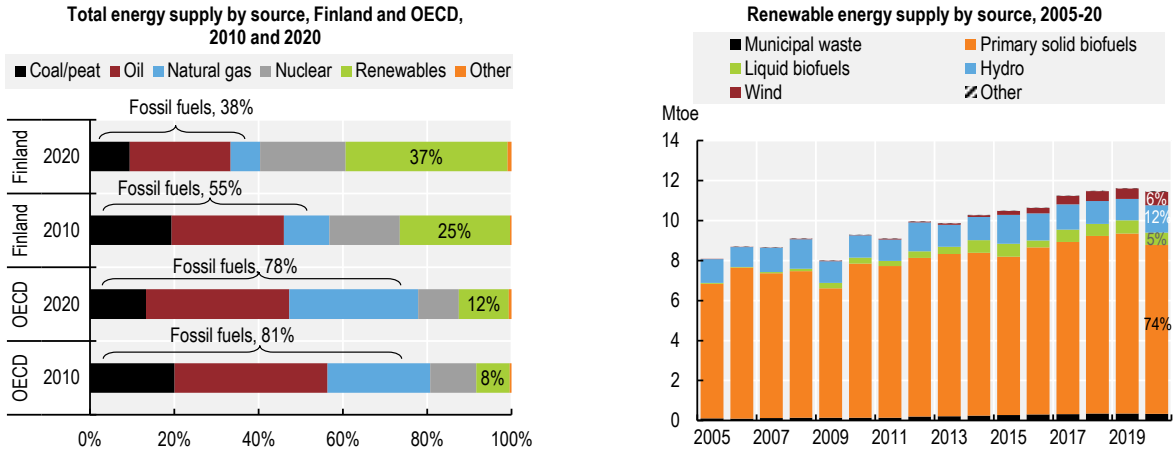
Finns generally attach high importance to the environment and showcase a high environmental consciousness. According to a 2019 Eurobarometer, Finns consider the environment, climate change and energy issues to be the European Union's biggest challenge, and the second biggest national challenge (after health and social security) (EC, 2019a). National surveys suggest that over 90% of the population see nature as important, feel it is part of the national identity and believe that nature increases well-being and health. More than half of Finnish people report to have consciously reduced their consumption for environmental reasons (Sitra, 2019). Most people consider climate change as the main environmental challenge (65%), followed by air pollution, growing waste generation and water pollution (EC, 2017).

1.3. Moving towards a low-carbon and climate-resilient economy

1.3.1. Energy mix and intensity

The energy mix is characterised by a high share of renewables, which accounted for 37% of total energy supply (TES) in 2019, one of the ten highest shares among OECD countries (Figure 2 in Assessment and recommendations). The share of renewables has increased steadily over the past decade (Figure 1.2). This is mainly driven by more use of solid biomass but also of wind power and biodiesel. Most renewable energy is generated from bioenergy (solid and liquid biofuels), which accounted for 79% of all primary energy from renewables and 29% of TES in 2020. Meanwhile, hydropower accounted for 4% and wind for 2% of TES. Fossil fuels accounted for 38% of TES in 2020, about half the average in the OECD, while nuclear power made up nearly 20% of TES, or double the OECD average.

Figure 1.2. Finland's energy mix features a high share of renewables, especially biomass



Note: Graphical breakdown of total energy supply (TES) excludes trade on electricity and heat but percentages shown are calculated on TES (i.e. including electricity/heat trade). Electricity and heat trade accounted for 5% of TES in 2020 (left panel).
Source: IEA (2021), *IEA World Energy Statistics and Balances* (database).

StatLink https://doi.org/10.1787/888934287851

Finland has almost no domestic fossil fuel resources. As a result, nearly half of Finland's energy needs are met through imports, mostly from the Russian Federation (hereafter "Russia"), its neighbour. The country does boast 9.3 million hectares of peat lands, and peat fuels 4% of energy supply (IEA, 2021). Peat plays an important role as fuel in combined heat and power (CHP) plants and district heating, both of which are widely used in Finland (Chapter 4).

Finland is a global leader when it comes to bioenergy. Most bioenergy is produced from wood residues from Finland's large forest industry (more than 90% of bioenergy use stems from solid biomass, with minor shares coming from biodiesel, biogasoline, black liquor and biogases). Bioenergy is mainly used for heat and power generation, either through district heating systems or through CHP plants. To a small extent, biomass is also used in industrial processes. Finland aims to maintain bioenergy as a central energy source, producing it on market terms from the side streams of other wood use.

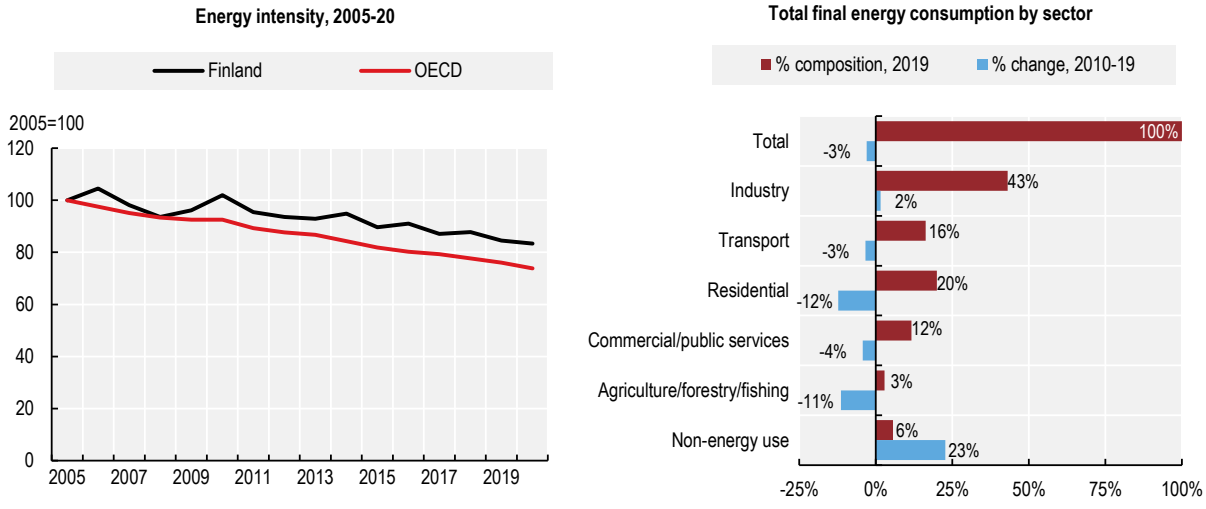
Thanks to the continuous expansion of renewable energy, Finland's national target of supplying at least 38% of energy gross final consumption from renewables by 2020 was already met in 2014. In 2019, renewables accounted for 43% of gross consumption. This means the country is also well positioned to reach its goal of satisfying at least 51% of energy consumption through renewables by 2030. National projections suggest that Finland will overshoot its 2030 target, assuming that the energy and climate policy measures included in the 2016 Energy and Climate Strategy and the 2017 Medium-term Climate Change Policy Plan are fully implemented.[1] These plans, which were under revision at the time of writing, list Finland's actions to reduce GHG emissions and set a number of targets for the energy sector (Chapter 4).

Power generation is largely decarbonised. Renewables accounted for over half of electricity generation in 2020. Hydro is the main renewable electricity source (23%), followed by biofuels and waste (17%) and wind (12%). Slightly over a third of electricity is produced by nuclear power plants (Figure 4.6). The share of fossil fuels declined to 14% in 2020, down from about 40% a decade earlier. Finland's electricity grid is well connected to other countries, which facilitates the integration of a large share of variable renewable energy and enhances the overall resilience of the electricity sector. Finland plans to expand nuclear power to 60% of power generation, further reducing the need for fossil fuels (IEA, 2018). In addition, the government intends to phase out coal in energy (power and heat) generation by 2029 and at least halve peat use by 2030 (Chapter 4).

Both the energy intensity of the economy and energy consumption per capita are high compared to the OECD average (OECD, 2021; Table of Basic Statistics). This is due to the cold climate, a low population density and a relatively large share of energy-intensive industries. The energy intensity of the economy (TES/GDP) improved by 18% between 2005 and 2020, less than in many other OECD countries and the OECD as a whole (Figure 1.3).

Total final energy consumption (TFC) decreased by 3% in 2010-19. Energy consumption has broadly followed economy activity, dropping after the 2008 global financial crisis and in the early 2010s and increasing since 2016 as economic activity picked up again. Energy consumption in industry increased slightly over 2010-19, while it decreased in the transport, residential and commercial, and agricultural sectors (Figure 1.3). Domestic industries account for nearly half of energy consumption, due to energy-intensive industries such as paper and printing (which account for nearly 60% of industrial energy use), steel and chemicals. The residential sector is the second largest energy user, accounting for 20% of TFC in 2019 (Figure 1.3). Space and water heating accounts for roughly 80% of energy consumption in the residential and commercial sector. Road transport accounts for more than 90% of transport-related energy use.

Figure 1.3. Final energy use declined in most sectors but energy intensity remains high



Note: Left panel: Energy intensity: total energy supply per unit of GDP at 2015 prices and purchasing power parities.
Source: IEA (2021), *IEA World Energy Statistics and Balances* (database).

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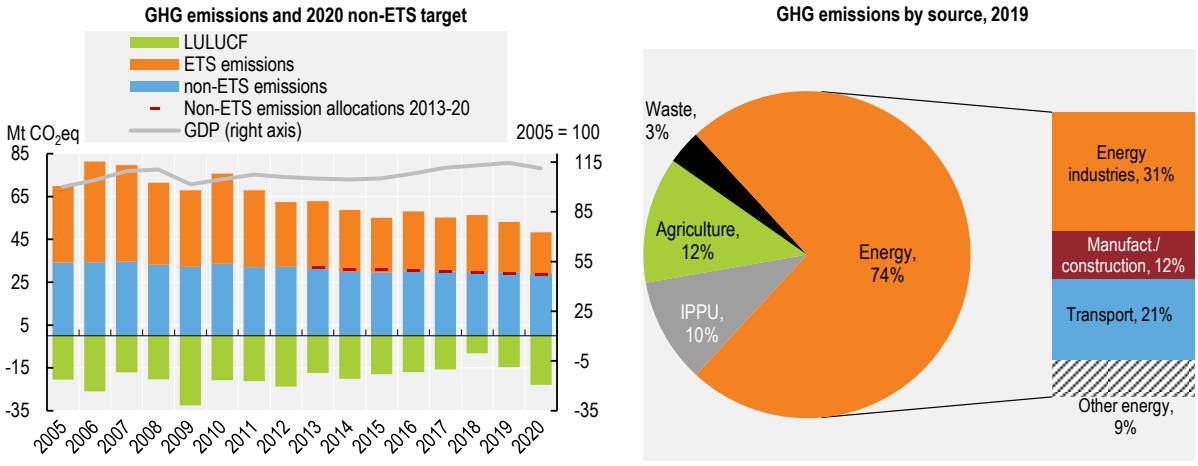
Finland met its 2020 energy efficiency targets under the European Union (EU) Energy Efficiency Directive. In 2019, final energy consumption stood 5% below the indicative 2020 target of limiting final consumption to 310 TWh (Eurostat, 2021a). Finland's Integrated Energy and Climate Plan envisages only a marginal decrease in final energy consumption (Chapter 4). Therefore, progress towards the 2030 target of limiting final consumption below 290 TWh needs to be closely monitored. Finland has no additional national targets for energy efficiency.

1.3.2. Climate change mitigation

GHG emissions, excluding emissions from land use, land-use change and forestry (LULUCF), reached 53 million tonnes of carbon dioxide equivalent ($MtCO_2eq$) in 2019, 24% below the 2005 level and 25% below the 1990 level. As such, Finland met its mitigation obligations under the Kyoto Protocol (Chapter 4). Emissions peaked in 2003 and have since been declining. However, they stabilised around 2015 levels in recent years, reflecting the resurgence of the economy since the mid-2010s (Figure 1.4). According to preliminary data, in 2020, GHG emissions were 9% below their 2019 level.[2] This reflects a warmer winter, a further shift away from fossil fuels in power generation, as well as reduction in transport activity due to the COVID-19 pandemic (MoE, 2021). Finland's GHG intensity (GHG emissions per unit of GDP) and per capita emissions were lower than the OECD averages in 2019, but they were 12% and 24% above the average of European countries of the OECD, respectively (OECD, 2021c; Table of Basic Statistics).

Energy use accounted for 74% of gross GHG emissions in 2019 (i.e. excluding carbon sequestration from LULUCF), with remaining emissions coming from agriculture, industrial processes and waste (Figure 1.4). Energy-related emissions largely came from energy industries (which accounted for 33% of gross total emissions), transport, manufacturing and construction and energy use in the residential and commercial sectors (Figure 1.4). According to preliminary data, there were negligible changes to the structure of emissions in 2020 (OSF, 2021a). The LULUCF sector is a net carbon sink, absorbing about 30% of domestic gross GHG emissions during the past decade. Carbon sequestration fluctuates from year to year; it declined between 2009 and 2018 because of higher forest harvesting. The net sink improved significantly in 2018-20 thanks to lower forest removals (MoE, 2021).

Figure 1.4. GHG emissions are on a downward trend



Note: ETS: Emissions Trading System (left panel); IPPU = Industrial processes and product use (right panel).
Source: MoE (2021), *Annual Climate Report 2021*; Statistics Finland (2021), *Greenhouse Gas Emissions in Finland 1990-2019 – National Inventory Report under the UNFCCC and the Kyoto Protocol*; OECD (2021), *OECD Economic Outlook No. 109: Statistics and Projections* (database).

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Like other EU countries, Finland participates in the EU Emissions Trading System (EU ETS). The share of emissions covered by the system peaked in 2006 to 58% and declined steadily to 45% in 2019, with the shift to renewables (Figure 1.4). Preliminary data indicate that the share further decreased to 41% in 2020. This means that most mitigation efforts need to focus on the non-trading sectors, i.e. mainly transport, residential, commercial and agriculture. Under EU regulations, Finland is committed to reduce GHG emissions from the non-ETS sectors by 16% by 2020 and 39% by 2030, compared to 2005 levels. According to preliminary data, non-ETS emissions fell by 3% in 2020 compared to the previous year but exceeded the annual emission allocations by 0.1 $MtCO_2eq$. Hence, Finland is positioned to meet the 2020 target by using surplus emissions allowances banked from previous years (MoE, 2021). According to Finland's Integrated Energy and Climate Plan of December 2019, existing and planned measures combined with the use of flexibility mechanisms will also allow Finland to meet its 2030 target.

The Government Programme of December 2019 defined a new ambition to become carbon neutral by 2035,[3] and carbon negative soon after that. Existing and planned measures will not be sufficient to meet this goal (Chapter 4). Hence, swift measures and policy decisions to reduce emissions across all sectors and strengthen land-use sinks are needed. In July 2021, the environment ministry released the proposal for a revised Climate Change Act for consultation, with a view to including the 2035 carbon-neutrality goal in the act. The proposed bill also sets an emission reduction target for 2030 consistent with the carbon-neutrality goal and with reducing emissions by 90% by 2050 from 1990 levels.[4] The government also plans to revise the National Energy and Climate Strategy and Medium-term Climate Policy Plan in 2021. These lay out key climate policy measures and provided the basis for the 2019 Integrated Energy and Climate Plan. In addition, the government adopted a roadmap for fossil-free transport in May 2021 and a climate programme for the land-use sector was envisaged for later in the same year.

As discussed in Chapter 4, Finland expects to reduce most of its emissions to 2030 in the transport and agricultural sector (which accounted for 38% and 22% of 2019 non-ETS emissions, respectively). Smaller reductions are expected in the buildings sector. Key measures to reduce emissions from the transport sector include increasing use of biofuels and improving carbon efficiency of vehicles, notably through the roll-out of electric vehicles. Other measures include the phase-out of coal for energy production by 2029,

a halving of peat for energy production by 2030 and the phase-out of oil use in heating by the early 2030s. Different sectors also have specific targets to increase the share of renewables. Across sectors, significant emphasis is put on bioenergy, building on Finland's vast forest resources and strong forestry industry. Given this emphasis, the sustainability of biomass and the impact on biodiversity and the carbon sink deserve special attention. There are trade-offs between forests' potential as a carbon sink, essential to achieve the carbon-neutrality goal, and forest harvesting levels, including for biomass for energy generation (Chapter 4).

1.3.3. Climate change impacts and adaptation policy

Finland is strongly affected by climate change. The average temperature increase in Finland is expected to be 1.5-2 times larger than the mean for warming globally (MoE, 2017a). The temperature increase will be larger in winter than in summer. The January mean temperature would increase by 4-11°C and precipitation by 10-60% by the end of the 21st century. Summer heatwaves will become longer and more frequent, whereas severe cold spells will gradually diminish. Heavy precipitation events will intensify in summer while the number of days with precipitation will increase in the winter. The snow season will become shorter and the Snow Water Equivalent will decrease, particularly in southern Finland.

Knowledge of the vulnerability and risks in specific sectors is generally good. Tools such as the web portal Climateguide.fi help citizens and businesses consider possible impacts and vulnerabilities. The economic impact of climate change is negative for some sectors and positive for others, assuming Finland acts on adaptation opportunities. For example, an increase in average temperatures may benefit the agricultural, forestry and tourism sectors. The largest economic losses are expected in the water sector due to heavy rains and flooding.

Finland was among the first countries to adopt a national adaptation strategy in 2005. The National Climate Change Adaptation Plan 2022, launched in 2014, updated the first strategy. This was in keeping with the 2015 Climate Change Act, which provides for a national adaptation plan at least every ten years. These plans aim to identify the most important tasks to promote adaptation nationally. The latest plan aims to ensure Finnish society can manage and mitigate climate-related risks in each sector. A multi-stakeholder group monitors implementation of the plan. At the subnational level, several regional and local governments have integrated adaptation elements into their climate strategies. Ten Finnish cities are signatories to the Covenant of Mayors for Climate & Energy in relation to adaptation (CMCE, 2021).

A mid-term evaluation of the National Climate Change Adaptation Plan 2022 concluded that awareness of climate change and adaptation needs has increased among administrative actors. It also found that adaptation objectives have been integrated into planning and activities of the various sectors (MoAF, 2020). The most advanced sector is water management, where adaptation has been integrated into decision making and where digital monitoring and risk management processes have been developed. Agriculture is also relatively advanced, while implementation in transport and communication, forestry, health, energy, tourism have only begun in recent years (EC, 2018a). Since 2017, environmental impact assessments need to include an assessment of climate change risks.

Nevertheless, the management of climate-related risks is partly insufficient (MoAF, 2020). Finland needs to raise more awareness about climate risks and options to mitigate them. Clearer division of responsibilities and co-ordination, especially for cross-sectoral issues and between private and public actors, was also identified as a priority area for improvement. Tools such as guides and early warning systems for regional and local actors can help promote practical adaptation to reduce weather- and climate-related risks. There is also a need to improve knowledge on the potential costs and benefits of impacts and measures (EC, 2018a).

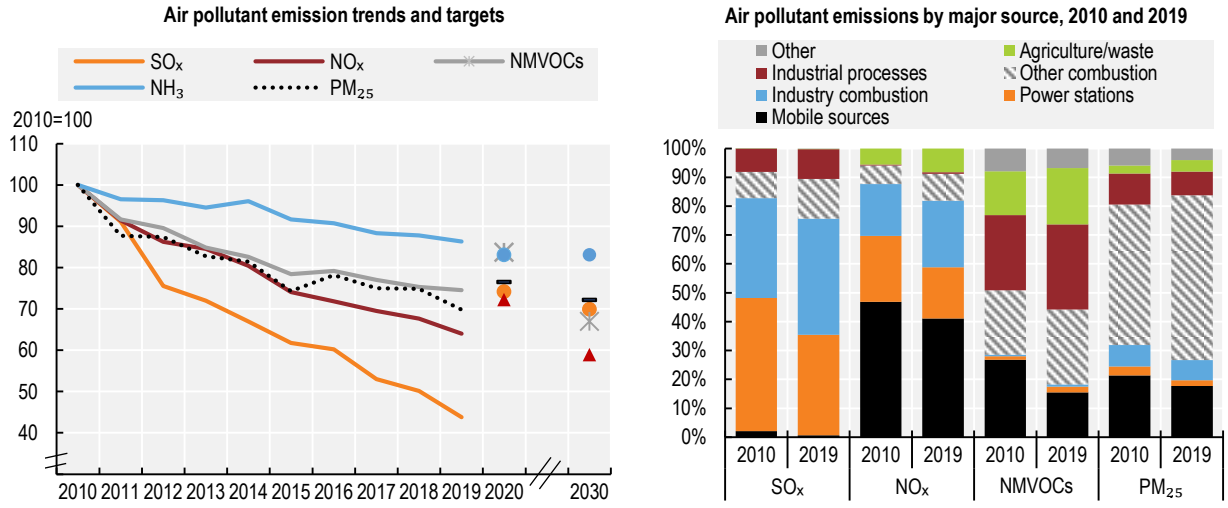
1.4. Improving air quality

1.4.1. Atmospheric emissions

The emission of air pollutants continued to decline over the past decade. Emissions of sulphur dioxide (SO_x) fell by more than half between 2010 and 2019. Much of this was driven by two factors: more stringent EU regulations (including application of EU minimum emission limit values and best available techniques for major emission sources) and a shift towards cleaner fuels. Nitrogen oxides (NO_x) emissions declined by 36% over 2010-19. This decline was largely driven by improved vehicle technology, which reduced emissions from road transport. Emissions of fine particulate matter ($PM_{2.5}$) fell in the early 2010s before levelling off in the second half of the decade (Figure 1.5, left panel). In terms of emissions per capita and per unit of GDP, Finland generally ranks close to the OECD average. The exception is for NO_x emissions, where intensities are higher than in many other OECD countries (OECD, 2021c). This is linked to Finland's relatively old vehicle fleet and to the higher share of coal, peat and biomass burning.

Fuel combustion for energy generation and heat production (in power stations, industry and buildings) are the main sources of SO_x, NO_x and $PM_{2.5}$ (Figure 1.5, right panel) and are also a source of heavy metal emissions. Small-scale combustion (e.g. the burning of wood for home heating and saunas[5]) causes about half of $PM_{2.5}$ emissions. It is also a major source of non-methane volatile organic compounds (NMVOCs) and black carbon emissions. Transport is a major emission source for NO_x; industrial processes (notably the pulp and paper and chemicals industries) are a significant contributor to NMVOCs and SO_x emissions (Figure 1.5, right panel); and agriculture accounts for most ammonia (NH_3) emissions.

Figure 1.5. Finland is on track to meeting its air emissions targets for 2020 and 2030



Note: Emission trends and reduction targets under the EU National Emission Ceilings Directive (2016/2284/EC).
Source: SYKE (2021), *Finland's Informative Inventory Report 2021*.

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Finland's targets related to atmospheric emissions are set under the EU National Emission Ceilings Directive (NECD). Finland has met the NECD targets for 2010 except for NH_3 but has complied with the NH_3 target since 2016.[6] The country is expected to meet its 2020 targets for all five air pollutants targeted under the NECD (Figure 1.5, left panel).[7] However, NH_3 emissions may exceed the target because progress has slowed down since 2015. Emissions are projected to decline slightly over the next decade

(EC, 2020). The action plan to reduce NH_3 emissions from agriculture aims primarily to improve storage and application of livestock manure (MoAF, 2018). Finland also seems on track to meet the 2030 targets using existing measures (Figure 1.5, left panel). In addition to targets set under the NECD, Finland – along with Canada, Denmark, Iceland, Norway, Russia and Sweden – has affirmed its support to achieve a collective reduction of black carbon emissions in the Arctic region by 25-33% below 2013 levels by 2025.

In accordance with the NECD, Finland prepared a National Air Pollution Control Programme 2030 (NAPCP) in 2019. The NAPCP highlights synergies between climate mitigation and air pollution control policies. It also refers extensively to measures under Finland's national climate mitigation plans (Section 1.4.2). The NAPCP identifies the two most significant measures to reduce air emissions: a fuel shift in road transport towards electricity, natural gas and biofuels; and a mode shift from private car use to walking, cycling and using public transport. Energy efficiency improvements and more stringent requirements under EU legislation will continue to drive emission reductions from energy generation and industrial activity (MoE, 2019). Additional policies to adopt the best available techniques extensively could allow Finland to further reduce emissions and enjoy associated health benefits without affecting economic growth (OECD, 2021d).

Even though Finland is expected to meet the 2030 targets under existing measures, the NAPCP proposes new measures to reduce air pollution. It focuses on pollution from small-scale wood burning and street dust, with a view to mitigating the persistently high health impact from these sources (Section 1.4.2). For example, the NAPCP proposes to intensify and expand information campaigns on health effects from small-scale wood burning; enhance guidance on the correct use of fireplaces; establish new co-operations (e.g. schools and sauna clubs); and study the feasibility of standards for sauna stoves, as well as the potential of voluntary requirements with stove manufactures (MoE, 2019). However, due to limited resources, not all of these measures are being implemented. Additional measures, including subsidies, seem justified to accelerate replacement of inefficient fireplaces, space heaters and sauna stoves, given the considerable health benefits of such investments.

As regards road dust, the NAPCP proposes to promote diffusion of best street cleaning and maintenance practices among municipalities and contractors. These practices include selection criteria for procurement activities, improved information on the effect of tyre choices on air pollution and investigation of the regulation of studded tyres in certain areas, as practised in Norway, for example. In Oslo (and certain other cities), a charge for using studded winter tyres has significantly reduced their use.

Reduced overall traffic volume will remain one of the most efficient measures to cut emissions from both exhaust gases and road dust. This is achieved through the shift from private car use to more walking, cycling and use of public transport. Fewer cars will also generate important co-benefits for climate change mitigation (Chapter 4). It should therefore remain a priority in Finland's efforts to improve air quality.

1.4.2. Air quality

Air quality in Finland is among the best in the OECD. Unlike nearly all other countries, good air quality is nearly uniform across Finland. In 2019, mean exposure to $PM_{2.5}$ pollution was 5.6 microgrammes per cubic metre ($\mu g/m^3$), the lowest value among OECD countries and 60% below the OECD average (OECD, 2021c; Table of Basic Statistics). Exposure to $PM_{2.5}$ is higher in the urban areas of Lahti and Helsinki, but it remains below the World Health Organization's guideline value of 10 $\mu g/m^3$. No air quality zones exceeded the EU standards for NO_2, PM_{10} and $PM_{2.5}$ (EC, 019b). The annual limit value for NO_x and the daily limit value for PM_{10} have been randomly exceeded in the largest cities and near streets with heavy traffic in the early 2010s (MoE, 2019), but no exceedences have been recorded since 2016. The exceedance of PM_{10} values is largely caused by the use of studded tyres, and either sand or salt for the winter maintenance of roads and streets.

Despite generally good air quality, health risks exist. The welfare costs resulting from exposure to ambient air pollution from particulate matter was 0.7% of GDP in 2019, lower than in most other OECD countries (OECD, 2021c). Still, ambient PM concentrations are estimated to have caused some 1 600 to 2 000 premature deaths in Finland each year in 2005-15 (MoE, 2019). Despite the expected decline in the emission of air pollutants, the number of premature deaths is projected to drop only mildly to 2030. This is linked to population growth and ageing, as well as urbanisation. While the health impact of transport-related exhaust gas emissions will decline with the expected decline in these emissions, the adverse health effects caused by street dust and small-scale wood burning are projected to remain constant. Small-scale wood burning is projected to account for more than half of $PM_{2.5}$ emissions in 2030, and to become the major driver of premature deaths from air pollution (MoE, 2019).

According to national legislation, municipalities shall prepare a plan to reduce air pollution when limit values are exceeded or risk being exceeded. On this basis, municipalities in the Helsinki metropolitan region have prepared air quality protection plans. Helsinki's 2017-24 plan includes measures such as investment in electric buses, electric charging stations and purchase of electric vehicles for the city administration. The municipality has also been investigating implementation of vehicle traffic pricing. Meanwhile, new street cleaning methods and practices are being tested to reduce dust. The plan also advocates for better integration of air quality perspectives into urban planning (e.g. compact city structures and connection to public transport) (City of Helsinki, 2016).

1.5. Moving towards a circular economy

1.5.1. Waste and material management

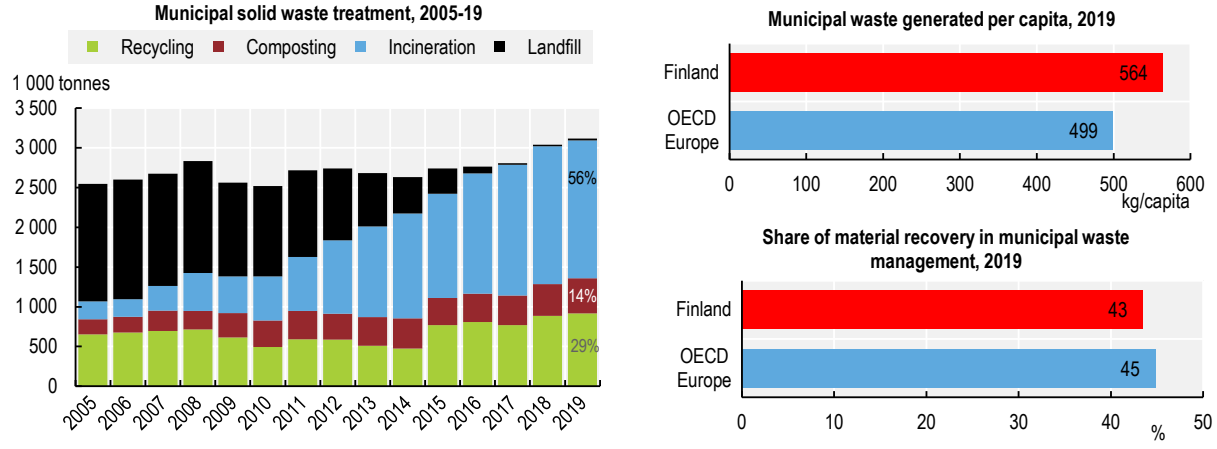
Waste generation increased by about 20% in 2010-19. The increase was largely driven by mineral and solidified waste (e.g. rock, soil) generated by mining and construction, which account for about 90% of total waste generated. Most mining and construction waste is deposited in mining areas, although an increasing volume of mineral waste is reused (10% in 2018). Manufacturing industries accounted for 8% of the total waste generated in 2019, and households and services for 4% (OSF, 2021b).

Municipal solid waste (MSW) generation has also continued to increase, rising by 24% between 2010 and 2019. As such, Finland did not meet its target under its 2008-16 National Waste Plan to reverse the trend of increasing MSW generation by 2016. Per capita MSW generation increased by 20% over this period (Figure 3 in Assessment and recommendations), which stands in contrast to the overall trend in the OECD. In 2019, per capita generation was 13% above the OECD Europe average (Figure 1.6, right panel). In the absence of strong policy measures, MSW volumes are expected to continue increasing alongside economic growth (Salmenperä, Moliis and Nevala, 2015). Households generate two-thirds of MSW in Finland.

As regards waste treatment, Finland has seen a massive shift from landfilling to incineration in the last decade. While nearly half of municipal waste was landfilled in 2010, this share dropped to less than 1% in 2019. Meanwhile, the share of waste being incinerated increased from 22% to 56% (Figure 1.6, left panel). The shift was accelerated by a ban on landfilling of organic waste. The ban, which came into force in 2016, stimulated significant investment in waste-to-energy plants and in biowaste collection and treatment (EC, 2019b). The tax on the landfilling of recyclable waste (Chapter 3) has also played a role, especially in diverting non-organic waste streams away from landfilling. Moreover, its effect increased as the tax rate increased.[8] However, the landfill tax had only limited effects on recycling rates, as much of the previously landfilled waste was diverted to incineration plants for energy recovery. Opting to include incineration plants in the EU ETS could help steer waste streams from incineration towards recycling. However, pricing incineration should be included in a broader policy package that looks at the entire waste value chain (Chapter 3).

The volume and share of material recovered (i.e. recycled or composted) has started to increase in recent years (Figure 1.6, left panel).[9] This can be attributed to more emphasis on separate collection in urban areas, as well as Finland's producer responsibility programmes for products (e.g. vehicles, tyres, electrical appliances, batteries and packaging).[10] The share of recovered materials is slightly below the average of European OECD countries (Figure 1.6, right panel). It is also below the target to recycle 50% of MSW by 2020 set both by EU and Finnish legislation (Figure 3 in Assessment and recommendations). Further efforts are therefore needed to comply with the more ambitious recycling goals under the updated EU Waste Directive to re-use or recycle at least 55% of MSW by 2025, 60% by 2030 and 65% by 2035. Investment needs to focus on waste prevention, separate collection and sorting, and recycling infrastructure.

Figure 1.6. Waste disposal shifted from landfilling to incineration



Note: Nearly all incineration occurs with energy recovery. Estimation method of recycling waste changed in 2015 (*left panel)*. Material recovery includes recycling and composting (*right panel*).
Source: OECD (2021), "Municipal waste, generation and treatment", *OECD Environment Statistics* (database).

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As in other countries, responsibilities for waste management are split among many actors. According to the 2011 Waste Act, municipalities are generally responsible for collecting waste from household and public institutions. In most cases, private companies collect waste on behalf of the municipality. Municipalities can also transfer the responsibility to inhabitants, who then chose their waste collector freely. Businesses manage their waste separately. In practice, producer responsibility organisations (PROs) collect most recyclable waste, including from households. Door-to-door collection of recyclable waste has been limited in Finland, with the exception of collection at multi-apartment buildings. Most household recyclables are collected through drop-off points, a sub-optimal solution to maximise recycling, especially in densely populated areas dominated by single-family houses.

The revised Waste Act, approved in mid-2021, aims to address the inefficiencies caused by the fragmentation of waste management responsibilities and collection operations, which risk holding back further progress towards higher recycling rates (EC, 2018b; Papineschi et al., 2019). The separate collection of different waste streams reduces economies of scale and incentives to invest in separate waste collection and recycling infrastructure.[11] In addition, numerous local collection companies, which often have strong vested interests, are involved. This has made it politically challenging for most municipalities to impose instruments that would encourage waste reduction and recycling, such as obligations for separate collection or reduced collection fees for sorted waste.

The revised Waste Act requires municipalities and waste producers to establish agreements on the organisation and collection of packaging waste (paper, plastic, glass and metal waste) from households. It also establishes a basic obligation for separate waste collection, as well as a requirement for door-to-door collection of biowaste and packaging waste for multi-apartment buildings and public and private operators generating MSW.[12] Waste collected separately for re-use or recycling, for example, shall not be disposed of in landfill or be incinerated. These measures are expected to improve separate collection and recovery rates and to support the development of recycling markets – a crucial precondition for Finland's circular economy aspirations (see below). However, the framework for waste charges and taxes remains unchanged.

Finland could make better use of the charge system, especially to provide incentives for recycling over incineration. Municipal waste charges cover the cost of municipal waste management services (including collection and treatment). All municipalities use a pay-as-you-throw scheme, where the charge is based on bin volume and emptying frequency of bins (Papineschi et al., 2019). Weight-based systems are used only in a few municipalities; some also set lower charges for sorted waste to encourage waste sorting and recycling. In addition, some municipalities levy an additional "eco-charge" to recover costs associated with a separate waste collection and recycling infrastructure and service. A well-designed nationwide weight-based pay-as-you-throw system would be an effective way to increase recycling rates (Salmenperä et al., 2019). Hazardous waste too is subjected to service charges (EUR 270 per tonne, on average). Drop-off points of hazardous waste are free of charge for households.

1.5.2. The circular economy policy framework

Finland launched numerous strategies, roadmaps and action plans to advance the circular economy. It was the first country to adopt a National Roadmap to a Circular Economy in 2016 (updated in 2019). This roadmap aims to make Finland a world leader in the circular economy by 2025 (Sitra, 2016). A Circular Economy Action Plan, launched in 2017, aims to build platforms for circular economy pilot models, promote public procurement for the circular economy, and support product and service innovation. The National Waste Plan "From recycling to a circular economy", adopted in 2018, sets recovery targets for four key waste streams.[13] It announced voluntary agreements between central government and enterprises for selected industries (Chapter 3); stable funding for material efficiency audits and their expansion to new sectors;[14] and better attention to material efficiency in environmental permits to promote the circular economy (MoE, 2018). The Plastics Roadmap, also launched in 2018, aims to reduce the environmental damage caused by plastics. It outlines potential actions to avoid unnecessary consumption of plastics, improve recycling and find alternative solutions to reduce single-use plastics and dependency on fossil raw ingredients.

Despite these efforts, the use of circular material was estimated at about 6% in 2019, compared to nearly 12% in the European Union (Eurostat, 2021b).[15] Material productivity (expressed as the amount of economic value generated per unit of materials used) has improved. However, in 2019, it was about half the OECD average and among the lowest in the OECD (OECD, 2021c; Table of Basic Statistics).

In early 2021, the government launched the Strategic Programme to Promote a Circular Economy, which aims to transform the economy into one based on the principles of circular economy by 2035. The programme includes specific targets on raw materials use and resource production. For example, it envisions that the total consumption of primary raw materials in 2035 will not exceed what it was in 2015; and that resource productivity and the circular material use rate will double. Achieving this will require a regulatory and incentive framework that supports new business models. This could include, for example, promoting ownership-free and sharing models; requirements and financial support for circular design, repair, sharing and reuse; labelling for longer lasting products; new deposit-refund schemes; and using public procurement policy to promote circular economy in key sectors. It will also require higher recycling

rates and expansion of recycling systems to products that are not yet recycled. Finland could also establish a single entry point for firms operating with circular business models (like Denmark did).

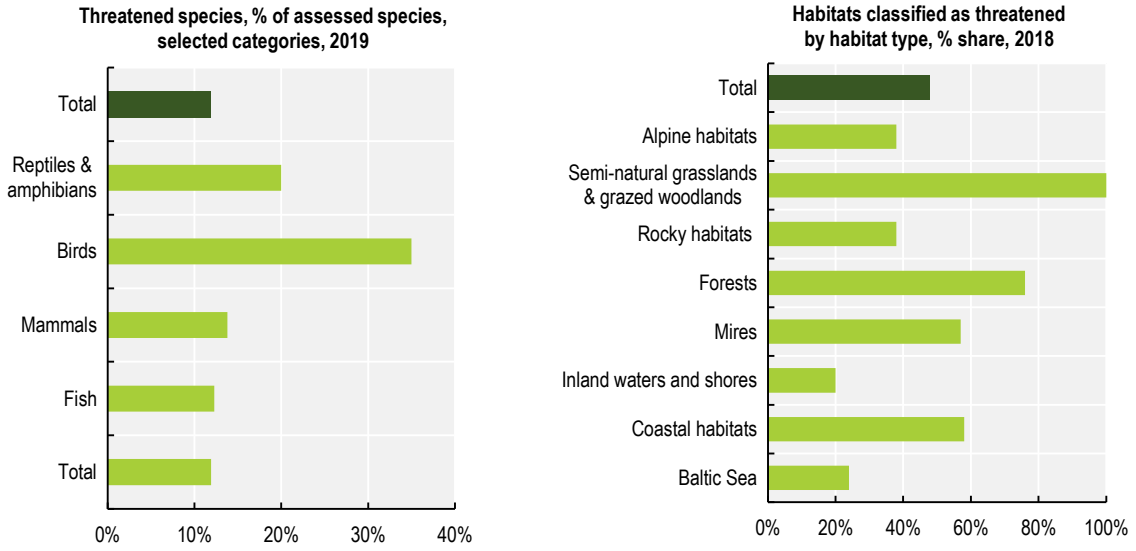
1.6. Halting biodiversity loss

1.6.1. Conservation status of habitats and species

Nearly all of Finland is in the boreal coniferous forest zone. Forests cover over more than 70% of the Finnish total area, a higher share than in any other OECD country. Inland waters cover nearly 10%, cropland 9% and wetlands cover 8% of land area. Built-up area accounts for less than 0.5%. While the share of agricultural land and built-up area is small compared to most other OECD countries, Finland lost 1.7% of its (semi-)natural vegetated land between 2004 and 2019. This is a high share compared to most other OECD countries (OECD, 2021c).

Finland hosts approximately 48 000 animal and plant species, representing about 30% of total species described for Europe (SYKE, 2019; IUCN, 2020a). Nearly half have been evaluated for their conservation status. The latest assessment of 2019 showed that every eighth species is threatened (12% of assessed species; Figure 1.7), an increase compared to the previous assessment of 2010. The highest proportion of threatened species is found among birds, and reptiles and amphibians. Twenty-three species are critically endangered, including iconic species such as the Arctic fox and landlocked salmon (IUCN, 2020b).

Figure 1.7. Every eighth species, and every second habitat, is threatened



Source: SYKE (2019), *Threatened Habitat Types in Finland 2018*; SYKE (2019), *Suomen lajien uhanalaisuus* (Red List of Finnish Species 2019).

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The decline and degradation of habitats is the single largest pressure for species. Of the nearly 400 evaluated habitat types in Finland, 48% are categorised as threatened (Figure 1.7). The situation is particularly worrisome in southern Finland, where habitats are often fragmented and land-use pressures much greater than in the north. In terms of habitat types, mires, forests and semi-natural grasslands are

facing the largest pressures. The overall status of habitats has not improved during the past decade, despite some progress in individual habitats (GoF, 2019).

As in other countries, anthropogenic factors are the biggest threat to species and habitats. The main reason for the threatened status of mires has been drainage for forest cultivation (see below). The degradation of forest and woody habitats is linked to intensive forestry and associated reduction of old-growth forests and large trees, as well as decreasing amounts of dead and decaying wood. The intensity of forest use (i.e. the ratio between actual harvest over annual productive capacity) is high compared to other OECD countries (OECD, 2021c). Moreover, it has increased with the growth in biomass use observed during the past decade. Other pressures on habitats and species include construction activities and the eutrophication of inland and coastal waters and overgrowing of open habitats. Climate change is evaluated as a significant threat (GoF, 2019).

Wetland and peatlands

Finland is a country of wet habitats and many European wetland habitat types are primarily found in the country.[16] Roughly two-thirds of Finland's land area was originally mire. However, two-thirds of this former mire area have been substantially altered during the 20th century, mostly through drainage for forestry and, to a lesser extent, agriculture.[17] In recent times, the natural state of mires is threatened by a variety of factors. These include commercial peat extraction for energy generation, clearing of mires for agricultural use, construction of reservoirs, removal of vegetation from streams, soil preparation, felling in untrenched wooded mires, road networks and groundwater abstraction.

Drainage of mires has negative consequences on biodiversity and also causes significant GHG emissions (Chapter 4). First-time ditching of peatlands for peat production is prohibited by law. Peat extraction is permitted only in already drained or otherwise altered bogs. Draining intact peatlands for forestry has been reduced, but peatlands have continued to be converted to fields and peat production areas. No clear change has occurred in restoring mires to a semi-natural state (MoE, 2017b).

1.6.2. Policy measures for biodiversity conservation and sustainable use

Protected areas

Finland declared to have achieved the Aichi target of conserving at least 17% of its terrestrial areas and inland waters by 2020. This share includes statutory protected areas on state-owned and private land (protected by government resolution), sites reserved for nature conservation in the process of being officially established, and sites under "other effective conservation measures" (as defined by the UNConvention for Biological Diversity, or CBD, and the International Union for Conservation of Nature). Parks and Wildlife Finland manages the protected areas officially established on state-owned land, which covered about 13% of total land area in 2021.[18] Most (85%) of the terrestrial protected areas are designated as nature or wilderness reserves within the Natura 2000 network. The most valuable wetlands are part of a network of conservation areas. Finland's 49 Ramsar sites are also included in the Natura 2000 network (MoE, 2016).

As in most countries, further improvement is needed with respect to the geographical distribution, connectivity and representativeness of ecologically valuable land in the protected area network. For example, three-quarters of protected areas are in northern Finland, in the regions of Oulu, Kainuu and Lapland, where pressures from human activity are less acute (GoF, 2019). The ongoing revision of the land-use planning law provides an opportunity to strengthen the connectivity of nature protection zones (Chapter 2).

Marine protected areas covered 12% of Finland's territorial waters in 2021, above the Aichi target of 10%. This includes Natura 2000 sites and Ramsar sites. As for terrestrial protected areas, there remains room

for improving the connectivity and ecological efficiency of the network. Studies suggest the marine protected area network covers merely 27% of the ecologically most valuable areas (Virtanen et al., 2018).

The National Strategy and Action Plan for the Conservation and Sustainable use of Biodiversity

Finland's National Strategy and Action Plan for the Conservation and Sustainable use of Biodiversity 2012-2020 (NBSAP) is largely based on the goals of the UN CBD, as well as the European Union's biodiversity strategy. The strategy aims to halt biodiversity loss in Finland by 2020, and to ensure favourable status of biodiversity and ecosystem services by 2050. Given the increasing number of threatened species and the continuously worrisome state of habitats, Finland has not attained this goal.

An impact assessment of the NBSAP noted the action plan's 105 measures have led to progress in several areas. These include sectoral responsibility of the administration; communication and education; and nature management in agriculture and forestry. Overall, however, they have not been effective and timely enough to halt biodiversity loss (Auvinen et al., 2020). Only one in ten actions was estimated to have led to a clear improvement in the trend sought by the NBSAP. This is due to a combination of factors, including insufficiently ambitious or poorly defined goals and policy measures, insufficient funding, delays in implementation and conflicting development goals (e.g. overuse of natural resources). Some measures were simply too vague to allow for an impact assessment.

The development of the post-2020 biodiversity framework provides an opportunity to focus conservation on areas with the largest likely impact. At the same time, the framework could establish clear and measurable targets supported by adequate indicators to track the implementation and effectiveness of individual measures. Building on the success of the Climate Change Panel (Chapter 4), Finland should consider legally recognising the Nature Panel to strengthen its role in advising public institutions in assessing the potential and actual impact of policies on ecosystems.

As in other countries, funding has been a major impediment to more effective conservation action. Finland makes limited use of economic instruments to raise revenue for biodiversity protection. These include fishing and hunting licence fees, whose receipts are used to finance management of fish population and game, and water protection charges paid by industrial installations and fish farms licenced prior to 2000. Public funding for biodiversity has decreased in the 2010s, alongside broader government efforts to improve public finances (Auvinen et al., 2020). Due to insufficient resources, the biodiversity indicators on the Biodiversity.fi portal have not been updated comprehensively since the early 2010s. The overall financial gap for implementing the NBSAP was estimated at EUR 46 million annually for 2016-20 (GoF, 2019). In 2020, Parliament allocated an additional EUR 100 million for nature conservation (MoE, 2020). Of this, EUR 42 million will be used for Helmi, a voluntary programme that aims to improve the conservation status in key ecosystems. Helmi compensates landowners for efforts to conserve ecosystems such as mires, aquatic shores, and semi-natural and wood habitats.[19]

Mainstreaming of biodiversity in forestry and agriculture

About one-third of forests is publicly owned. About two-thirds of the Finnish terrestrial area is available for forestry use, making effective nature management in commercially managed forestry a key component of biodiversity protection. Biodiversity is integrated into forestry legislation, programmes and guidelines. About 13% of forest area is protected. The application of sustainable forestry practices has also improved. For example, use of lighter soil preparation methods and safeguarding of small key habitats are more widespread. However, the effect of these efforts is diminished by more wood harvesting for energy. This practice reduces the accumulation of decaying wood needed for several species in commercially managed forests. In this context, Finland will need to carefully study the potential impacts of the anticipated increase in bioenergy use on biodiversity and develop measures and performance targets to ensure the bioeconomy goals do not increase pressures on forest ecosystems (Chapter 4).

One of the main programmes to protect private forests is the Forest Biodiversity Programme for Southern Finland (METSO) 2008-25. METSO aims to promote voluntary forest protection by compensating private landowners that protect their forests temporarily or permanently. Budget cuts in 2015-17 threatened the goal of protecting 96 000 ha of land by 2025. Since 2018, funding has increased but may not be enough for METSO to meet its needs. If Finland were to expand the total forest area under the programme, funding would need to at least double from current levels (Kärkkäinen et al., 2021). In addition, more demand for forestry products (including for bioenergy) will increase wood prices. Thus, the cost of compensating landowners for protection and better nature management will likely increase. Finland therefore needs to ensure the METSO programme concentrates on areas where benefits to biodiversity are greatest. It may also be important to enlarge the area of strictly protected forests, especially in the south of the country. Finally, Finland should consider evaluating whether regulatory changes are needed to ensure better nature management (e.g. larger retention of deadwood) in private forests.

Cropland covers less than 10% of Finland total area – a small share compared to most other OECD countries (OECD, 2021c). However, agriculture has significant biodiversity impacts. Notably, these impacts include nutrients leached into ditches, rivers, lakes and coastal areas, causing eutrophication in water bodies (Section 1.7.1). Organic farming covered 13% of agricultural area in 2019, above the EU average of 8.5%. Some 5 000 farms (11% of all Finnish farms) practised organic farming in 2018 (Niemi and Väre, 2019).

The main tool to reduce the impacts of agriculture on biodiversity are the agri-environmental payments under the EU Common Agricultural Policy (CAP). Subsidies to Finnish farmers are among the largest in Europe. Part of the subsidies are used to address the impact of agriculture on biodiversity, notably to reduce the leakage of nutrients to water bodies. However, the overall impact of CAP payments on agricultural practices has been limited. Agricultural subsidies should play a greater role in stimulating sustainable agricultural practices that reduce GHG emissions and impacts on biodiversity. The reform of the CAP provides an opportunity to achieve this goal (Chapter 3).

1.7. Improving water resource management

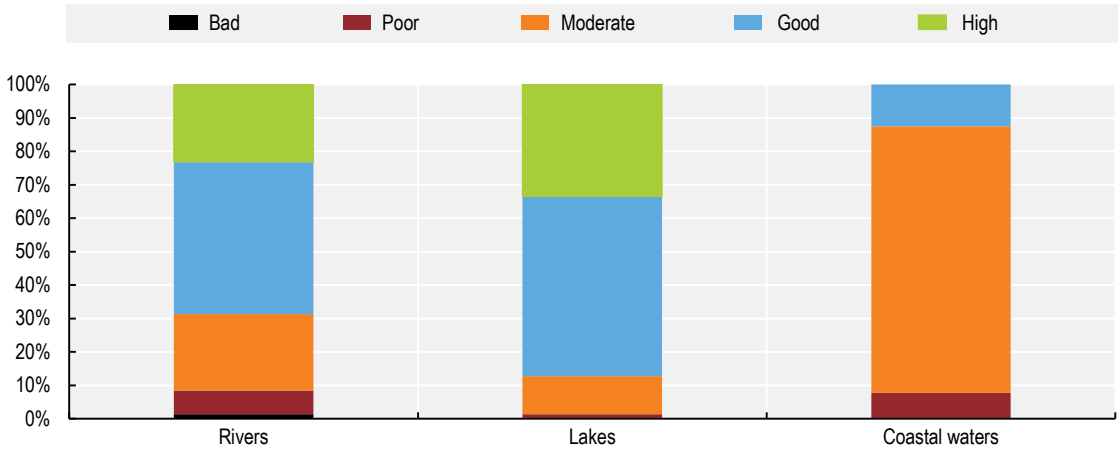
Finland is rich in water resources. Inland waters cover a tenth of the country's surface area and shorelines extend over 336 000 km. More than half of the population live within 500 m of a river, lakeshore or seashore (SYKE, 2017). Finland shares freshwater resources with Norway, Sweden and Russia. It has traditionally been active in transboundary water co-operation, including though the Helsinki Commission for the protection of the Marine Environment in the Baltic Sea (HELCOM).

1.7.1. Water quality

In line with the EU Water Framework Directive (WFD), the ecological and chemical status of inland and coastal waters are evaluated as part of river basin management plans (RBMPs) every six years.[20] The national objective, as well as for the European Union, is to achieve good ecological status for all surface water and groundwater bodies by 2027. According to the latest assessment of 2019, two-thirds of the length of rivers and 85% of the area of lakes are in high or good ecological status (Figure 1.8), an improvement from the previous assessment in 2013 (EEA, 2018).

Figure 1.8. Most rivers and lakes are in good ecological condition, but coastal waters are under pressure

Ecological status of rivers, lakes and coastal waters, 2019



Source: SYKE (2019), *Assessment of the Status of Finland's Waters*.

StatLink https://doi.org/10.1787/888934287965

Most rivers in northern Finland are in good ecological status, but not in the south, west and southwest of the territory where most of the population and agricultural land are located. There, many watercourses are affected by excess nutrients from agriculture. In some watercourses, dams impede the natural river flow and obstruct fish migration and sediment transport. The ecological status of lakes is generally better than that of rivers. However, problems associated with eutrophication, such as alga blooms, are widespread in small and medium-sized lakes in agricultural areas. Shallow lakes are easily contaminated by pollution. Even relatively low concentrations of excess nutrients, acidic deposition or other harmful contaminants can disrupt the lakes' sensitive aquatic ecosystems. Overall, half of the monitoring stations in rivers, lakes and coastal waters are eutrophic or hypertrophic (EC, 2018c).

Improvements in inland waters have not been reflected in coastal waters, nearly 90% of which still fail to achieve good ecological status (Figure 1.8). In 2007, the nutrient reduction scheme of HELCOM's Baltic Sea Action Plan (BSAP) entered into force to tackle eutrophication of the Baltic Sea. Finland is meeting its nutrient input ceiling (NIC) targets for all Baltic Sea basins but the Gulf of Finland and Bothnian Sea (HELCOM, 2021). Measures under the RBMPs and the EU Marine Strategy Framework Directive National Implementation Plan are expected to be sufficient to achieve the Gulf of Finland NIC target for nitrogen by 2027 but not for phosphorus (Knuuttila et al., 2017).[21] Further nutrient reduction efforts may be required, both for nitrogen and phosphorus, with the ongoing update of the BSAP. However, its overall goal of achieving good ecological status of the Baltic Sea by 2021 is unlikely to be met.

As regards chemical status, Finland's inland surface waters are 70% compliant with environmental quality standards for priority substances (in average annual concentrations). The contamination of the remaining 30% is largely due to transboundary air pollution for heavy metals such as mercury, cadmium and nickel. Some of the metals that affect the chemical status of inland waters also occur naturally. All coastal waters achieve good chemical status (EEA, 2018).

Groundwater is widely used by local residents and by waterworks. It is often much purer and better protected from contamination than the water in lakes and rivers. Untreated groundwater is generally considered suitable for human consumption, with only 2% of groundwater bodies failing to achieve good

chemical status (Environment.fi, 2019). There are a few instances of nutrient pollution from agriculture but not on a large scale.

The main pressures on water ecosystems are nutrient loads from agriculture. Agriculture accounts for an estimated 60% of phosphorus and nearly 50% of nitrogen loading. The remainder stems from forestry, individual wastewater systems in sparsely populated areas, municipal wastewater treatment plants, industrial plants and fish farms (Niemi and Väre, 2019). Climate change will likely exacerbate pressures, as stronger winter rainfall, more frequent snowmelt and the shorter duration of snow cover are increasing nutrient leaching from fields into lakes and rivers.

Finland did not achieve its target to reduce nutrient loads entering water bodies by one-third by 2015 compared to 2001-05. The nutrient surplus of Finnish agriculture declined slightly in the early 2000s but has remained relatively unchanged since 2005, at around 50 kg/ha for nitrogen and 5 kg/ha for phosphorus; these surpluses are in the middle range of OECD countries (OECD, 2021e). Use of chemical fertilisers has decreased slightly since 2005 for both nitrogen and phosphorus, alongside declining crop production. Meanwhile, use of nitrogen and phosphorus from manure has remained stable.

Better recycling of nutrients from manure (and sludge from sewage treatment plants) could further reduce reliance to chemical fertilisers and reduce excess nutrients. Nutrient recycling would also reduce CO_2 emissions linked to the energy-intensive production of chemical fertilisers. Finland provides financial support to direct manure to biogas production, which is an effective form of nutrient recycling.[22] It could consider other policy measures such as nutrient reporting at farm level (as in Denmark) and taxing nutrient surpluses. Such taxes would improve environmental performance without compromising productivity or overall social welfare, especially if applied in combination with a revenue-recycling mechanism to avoid negative effects on farm income (Lankoski et al., 2018). Finland could also direct CAP financial support to integrated nitrogen management; this would encourage agricultural practices that reduce nitrogen in all its forms[23] with co-benefits in terms of air, climate and biodiversity (Chapter 3). Finally, in the context of the BSAP, it could allow cap-and-trade in nutrients in the Baltic Sea watershed (as in New Zealand lakes).[24]

1.7.2. Water supply and sanitation

Renewable freshwater resources available per capita are among the highest in the OECD. Water abstraction intensity is low in international comparison. Approximately 90% of the Finnish population are served by municipal waterworks and some 60% of the served water is groundwater. The remaining 10% of the population rely on small systems of private wells. These are appraised by municipal authorities only in case of health concerns of the population.

Finland has a high treatment efficiency of urban wastewater. In 2019, 85% of the population were connected to public wastewater treatment plants applying tertiary treatment (OECD, 2021c). The remaining 15% of the population rely on independent wastewater treatment. This relatively high share is explained by the large number of sparsely populated areas of the country, which host almost one-fourth of the population. In these remote areas, the connection to a public sewage network would not be economically viable. Finland complies with the requirements of the EU Urban Waste Water Treatment (UWWT) Directive for agglomerations of more than 2 000 population equivalent (EC, 2021). All property-specific treatment systems were to meet tertiary treatment standards by the end of 2019. However, not all treatment systems comply with these standards.

Despite the good performance of water supply and sanitation (WSS), challenges remain with regards to ageing public infrastructure. Much of the water network is considerably old, and its actual condition is often not precisely known (Laitinen et al., 2019). Within the framework of the Protocol on Water and Health to the UNECE Water Convention in 2019, Finland is assessing the vulnerability of its water infrastructure to climate change, particularly the risks of untreated storm water overflow caused by increased heavy rain.

Finland does not use water abstraction and pollution charges, but industrial facilities and fish farms with permits dating from before 2000 continue to pay a water protection charge. Most water utilities operate according to the cost recovery principle, with some smaller utilities requiring public subsidies for their operation. As a rule, WSS services are not eligible for state aid in Finland, except to encourage the diffusion of new technologies such as smart meters. All municipal and industrial water usage is metered. Water supply charges consist of a fixed (connection, basic charge) and volume-based component. Municipal wastewater charges are based on water consumption (as a proxy for wastewater volume). Wastewater charges for large users are based on the volume and quality of wastewater. Water tariffs cover 95% of WSS expenditure, with budgetary transfers covering the rest. However, tariff levels will result in a financing gap of EUR 2.8 billion needed to comply with the EU Drinking Water Directive and the UWWT Directive by 2030 (OECD, 2020c). Water tariffs will eventually have to increase to finance infrastructure rehabilitation and upgrade. Tariff increases may exacerbate regional disparities in tariff levels. Finland could consider tariff levels per watershed, as in England and Wales, to share the infrastructure rehabilitation bill between residents of the watershed.

Steps can also be taken to reduce demand for water infrastructure. Prompted by the European Union's amendment of the Directive on Energy Efficiency (2018/2002) and its provision on hot water consumption in buildings, Finland amended its Water Services Act in November 2020. The new legislation requires housing companies to charge tenants for their consumption of water. Individual water meters have been required since 2011 in newly built properties, and in building undergoing pipe renovations since 2013. This is a step in the right direction as it creates incentives to reduce water demand and, in doing so, reduces the need for WSS infrastructure. However, despite the installation of water meters, tenants' water bills often remained based on the number of people in the household.

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Notes

[1] The projections refer to the With Additional Measures (WAM) scenario, presented in Finland's Integrated Energy and Climate Plan of December 2019.

[2] The calculation of instant preliminary data on emissions and removals for 2020 was based on a less detailed methodology than that used for GHG inventories. Hence, the 2020 preliminary data present higher

uncertainties than the GHG inventory data and will be revised. Preliminary GHG data are expected to be released in December 2021 and official data in March 2022 (OSF, 2021a).

[3] With net zero referring to gross GHG emissions being offset by net LULUCF sinks and/or purchases of foreign emission permits.

[4] The 2015 Climate Change Act (609/2015) provides for the legal and institutional structure of climate policy planning across government. It set the long-term goal to reduce emissions by at least 80% by 2050 compared to 1990.

[5] There are some 2 million wood-based saunas in Finland.

[6] Finland applied for adjustments for i) manure management; ii) small-scale combustion; and iii) transport sector emissions. When applying the adjustments, which were accepted for small-scale combustion and transport in 2015, ammonia emissions were below the emissions ceiling set by EU NECD in 2016 and 2017. Finland applied for an adjustment of agricultural emissions for 2019. If this proposed adjustment is accepted, Finland is complying with ammonia emissions reduction targets for 2019.

[7] Final official estimates of 2020 emissions of air pollutants were not available at the time of writing.

[8] The tax has been increased several times in the past decade. Since 2017, the tax rate has been EUR 70/t (Chapter 3).

[9] Note that the estimation method for recycled waste changed in 2015, which explains most of the increase observed between 2014 and 2015.

[10] Producer responsibility pertains to companies that import or manufacture the following products: i) cars, vans and comparable vehicles; ii) tyres from motor vehicles, other vehicles and equipment, as well as vehicles or equipment supplied with tyres; iii) electronic and electrical appliances; iv) batteries and accumulators; v) printing paper and paper for manufacturing other paper products; and vi) packaging where the producer responsibility pertains to the packers of the products and importers or packaged products but excluding the packaging producers.

[11] For example, this system does not encourage municipalities to separate the recyclable material from the mixed waste they collect, because the PROs, which are responsible for collecting these waste streams, receive the income these materials can bring.

[12] Door-to-door collection of biowaste and packaging waste will become mandatory for agglomerations with at least five apartments from July 2022 and July 2023, respectively. Door-to-door collection of biowaste will be expanded to agglomerations from July 2024. Equivalent requirements for non-residential properties (i.e. public and private operators generating MSW) will enter into force as from July 2022.

[13] Construction and demolition waste, biodegradable waste, municipal waste, and waste electrical and electronic equipment.

[14] The material efficiency audits, launched in 2010, investigate the amount of waste generated by a business's operations, the costs of the waste and measures for reducing waste, with a view to enhancing competitiveness and reducing costs and carbon footprint.

[15] Circular material use, or circularity rate, measures the share of material recovered and fed back into the economy in overall material use. It is defined as the ratio of the circular use of materials to the overall material use (Eurostat, 2021b).

[16] Finnish wetlands include shallow gulfs and archipelagos, lake habitats, mires, peatland forests, ponds, alluvial meadows and forests, and spring complexes, as well as flowing waters.

[17] Ditches lower the water level in peatlands and improve tree growth.

[18] The network of statutory protected areas includes 37 national parks, 19 strict nature reserves, 12 wilderness reserves and some 500 other protected areas.

[19] Among other things, the programme aims to protect 20 000 hectares (ha) of mires, restore 12 000 ha of ditched mires and rehabilitate 80 wetlands by 2023.

[20] The ecological status of surface waters reflects aquatic life, underlying physico-chemical parameters (including nutrient pollution), as well as habitat alteration due to hydrological or morphological changes. The chemical status reflects compliance with environmental quality standards for 45 hazardous substances and substance groups (priority substances).

[21] The WFD RBMPs set more stringent nutrient reduction targets for coastal waters than the HELCOM BSAP; the only exception is the phosphorus target for the Gulf of Finland.

[22] The digested biogas slurry can be used as an organic fertiliser for agriculture.

[23] Nitrates, ammonia, nitric oxide and nitrous oxide.

[24] Duhon, McDonald and Kerr (2015) and www.rotorualakes.co.nz/cleaning-up-lake-rotorua.

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Chapter 2. Environmental governance and management

Finland is a small unitary state with a strong role for local governments. The national and local governments implement a wide range of good and innovative practices in environmental permitting, compliance assurance and promotion of green business practices. However, there are several gaps in the implementation of environmental assessment and land-use planning. This chapter analyses the institutional and regulatory framework for environmental management, the setting and enforcement of environmental requirements, and mechanisms of public participation in decision making, as well as access to environmental information, education and justice.

Recommendations on environmental governance and management

- Improve co-ordination between permitting and compliance monitoring authorities to allow more efficient use of human and financial resources for environmental regulation.
- Expand the application of EIA to cover impacts on smaller forest, wetland and peatland areas; reinforce the impact of EIA conclusions on permitting decisions under sectoral legislation.
- Strengthen the central government's oversight of the integration of environmental considerations into local land-use planning, particularly in coastal areas; ensure appropriate application of SEA to local master plans and detailed plans.
- Introduce financial responsibility provisions to cover environmental remediation in cases where the liable party is insolvent or unknown.
- Develop tools to monitor and report progress on GPP, linking it to other environmental policy priorities.
- Remove restrictions on standing of citizens and NGOs in environmental cases in administrative courts to make it easier for them to act in defence of public interest.

2.1. Introduction

In the last decade, Finland has continued to modernise its environmental governance by making it more efficient and transparent, as recommended by the 2009 OECD Environmental Performance Review (OECD, 2009). The country's government remained stable and far above the OECD average on the indicators of effectiveness, regulatory quality, rule of law and accountability (World Bank, 2019). This has had positive implications on environmental management.

Finland has traditionally relied on voluntary actions of the regulated community to comply with and go beyond its legal obligations and adopt green practices. The acceptance of environmental policy implementation as a societal goal also facilitates collaboration across sectors and administrative levels of government, and between regulators, businesses and the public.

2.2. Institutional framework for environmental governance

Finland is a unitary state with strong local governments. It has 19 regions, which have important responsibilities in spatial planning and education. The Åland region (with a majority Swedish-speaking population) is autonomous with its own competence in environmental matters, including legislation and implementation. The other 18 regional councils are statutory joint municipal boards. Reform of the regional structure to establish full regional governments had been conceived but was terminated in 2019 due to lack of political consensus.

The number of municipalities (310 in 2020) has been reduced through voluntary mergers by almost a third over the last 15 years; the multitude of small municipalities was seen as detrimental to the provision of public services. Local governments have become increasingly independent over the last decade but receive guidance from the central government. They also get funding transfers, which are rarely earmarked.

2.2.1. Central government and horizontal co-ordination

The Ministry of the Environment (MoE) develops government policies and drafts legislation on environmental protection, land use, nature conservation, construction and housing. The MoE is headed by the Minister of the Environment and Climate Change, whose title emphasises the ministry's top policy priority. The MoE's Strategy 2030 has three impact objectives – good environment and diverse nature, carbon-neutral circular economy society and sustainable urban management – with priorities and indicators under each.

Several other ministries have environment-related responsibilities. The Ministry for Agriculture and Forestry (MAF) is responsible for the use of natural resources: forest management, fisheries, hunting and water resources, and infrastructure management (including regulation of water supply and sanitation). It also manages land surveillance and spatial information. The Forest Administration (Metsähallitus) is a state enterprise operating under the oversight of the MAF, as well as guidance from the MoE on relevant issues. Its Natural Heritage Services unit manages Finland's national parks, nature reserves and other protected areas. The Ministry of Economic Affairs and Employment (MEAE) is responsible for mining and energy policies.

Government programmes are structured around horizontal policy objectives, which leads to extensive collaboration between ministries. In addition to four statutory ministerial committees for foreign and security policy, European Union (EU) affairs, finance and economic policy, the government may appoint ad hoc ministerial co-ordination bodies. In January 2021, the government appointed a new ministerial working group on sustainable growth, chaired by the Minister of Finance. It oversees the preparation of a Sustainable Growth Programme for Finland and the related national recovery and rehabilitation plan financed through the EU recovery instrument, and guides and monitors their implementation. Another co-ordination body in the current government is the Ministerial Working Group on Climate and Energy Policy. There are also short-term working groups on issues such as energy and transport taxation reform.

In 2010, a regional administration reform streamlined several agencies into two cross-sectoral state authorities operating at the regional level. It established 6 Regional State Administrative Agencies (AVIs) under the Ministry of Finance and 15 Centres for Economic Development, Transport and the Environment (ELY Centres) under the MEAE. The permitting and compliance assurance functions, previously performed jointly by Regional Environment Centres, were separated. There are concerns that this has led to fragmentation of environmental responsibilities and inefficient use of budget resources.

Four AVIs issue environmental permits under the Environmental Protection Act and permits for water abstraction and construction of water-related infrastructure under the Water Act.[1] AVIs process environmental permit applications only for projects with a major impact on the environment (less than 40% of the permitted installations in 2020), as others are handled by local authorities.

Out of the 15 ELY Centres that manage the central government's implementation and development tasks, 13 monitor and enforce compliance with the environmental and water permits granted by AVIs.[2] These ELY Centres also act as competent authorities for environmental impact assessment (EIA) and issue opinions as part of strategic environmental assessment (SEA) of plans and programmes. ELY Centres also oversee preparedness for, and response to, environmental accidents.

AVIs and ELY Centres are independent from the MoE and MAF. These two ministries provide guidance to both agencies in their respective areas of competence and can influence their work through strategic and operational plans and performance agreements. Performance agreements, whose implementation results are reported to the public, are concluded every year between these agencies and the competent ministries. On the one hand, the multi-sectoral nature of AVIs and ELY Centres has contributed to whole-of-government decision making at the regional level. On the other, this has often led to prevalence of local economic interests over environmental considerations.

A particular role is played by the Finnish Environment Institute (SYKE) – a multidisciplinary environmental research and development centre under the aegis of the MoE. In addition to research and development operations, SYKE provides expert services and operates as a permitting and supervisory authority. It handles matters related to, for example, international shipments of waste and international trade in endangered plants and animals.

2.2.2. Local government and vertical co-ordination

Regional councils promote regional development and land-use planning, primarily through preparing regional spatial plans (Section 2.3.3). A new concept of "institutionalised dialogues on regional development" has been piloted recently to ensure better co-ordination between the central government and regional councils. Regional councils also support selected activities of municipal environmental authorities.

Municipalities serve both as permitting and supervising authorities on local environmental issues. An environmental authority appointed by the municipal council, frequently the municipal environmental board, is responsible for permitting and compliance monitoring and enforcement. A single body can also serve as a joint authority for more than one municipality. The six largest municipalities (Helsinki, Espoo, Tampere, Vantaa, Oulu and Turku) have significant numbers of dedicated environmental staff. However, some smaller ones dedicate limited resources to environmental management.

Municipal environmental authorities issue and control environmental permits for roughly two-thirds of operators that require them. These functions, on average, take about half of their resources. Municipalities also develop and maintain local environmental services – water supply, sanitation and waste management. Some local governments pool their resources to deliver these services together: for example, several municipalities in the Helsinki area have established a joint environmental services company. The Association of Finnish Municipalities supports and promotes the local governments' environmental work. In addition, ELY Centres provide compliance monitoring guidance to municipalities to harmonise practices across the country and ensure consistency.

Agreements on land use, housing, and transport between relevant state authorities and Finland's larger metropolitan areas are a good example of vertical co-ordination. Seven such agreements – for Helsinki, Tampere, Turku, Oulu, Jyväskylä, Kuopio and Lahti – were signed in 2020-21. Municipalities put forward specific goals and detailed plans for achieving them, while the central government participates in the required investments. This mechanism demonstrates the country's progress in addressing the OECD recommendation to strengthen co-ordination of land-use planning between municipalities and state authorities (OECD, 2009).

2.3. Setting of regulatory requirements

Finland had 10 open infringements against EU directives in 2020, less than the number in 2010 (13) and significantly below the EU average of 16 (EC, 2021). Most of the current infringements are related to the transposition of amendments to EU waste directives. An infringement procedure opened in November 2019 signalled deficiencies in the application of EIA (Section 2.3.2).

2.3.1. Regulatory and policy evaluation

Finland actively uses *ex ante* policy analysis to support evidence-based decision making. Regulatory impact assessment (RIA) is conducted for all primary laws and most important subordinate regulations, and includes an evaluation of alternative regulatory and non-regulatory options. However, the consideration of environmental aspects as part of RIA seems to be insufficient. For example, only 23% of

the RIAs in 2014 assessed environmental impacts (Hjerp, 2019). Although the government does not regularly use *ex post* evaluation of legislation, it is planning one of the Environment Protection Act in 2021.

In 2016, Finland established the Finnish Council of Regulatory Impact Analysis (FCRIA) with a mandate to improve the quality of bill drafting and RIA. The FCRIA reviews selected RIAs based on significance and representativeness before approval of the final version of the regulation. It also provides advice and a formal opinion on the quality of the RIA. However, it does not have the power to block regulatory proposals for which RIA has been inadequate (OECD, 2018).

Finland has a well-established tradition in SEAs. SEA is required for all new, or modifications of, land-use plans. However, for local plans, SEA is often reduced to general statements about the environmental impact that are part of broader justification documents. SEA is also routinely used to investigate environmental effects of plans and programmes. For example, Finland has conducted SEA for long- and medium-term climate change policy plans, the national waste plan, the National Risk Management Strategy for Contaminated Land and the National Transport System Plan for 2021-32.

2.3.2. Environmental impact assessment and permitting

In the Finnish EIA system, regional ELY Centres act as a “liaison authority”: they co-ordinate the EIA process, play a central role in ensuring meaningful public participation in EIA and conduct quality control of assessments. However, as AVIs issue development consents and permits, ELY Centres do not make any decisions based on EIA.

The Finnish EIA system contains one notable gap: the assessment is almost never applied to forestry, the sector that has been the main cause of biodiversity loss in the country. The EIA law requires an assessment in case of permanent alteration of a natural forest or wetland of more than 200 hectares or peatland of more than 150 hectares. However, this threshold is too high, allowing many relevant projects to avoid an assessment. The competent authority could initiate a case-by-case EIA, but this does not happen in practice.

EIA and permitting are not directly linked, distinguishing the Finnish system from those of many other countries. EIA is meant to guide the project planning stage towards more environmentally sustainable alternatives, whereas permit decisions focus on the operational stage. Information gathered in the EIA process must be considered to obtain a building, land extraction, water or environmental permit. However, the results of an assessment are not binding for permit decisions (Pölönen et al., 2011). A recent EU infringement procedure pointed out the weaknesses of EIA implementation under sectoral legislation, particularly in how EIA is considered in issuing building permits. In addition, concerns have been raised about the real impact of EIA on permits for mineral mining activities (recently on the rise in the country) that are issued by the Finnish Safety and Chemicals Agency under the MEAE.

In the last decade, Finland has undertaken several initiatives to streamline its environmental permitting system in line with a recommendation of the 2009 OECD Environmental Performance Review. It has reduced the number of environmental permits by introducing registration and expanding the notification system for small polluters. It has also improved the institutional setup of the permitting system by creating a co-ordinated, one-level network of permit offices, and reduced administrative costs by introducing electronic permit applications.

All environmental permits, whether issued by AVIs or municipalities, are integrated across media and based on best available techniques. In 2011, a requirement to consider material efficiency in defining conditions of environmental permits was introduced into the Environmental Protection Act. The MoE has published a guide on material efficiency in the environmental permitting process. Between 10% and 20% of environmental permits issued by AVIs are appealed to the Vaasa administrative court, mostly by operators or members of the public (Section 2.5.3). AVIs publish the environmental and water permits issued and related information in the electronic environmental permit information service (eLUPA). The

business community is exerting pressure on the government to put a one-year limit on the length of permit determination by AVIs. However, such a restriction would be unjustified for high-risk installations.

A 2010 amendment to the Environmental Protection Act simplified the procedure for some small installations permitted by municipal environmental authorities. It replaced customised permits with registration in accordance with government-issued, sector-specific general binding rules (GBRs). Examples include small energy production units, dry cleaners, petrol stations, concrete-producing facilities and painting and coating activities using less than 50 tonnes of organic solvents per year. About 3 400 installations (19% of the total) – those with minor environmental impact, large numbers and stable technologies – were covered by GBRs and the registration regime in 2020. Unlike permits, GBR-based registration is not subject to public hearings on applications.

In 2019, Finland also expanded the use of notifications, which are allowed instead of permitting for lowest-impact activities regulated by municipalities. The roughly 4 100 installations covered by the notification regime include, for example, small farming, food processing and chemical storage installations, and saw mills. Under notification, operators do not have to follow a GBR (except for small animal shelters), but the municipality can set additional operational requirements (which is not the case for registration).

A regulation determines the fees for different types of permits. The fees vary by the facility's potential level of environmental impact. AVIs recovered an average of 38% of the real permitting costs through permitting fees in 2018 (from 26% to 43% across the four AVIs), with a target to increase the recovery level to 50% by adjusting the fees. Municipalities have low permitting fees.

Any institutional stakeholder or individual can complain against a permit decision and/or permit conditions to the Administrative Court of Vaasa, then to the Supreme Administrative Court. If anyone appeals the granting of a permit to an operator, the operator may proceed with the activity after depositing a bank guarantee for decommissioning in case the court cancels the permit. This is a good practice that reconciles the legitimate needs of economic entities with the procedural requirements of the rule of law.

2.3.3. Land-use planning

Spatial planning in Finland is regional and local. The MoE establishes national land-use objectives. For example, the MoE in co-operation with other ministries has developed a non-binding vision "A renewable and enabling Finland" for the country's regional structure and transport system in 2050 (OECD, 2017). The MoE also provides guidance on the land-use planning process and the regulation of building activities. The National Transport System Plan for 2021-32 adopted by the government in April 2021 after extensive public consultation brings together measures at the national and local levels and aims to integrate transport and land-use planning.

The highest-level spatial plans are regional plans prepared by regional councils. In accordance with the Land Use and Building Act, a regional plan sets out principles for land use and community structure and designates areas needed for regional development. It also provides instructions for municipal land-use planning and other activities that affect land use.

Regional councils in coastal areas also prepare maritime spatial plans in co-operation with relevant stakeholders and under the MoE's co-ordination. The first Maritime Spatial Plan 2030, prepared by eight regional councils responsible for the three planning areas – the Gulf of Finland, the southern and northern Bothnian Sea – was approved in December 2020. The plan is a presentation with a map covering both territorial waters and the exclusive economic zone. It outlines, for example, significant and potential areas for underwater natural and cultural values, energy production, fishing, aquaculture, shipping and tourism. Each area's opportunities for multipurpose use consider interactions between land and sea areas. Around 60 coastal municipalities also include territorial waters in their spatial plans.

Municipalities prepare local master plans and local detailed plans. Local master plans exist in all municipalities and are approved by the municipal council. Local detailed plans are drawn up to guide development in particularly important or sensitive areas. Regulatory changes introduced in 2017 enable simultaneous implementation of EIA and SEA in case of a project-specific land-use plan. As part of the co-ordinated procedure, the municipality in charge of the land-use plan conducts an SEA, while the project developer prepares an EIA report. The EIA report becomes an input to the draft land-use plan. The public hearing on the draft plan (including its SEA) is held simultaneously with that of the EIA. This co-ordination is more environmentally sound than in some other OECD member countries, which may not do an EIA for every project if the larger programme or plan is subject to SEA.

The 2009 OECD Environmental Performance Review concluded that meeting environmental objectives in land-use planning in coastal areas was hampered by lax enforcement of construction permits (OECD, 2009). Shoreline development is controlled through detailed shore plans approved by municipalities. These plans lay out procedures for granting exceptional building permits in the coastal zone, considering nature conservation, landscape protection and recreational uses. The use of exceptional building permits in coastal areas has decreased in recent years.

ELY Centres monitor regional and local land-use policies to ensure adherence of land use and building activity to national objectives. They also ensure coherence of transport system plans with land-use plans at the regional and local levels, in line with a recommendation from the 2009 OECD review (OECD, 2009). In 2017, the central government's role in regional planning was substantially reduced, and more land-use planning powers were transferred to municipalities. ELY Centres can only appeal local planning decisions if they carry regional or national importance; this rarely happens with respect to construction decisions in the coastal zone.

The government is designing a comprehensive reform of the Land Use and Building Act with a plan to enact new legislation in 2023. The reform would introduce planning at the scale of metropolitan urban areas and emphasise climate change mitigation and adaptation, as well as biodiversity-related aspects of land use (e.g. continuity of green zones). It would reduce duplication of planning and increase the flexibility of the hierarchy. Specifically, it would limit regional planning to matters of national and provincial importance, which may further reduce national oversight of local planning. The reform would also reinforce SEA of local land-use plans.

2.4. Compliance assurance

In the Finnish compliance culture, once a permit has been agreed upon, operators usually make earnest efforts, using their environmental management system (EMS), to comply with the requirements. This explains a substantial emphasis on compliance promotion, voluntary actions by businesses and reliance on self-monitoring and self-reporting by operators. Coercive actions by enforcement authorities are considered a last resort.

2.4.1. Environmental inspections

Routine inspections usually account for 70-80% of the environmental inspection programmes of ELY Centres and large municipalities. These inspections are conducted in accordance with 2017 MoE guidance. It specifies minimum inspection frequencies (once a year, every other year, once in three years and once in five-ten years) for four classes of installations based on several risk-based criteria. In addition, special inspections are carried out for new installations as part of the permitting process, to control self-monitoring arrangements and in case of accidents or complaints.[3] There are also a significant number of operator-requested inspections, a unique practice used by operators to demonstrate their environmental

performance (IMPEL, 2013). Complaints can be brought by either individual citizens or non-governmental organisations (NGOs).

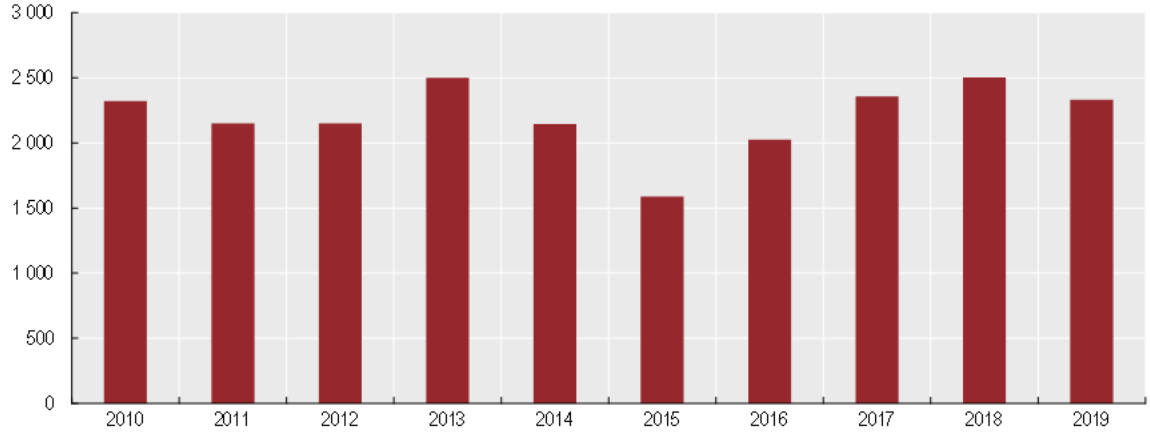
Inspections complement regular electronic submission of self-monitoring reports by operators. These reports cover not only data on air emissions, wastewater discharges and waste generation but also key parameters of technological processes such as raw materials and energy use. Operators must also immediately report electronically to the authorities all exceedances of short-term emission limits, breakdowns, spills or other incidents. ELY Centres charge a fee for checking self-monitoring reports.

Practically all (even special) inspections are announced to the operator in advance to ensure on-site presence of relevant enterprise staff. Since the operator must report all operating incidents anyway, inspectors do not see the sense of unannounced site visits. This practice differs from that of many other OECD member countries that do not want to give operators a chance to hide potential non-compliance. ELY Centres always invite municipalities to join inspections.

The number of inspections by ELY Centres since 2010 has largely depended on the availability of resources (Figure 2.1). In 2015, the government was faced with a financial shortage and declining inspections. In response, it introduced inspection fees for planned site visits, as well as for inspections to verify the rectification of violations. This allowed ELY Centres to hire additional inspectors. The fees, which can also be charged by municipal environmental authorities, are set in a decree for three categories of facilities.

Figure 2.1. The number of environmental inspections has fluctuated with the availability of resources

Inspections by the Centres for Economic Development, Transport and the Environment (ELY Centres), 2010-19



Source: Country submission.

StatLink https://doi.org/10.1787/888934287984

At the municipal level, the same staff work on permitting and compliance monitoring. In 2017, they spent an average of 30% of their working hours on inspections. Data on the number of inspections across municipalities are not available. While the largest municipalities have developed full-fledged inspection programmes, small ones often lack capacity to conduct inspections except in reaction to complaints. Several municipal environmental authorities engage in local inspection campaigns on specific issues.

Fewer meetings between inspectors and operators involve site visits. These meetings may occur several times a year and cover planned changes in operations, potential or recent incidents, implementation of

permit conditions, etc. Such regular discussions are based on mutual trust and are considered crucial for maintaining compliance.

Inspection reports are maintained in the Compliance Monitoring Data System (YLVA), which also contains electronic self-reporting submissions by operators, as well as data on materials use, production and pollution releases of individual installations. Through an YLVA-linked case management system, inspection reports are made available following site inspections to inspectors across the country. This system enables ELY Centres to review company performance across Finland. Municipalities have access to this system and must upload information about permitted and registered installations under their jurisdiction, as well as their respective compliance monitoring records. Local authorities can also, to a limited extent, use YLVA in their own compliance monitoring activities.

Finland has made some progress in expanding public access to compliance information, as recommended by the previous OECD Environmental Performance Review (OECD, 2009). YLVA is not open to the public, but some of its outputs are uploaded to environmental authorities' websites. For example, summaries of inspection reports for high-risk installations are available to the public on line. The public can request access to full inspection reports from the relevant office using their freedom of information rights. There are plans to create a mechanism to publish more environmental compliance data derived from YLVA in connection with the pollution release and transfer register. However, this project has been delayed due to lack of funding.

2.4.2. Enforcement

Non-compliance is low: on average, 15% of inspections detect some sort of regulatory breach. This level has been stable since 2016. If a violation is discovered during an inspection or reported voluntarily, the operator can present a plan of corrective actions to return to compliance. Alternatively, corrective actions may be recommended in an inspection report with a specific deadline. The operator then has to report on the completion of the corrective actions.

If the operator fails to present a compliance plan or its actions are judged inadequate by the competent authority (an ELY Centre or a municipality), then the latter issues a compliance notice and the case may be referred to the police for criminal prosecution. In practice, compliance notices are used rarely: only 36 were issued in the entire country over 2015-19. Even when a compliance notice is used, it is regarded as a sanction in itself (as it is disclosed to the public) and rarely includes penalties.

Even after lodging a statement of criminal offence with the police, the competent authority may continue to investigate the case in an administrative procedure, applying sanctions if necessary. Authorities can impose a conditional fine or an actual administrative fine when the threat of a conditional fine is not enough to restore compliance. In practice, fines are mostly used for waste management violations. Their rate is usually a function of the gravity of the offence and the operator's ability to pay. The law does not define an upper limit for administrative fines but states the fine should be high enough to ensure operator compliance.

Criminal enforcement in Finland is handled by the police, which have specialised personnel focusing on environmental issues. On average, about 500 cases of potential environmental crime – some reported by citizens and NGOs – are investigated annually. Approximately one in three investigated offences is referred to the prosecution service. About a third of the prosecuted cases concern violations by enterprises. Once brought to court by the prosecution, 75-80% of the charges result in conviction by the court (National Police Board, 2019).

Criminal penalties vary from a fine (based on the severity of non-compliance) to a maximum of six years of imprisonment (based on the severity of the offence). On top of the penalty, the court determines the economic benefits (evaluated by experts) gained from the offence and orders their forfeiture to the state. This good practice of deterring environmental crime is rarely seen in other OECD member countries.

ELY Centres engage in regular enforcement collaboration on environmental matters with municipal environmental authorities, police, the Border Guard and customs through co-operation groups, joint training programmes and on an ad hoc basis. A national working group on monitoring environmental crime (with MoE and SYKE participation) has been in place for over two decades. It has recently been complemented by similar regional working groups. Finland produces an annual report on environmental crime with detailed statistics on offences.

2.4.3. Environmental liability

Companies must cover the costs of rehabilitating any areas they have contaminated. This liability must be reported in annual corporate accounts, financial reports and voluntary environmental reports. Such reports are due as soon as contaminated areas have been duly surveyed, and reasonably reliable estimates of rehabilitation costs are available. The liability is strict: proof of a legal offence is not required for the operator to be found liable for damages. ELY Centres can intervene in case of accidents to prevent or limit environmental damage and then recover costs from the responsible party. However, when the liable party is insolvent or unknown, the remediation burden falls on the government.

A complementary insurance and compensation scheme for environment-related damage to health, welfare and property has existed in Finland for over 20 years. All enterprises whose activities require an environmental permit or a permit from the Technological Safety Authority for handling hazardous chemicals must buy complementary environmental damage insurance. This insurance allows insurance companies to pay compensation even when the party that caused the damage is unknown or financially insolvent. It covers compensation for bodily injury and material losses from environmental causes but not restoration of the environment itself. A similar model is used for the Oil Pollution Compensation Fund, which covers both compensation of private damage and environmental remediation after oil spills.

The Ministry of the Environment is working to widen the scope of the mandatory environmental insurance to reimburse the government's remediation costs in cases where the liable party is insolvent or unknown. The ministry is also considering the creation of a fund for environmental damage to potentially replace both the insurance and compensation scheme and the Oil Pollution Compensation Fund with a new environmental damage fund fed by fees that would be paid by operators of hazardous industrial installations.

Contaminated sites

SYKE maintains the National Soil Database System (MATTI) with site-specific data on land areas that are potentially contaminated, confirmed as contaminated, cleaned up and confirmed as clean. The database can be accessed by environmental, land-use and building-supervision authorities. In 2015, there were almost 25 000 MATTI sites. These sites are typically former industrial areas, landfill sites and petrol stations (MoE, 2017).

A government Decree on the Assessment of Soil Contamination and Remediation Needs stipulates that the degree of remediation of contaminated sites should be based on the results of a risk assessment. This means the final remediation standard may differ from the pre-contamination conditions (Milieu, 2019). The MoE has published guidance on remediation of key types of significant environmental damage, including assessment of the significance of the damage, selection of remedial actions and related official procedures.

The 2015 National Risk Management Strategy for Contaminated Land in Finland specifies the key objectives concerning contaminated areas and the needs and means of their remediation. The strategy also includes a national research and restoration programme. The national risk-based programme for investigation and remediation, managed by the Pirkanmaa ELY Centre, is one of the main policy measures for achieving the main goal of the strategy. The sites covered by the programme account for approximately 15% of all remediation sites (MoE, 2017).

Funding is allocated from the state budget for analysing the level of contamination and for clean-up of orphan sites – old contaminated sites where the cause of the damage is unknown or the responsible party cannot cover the costs involved. Municipalities also provide resources for soil and groundwater restoration on orphan sites. In addition, financial support for remediation operations is available through the Finnish Oil Pollution Compensation Fund and the state aid scheme that came into force on 1 January 2020.[4] The state aid can cover up to 50% of the eligible costs of investigating the site's level of contamination and up to 40% of the eligible clean-up costs. Every year about 50 studies are conducted on orphan sites, and ten such sites are remediated with government funding, at a cost of EUR 3-4 million. Conversely, responsible parties remediate 300-350 contaminated sites each year without government support.

2.4.4. Promotion of compliance and green practices

Finland has implemented a comprehensive set of compliance promotion measures, including technical assistance, regular dialogue with the regulated community, dissemination of guides on best practices and co-financing with business associations of environmental management studies. Inspectors often have discussions with operators on existing and potential compliance problems and possible solutions. Small and medium-sized enterprises benefit from direct technical assistance. For example, inspectors may help operators to develop their environmental management plans to better comply with regulatory requirements.

The dissemination of guides on best practices has been another prominent feature of compliance promotion in Finland. Environmental authorities co-finance with industry associations the development of studies on specific issues of industrial environmental management. The MoE has also produced a series of fact sheets describing Finnish companies' eco-innovations and put them on its website. The Confederation of Finnish Industries and sectoral industry associations use their own means (websites, newsletters) to disseminate regulatory and technical guidance. Some industry associations organise compliance promotion seminars for their members.

Voluntary business initiatives

The government has, as of October 2021, concluded nine Green Deal voluntary agreements with business sectors, usually represented by a trade association, municipalities and other organisations. They cover about 100 companies and other actors and include the following initiatives:

- The Plastic Carrier Bag Agreement (the first one to be concluded, in 2016) to decrease the consumption of light-weight plastic carrier bags to 40 bags per person by the end of 2025.
- A Green Deal climate agreement with the automotive sector to have at least 25% of newly registered cars run on alternative fuels by 2025, reduce the average carbon dioxide (CO_2) emissions for newly registered cars by at least 4% every year until 2025 and reduce the average age of the car fleet by 1.5% per year until 2025.
- A Green Deal agreement on developing national waste oil management to increase the recycling of oil waste from 74% to 80% by 2020.
- A Green Deal agreement to implement a range of measures to reduce CO_2 emissions from construction equipment machinery by 2025.
- A Green Deal agreement to increase the reuse and recycling of demolition materials by 2025.
- A Green Deal with the cities of Espoo, Helsinki, Turku and Vantaa to have only fossil fuel-free construction sites by 2030 by using green public procurement (GPP).
- An agreement with the cities of Helsinki, Tampere and Vantaa, as well as a number of procurement organisations, to reduce harmful chemicals in the early childhood education environment through public procurement.

- The Construction Plastics agreement with several industries and municipalities on separation and recycling of plastic packaging at construction sites to achieve 40% recycling of plastic film by the end of 2027.
- An agreement with the water utility sector to decrease the municipal wastewater discharges of nutrients and hazardous chemicals.

Several other voluntary agreements are under negotiation, including one to reduce CO_2 emissions from the waste sector. In addition, a first industry-wide voluntary commitment has been made in the area of materials efficiency (Box 2.1), which is in line with the respective recommendation from the previous OECD review (OECD, 2009). Finland's Green Deal initiative to promote sustainability and good management are similar to those implemented in the Netherlands and the Belgian region of Flanders. The Flemish seven Green Deals (as of early 2020) have involved over 1 000 parties, including industry, local governments, NGOs and universities (OECD, 2021a).

Many companies have developed their own initiatives within the framework of corporate social responsibility (CSR), demonstrating significant progress with regard to the OECD recommendation to promote corporate environmental reporting (OECD, 2009). Finnish Business and Society – the largest Nordic CSR network with over 300 members – helps businesses develop CSR expertise through trainings, events, consultancy, tools and studies. In 2019, the Finland Chamber of Commerce launched a climate programme to train businesses on how to commit to and achieve carbon neutrality by 2035. A similar programme on CSR was launched in 2020.

Box 2.1. Food industry makes a first materials efficiency commitment

Food industry associations and the Finnish Grocery Trade Association have made Finland's first voluntary materials efficiency commitment for 2019-21, which aims at boosting companies' profitability and reducing their environmental impacts.

Companies joining the commitment will work to reduce food losses, promote more environmentally friendly packaging, increase the recycling of food waste and materials, and improve the efficiency of logistics in goods transport.

In the first year, companies joining the commitment are expected to represent 85% of the Finnish Grocery Trade Association members' turnover and 20% of the Finnish Food and Drink Industries' Federation members' turnover. The food retail sector has set detailed targets to reduce food waste by 13% and increase the recycling rate from 74% to 78% during the commitment period. Each participating company makes its own commitment and determines the best methods and instruments to reach the targets.

Motiva – a sustainable development company working closely with the government – is responsible for co-ordination and development of the commitments that Finland is looking to expand to other industrial sectors.

Source: Motiva (2021), "Material Efficiency Commitment for Industry", webpage, www.motiva.fi/en/solutions/material_efficiency/material_efficiency_commitment_for_industry (accessed on 1 September 2021).

Environmental management system certifications

Finnish business has been working on its environmental management methods for years. The number of new ISO 14001 EMS certifications per year increased by 35% between 2009 and 2019. This growth is higher than in Sweden and Denmark and lower than in Norway, with all Scandinavian countries having

substantial EMS certification rates (ISO, 2020). The EU Eco-Management and Audit Scheme is not widely used: as of April 2020, Finland had only 4 EMAS-certified organisations with 22 certified sites (EC, 2020).

The MoE does not consider it necessary to make special efforts to promote EMS in industry because international pressure to adopt such systems is a much more powerful factor. Still, operators with certified EMSs receive a slight reduction in their permit fees.

Greening public procurement

The central government fully recognises the importance of GPP. Finland spends approximately EUR 35 billion on public procurement every year, which accounts for about 16% of the country's gross domestic product. The government programme includes the objective of increasing the share of innovative procurement to 10% of all public procurement by the end of the parliamentary term in 2023. In September 2020, Finland launched a national public procurement strategy to improve the effectiveness and sustainability of the use of public money.

A national strategy on GPP was part of the government's 2013 Decision on the Promotion of Sustainable Environmental and Energy Solutions in Public Procurement. It set ambitious GPP targets for the central, regional and local governments. Targets were set, for example, for energy consumption in public buildings, environmentally friendly vehicles and organic food served in public institutions. However, progress towards these targets has not been measured.

There are environmental criteria and guidance for 16 procurement areas, including food and catering, vehicles and transport, construction, energy services, energy-related products and textiles (for uniforms). GPP criteria for furniture, cleaning services, professional kitchen appliances and printing services are under development (EC, 2019). The Law on Environmental and Energy Efficiency Requirements for Vehicle and Transport Service Procurements, transposing the EU Clean Vehicles Directive, went into force in August 2021. It will require a major share of low- and zero-emission vehicles in public procurement of vehicles and transport services.

There is no systematic implementation monitoring of GPP, but a measurement tool is under discussion. A 2017 survey of municipal procurement practices showed that 44% of public tenders included at least one environmental criterion (Alhola and Kaljonen, 2017).

In an innovative practice, the carbon footprint of public procurement was for the first time calculated in 2019 based on the 2015 procurement data.[5] The total carbon footprint of Finland's public procurement turned out to be 8.3 million tonnes of carbon dioxide equivalent. The central government's procurement accounted for 21%, municipal procurement for 57% and joint municipal authority procurement for 22% of the total (Nissinen and Savolainen, 2020).

In 2018, a strategic partnership of eight organisations (including, among others, SYKE and the Association of Finnish Local and Regional Authorities) established KEINO – a competence centre for sustainable and innovative public procurement. The centre is funded by the MEAE. KEINO's main operations include a development programme for strategic management of procurement, support for Green Deals for the public sector (see above), capacity building and dissemination of good practices. KEINO has also studied the status of GPP and innovative public procurement in Finland, among other issues.

2.5. Promoting environmental democracy

Finnish people trust their institutions: the central government enjoys the trust of 66% of citizens, local governments – 52% (OECD, 2021b). Finland is also one of the EU countries with the highest online interaction between public authorities and citizens (EC, 2019). It has an action plan on open government that encourages public participation across the board. The National Democracy Programme 2025, issued

by the government in 2019, aims at promoting participation and new forms of interaction between the public administration and civil society. Still, the share of people who believe they can influence political processes is small compared to other countries with high trust in government (OECD, 2021b). According to the Civic Space Scan of Finland (OECD, 2021c), a more transparent, co-ordinated and consistent approach to the choice of civil society actors consulted by different ministries would help build partnerships and trust.

Environmental democracy builds upon a high level of public awareness: 95% of Finnish citizens consider protecting the environment to be important or very important, with 60% of the public concerned about climate change and marine pollution. Over a third of the public sees providing more information and education (35%) as a key solution to these problems (Eurobarometer, 2019).

2.5.1. Public participation in environmental decision making

Public participation in legislative drafting is a well-established practice in Finland. This can take the form of ad hoc committees, working groups and public hearings with participation of all relevant interest groups. These are widely used during the preparation of environmental laws or decrees and the elaboration of Finland's positions in the European Union. Environmental NGO representatives may participate in international forums as part of the official Finnish delegation and receive travel grants for this purpose (MoE, 2021). The government historically provides substantial funding to environmental and other NGOs, as is common across Nordic countries. Since 2019, this funding has substantially increased compared with the previous government. At the same time, trade unions would like to see their own involvement in environmental policy making grow.

The Finnish National Commission on Sustainable Development is a forum to promote co-operation to achieve the Sustainable Development Goals and to integrate the strategic objectives of sustainable development into national policy, administration and social practices. It gathers key societal actors: government stakeholders, NGOs, industry and research institutes. The commission meets two-three times a year and may also organise seminars and joint meetings with different actors. In 2020, the commission established a special roundtable of climate policy. In April 2021, the Climate Policy Roundtable convened a "citizens' jury" to assess the fairness and impact of 14 measures to be included in the government's new Climate Change Policy Plan 2035. The 37-member jury, facilitated by researchers from the University of Turku, adopted a statement with their assessment and proposals of new and supplementary measures. Furthermore, over 18 000 people participated in the online consultation on the plan.

Public participation is an integral part of the EIA, SEA, permitting and land-use planning processes. For example, the permit decision must describe how it has considered objections and other opinions. However, in some cases (e.g. in the forestry sector) timeframes for public consultation do not allow for meaningful involvement of citizens and NGOs.

2.5.2. Access to environmental information

According to the Act on the Openness of Government Activities, all official documents are in the public domain unless specifically otherwise provided for. Importantly, this includes information on environmental compliance by private entities (Section 2.4.1). If a request for information is refused, it can be challenged by means of administrative appeal to a regional administrative court.

Finland's joint environmental administration portal (www.environment.fi) is the source of most comprehensive environmental data. The MoE and SYKE websites also present rich environmental information. The MoE site was redesigned in September 2020 to enhance the accessibility of information. The Biodiversity.fi portal includes more than 110 indicators reflecting the state of biological diversity, as well as factors driving changes in it. The country has also made good progress in the implementation of the INSPIRE Directive (2007/2/EC), particularly in the identification and documentation of data. However, there is still room for improvement in access to geospatial data (EC, 2019). These platforms offer improved

public access to geographic and sectoral dimensions of environmental information, as recommended by the 2009 OECD Environmental Performance Review.

The first national state of the environment report was published in 2009. SYKE published four information packages about the state of the environment in 2017-18: on black carbon and climate change, urban nature, circular economy, and state and future of Finnish waters. Research reports on environmental issues are also increasingly put in the public domain. A decade ago, only a quarter of such reports were available to the public. By 2020, this share had grown to 62%, with a target to achieve fully open publication in the coming years.

2.5.3. Access to justice

Environmental disputes typically end up with the administrative courts. Most are handled through administrative appeals, with some notable exceptions that are reviewed based on municipal appeal (e.g. municipal land-use plans, building ordinances or local environmental regulations). The administrative appeal is a reformatory remedy, which means the court is competent to amend the challenged decision. In a municipal appeal, the court can only uphold or overturn the authority decision. Municipal appeal is available to all residents of a municipality, while the right to administrative appeal is typically restricted to parties more directly affected by the decision. In addition, the Rural Business Appeals Board handles some appeal cases concerning agriculture, forestry, hunting and fishery (European e-Justice Portal, 2020).

Within the administrative court system, most environmental cases have been centralised in the regional Administrative Court of Vaasa. This court deals with all cases under the Environmental Protection Act and the Water Act, which account for about a quarter of environmental cases in administrative courts nationwide. The court's judges are specially trained to determine environmental cases. The remaining environmental cases, such as those dealing with nature protection and land-use planning, are handled by the administrative court of the respective region. Its decision can be further appealed to the Supreme Administrative Court.

Citizens have access to courts only if they are directly affected by the matter; in other cases, they have to complain to environmental authorities. To have standing, an NGO must be registered and fulfil certain requirements with regard to the geographic area of operation and activity purpose. For example, the NGO's area of operation should suffer from the environmental impact in question. Therefore, NGOs operating at the national level may be barred from challenging decisions with only local impact (Box 2.2). However, once the right of appeal is established, appellants, whether NGOs or individuals, are generally free to challenge the decision on grounds of public interest as well.

Costs for administrative proceedings are relatively low in Finland compared to many countries; no lawyer is required, and a fee (EUR 260 in a regional administrative court) has to be paid only if the plaintiff loses the case. Legal aid at the expense of the state is available for persons who need expert assistance in a legal matter.

2.5.4. Environmental education

Finland has made substantial progress with regard to the recommendation on environmental education from the previous OECD review (OECD, 2009): it has created new coursework and support materials, engaging a broad range of non-governmental actors. The 2006-14 Strategy and Implementation Plan for Education for Sustainable Development was implemented with mixed results due to insufficient resources in key areas. Subsequently, the MoE and the Ministry of Education and Culture (MEC) had a working group identify development needs for fostering environmental education and raising environmental awareness. Since 2015, the MoE has funded environmental education projects for about EUR 2 million per year. The MEC's 2020 sustainable development policy stresses the importance of addressing sustainable development in teacher education and training. The National Agency for Education under the MEC has

made climate change the centrepiece of its education for sustainable development activities (Box 2.3). However, no institution co-ordinates climate and environmental education across the central government. An unofficial inter-ministerial sustainable education co-operation group aims at strengthening information exchange, funding co-ordination and effectiveness. Most regions have their own regional strategy or programme and a website on environmental education (MoE, 2021). Ensuring wide dissemination of education materials developed by multiple projects to secure their long-term impact is a challenge.

Under the recently reformed National Core Curriculum for Basic Education, all Finnish schools are expected to have some sustainable development or environmental system and to teach climate change and circular economy topics. In 2018, sustainable development was made a compulsory component of vocational degrees. In addition, environmental aspects have been integrated into competence requirements for every profession.

Box 2.2. An NGO shows the power of access to justice to preserve biodiversity

The Court of Justice of the European Union (CJEU) largely sided with a small Finnish nature protection organisation, Tapiola, in a recent judgement that interpreted limitations on the deliberate killing of wolves. Tapiola was able to use EU law to force national compliance with EU species protection law.

The wolf is listed in Annex IV of the Habitats Directive, meaning that hunting it must be prohibited. Finland negotiated an exception for wolves in the reindeer management area when it joined the European Union. Therefore, while still "protected" in northern Finland, wolves are in practice killed if they are in the area. However, the Finnish Wildlife Agency was issuing wolf hunting permits in other Finnish regions as well, arguing that this prevented illegal hunting.

Tapiola, a nature conservation association, was created in 2014 to protect wolves and other large carnivores. In 2015 and 2016, it appealed in administrative courts against every wolf hunting permit issued. All the courts except one dismissed the 2015 appeals on the grounds that Tapiola did not have standing, not being local to the relevant geographic areas. In 2016, Tapiola reorganised into six regional organisations covering the areas where the permits had been granted. Still, all the appeals in which Tapiola was determined to have standing were rejected on their merits.

In November 2017, agreeing with Tapiola, the Supreme Administrative Court said it needed the CJEU to answer unclear questions of EU law before it could determine whether Finland's hunting laws and policies violated the Habitats Directive. In October 2019, the CJEU ruled that if the Finnish court determined that the evidence provided by Tapiola was accurate, it should find that Finland had violated the Habitats Directive.

Finally, the Supreme Administrative Court ruled in March 2020 that the management hunting permits granted during the 2016 hunting season were unlawful, setting a new standard for the protection of wolves in the country.

Source: Epstein and Kantinkoski (2020), "Non-governmental enforcement of EU environmental law: A stakeholder action for wolf protection in Finland", *Frontiers in Ecology and Evolution*, Vol. 8, https://doi.org/10.3389/fevo.2020.00101.

Higher education institutions have developed common digital learning modules and have been sharing good teaching practices on sustainable development and climate change (Box 2.3). In 2020, Finnish universities adopted principles for sustainable development, including significant commitments to include sustainable development in degree requirements (MoE, 2021). The Interdisciplinary Network of Environmental and Sustainability Education Research (SIRENE) brings together researchers in environmental and sustainability education to increase the impact and visibility of these fields in the Finnish society. The Rectors' Conference of Finnish Universities of Applied Sciences (ARENE) has recently

approved a joint programme for sustainable development and responsibility based on the 2030 UN Agenda for Sustainable Development.

Box 2.3. Multiple actors contribute to education and awareness on climate change

Teaching about climate change is already important in the Finnish education system. Moreover, the government is developing a new climate studies programme with the idea that climate change should be part of every subject. In 2019, the National Agency for Education prepared, in collaboration with many civil society actors and experts, a Climate Responsibility Learning Action Plan "Our Planet, Our Responsibility" to support the inclusion of climate responsibility in schools and other educational institutions.

In higher education, Climate University, a collaboration project of 11 universities in Finland, runs an open online course on climate change for university students. Climate change is also a focus area of the LUMA Centre – a network of Finnish universities that is a key player in initial and continuing teacher education. In 2020, LUMA launched "CLIMATE?", a research-based climate change education project. The project seeks to co-design and test pedagogical models for climate change education with teachers all over the world using an online platform. Several NGOs have also developed climate change and circular economy material that teachers can use.

Both the government and NGOs are active in the public outreach on climate. In 2019, an NGO-organised summit brought together 500 young Finns to discuss the climate crisis and solutions to it. In another 2019 event, three ministers – those of education, science and the environment – invited young people and civil society organisations to a roundtable to discuss how the growing climate concerns should be reflected in schools.

The Finnish Innovation Fund Sitra has developed a "lifestyle test" carbon footprint calculator – a first of its kind – for individuals, as well as for NGOs and associations. This innovative tool contributes to public awareness of climate impacts of consumption behaviour.

Source: Country submission.

Finland has various environment certificates for schools and educational institutions, including the Green Flag and certification by the OKKA Foundation for Teaching, Education and Personal Development. About 300 schools and kindergartens participated in the Green Flag programme in 2019; 270 of them have been awarded the accolade. The OKKA Foundation maintains the Finnish national Sustainable Development Certification of Educational Establishments with permanent funding from the MEC. The certification system supported by criteria and evaluation tools covers secondary schools, vocational institutions and liberal adult education. As of 2018, the foundation had awarded the sustainable development certificate to 100 educational institutions. Funded by the MEC, the nine Finnish Youth Centres also carry out important environmental education work. The Finnish Association for Environmental Education co-ordinates the work of the various environmental NGOs in this field.

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Notes

[1] Other AVIs provide services related to occupational health and safety, emergency preparedness and response, and citizens' legal rights and permits.

[2] Nine ELY Centres handle transport and infrastructure issues for the Ministry of Transport and Communications; 15 ELY Centres deal with economic development, employment, competence and culture under the auspices of the ministries of Economic Affairs and Employment, Agriculture and Forestry, the Interior, and Education and Culture.

[3] If the authority does not adequately address a complaint, it may be sued in an administrative court.

[4] This direct aid scheme has replaced the State Waste Management System for contaminated soil sites. The previous system worked through agreements between the state and the party responsible for the damage (a private entity or a municipality). These agreements defined the objectives and shares of investigation and remediation costs.

[5] The main method used was the environmentally extended input-output model ENVIMAT, supplemented with statistics on public procurement.

Chapter 3. Towards green growth

This chapter reviews Finland's progress in mainstreaming environmental considerations in economic policy and in promoting sustainable development and green growth. It looks at efforts to ensure a green and inclusive recovery from the COVID-19 crisis and to increase investment in environment-related infrastructure and services. It also reviews steps taken to green the tax system and to remove environmentally harmful subsidies. Finally, it discusses the country's eco-innovation performance, as well as opportunities for expanding employment in green sectors as means to ensure a just transition to a green, low-carbon economy.

Recommendations on green growth

Greening economic recovery

- Accelerate the implementation of sustainable development or green budgeting procedures, by establishing a transparent system to track how expenditure contributes (positively and negatively) to meeting environmental goals; to this end, build adequate capacity in administration and enhance co-ordination across government branches; ensure a systematic *ex ante* and *ex post* assessment of the environmental and social impact of policy packages and resource allocations.
- Maintain the commitment to the green transition in allocating resources to the Sustainable Growth Programme until 2026 and possibly beyond; establish a sound monitoring framework, with measurable indicators, to track implementation of the programme and its effectiveness.
- Follow through on plans to increase R&D spending to accelerate investment in innovation at business level; further increase and better target environment-related R&D support to SMEs; assess the effectiveness of the policy to promote public procurement for innovation in fostering low-carbon and circular solutions.
- Continue to offer education, skill and entrepreneurship training programmes to prepare workers for the labour market needs of a low-carbon and circular economy; encourage women to undertake science, technology and engineering studies with a view to increase their participation in the green and clean-tech industry.

Greening the tax and subsidy system

- Set a trajectory of future effective carbon prices to 2030, as part of a broader fiscal reform that addresses potential adverse impacts on households and competitiveness; introduce annual surcharges on fuels to fill the gap between the yearly target price and the prevailing effective carbon price (given by the combination of energy and carbon taxes and the ETS allowance price).
- Address misalignments and inefficiencies in the energy tax system and strengthen carbon pricing, notably by:
  - phasing out the preferential tax treatment of peat
  - phasing out energy tax reductions for fuels used in agriculture
  - increasing the energy tax on diesel so it at least reaches the petrol tax rate (per litre)
  - establishing a formal mechanism to adjust the energy and carbon tax rates to maintain their incentive function and fiscal revenue
  - assessing the option of extending the energy and carbon tax structure (based on lifecycle GHG emissions) to solid biofuels.
- Redesign tax incentives to steer a transition towards sustainable mobility, by removing tax-free parking at the workplace, removing the tax incentive for company-owned EVs and other low-emission cars, introducing distance-based road pricing for heavy goods vehicles, and enabling the introduction of congestion charges in Helsinki and other urban areas facing congestion problems.

3.1. Introduction

Finland has a strong reputation as a "clean country" and leader in environmental policy. Sustainable development is high on Finland's political agenda. The country should be commended for its commitments to become carbon neutral by 2035 and to pioneer the world's first circular economy. However, Finland is not fully on track to meet all its ambitious goals. While emission of greenhouse gases (GHGs) and air pollutants have declined considerably, pressures such as waste generation, material consumption, intensity of forest use and nutrient losses to water bodies have continued to rise (Chapter 1).

To achieve its ambitious goals, Finland can tap into abundant renewable natural resources, a sound environmental policy framework, its experience with using economic instruments, its industrial strengths and strong innovative capacity. Nevertheless, targeted policy measures are needed to provide adequate incentives and boost investment and innovation for the green transition and to steer the economic recovery from the COVID-19 crisis towards low-carbon and circular patterns. Public policies also play a role to smooth the impacts of this transition on vulnerable communities. The challenge for the next decade will be to get the right policies in place, to secure sufficient resources, and ensure continued and broad public consensus.

3.2. Ensuring the framework conditions for sustainable development

Finland has a long tradition of promoting sustainable development both in domestic policies and in international development co-operation. It topped the Sustainable Development Goal (SDG) Index ranking in 2021, out of 165 countries (Sachs et al., 2021). Its score indicates that nearly 86% of the SDG goals and related targets have been met. In particular, Finland has achieved the goals related to water and clean energy. However, challenges remain to meet the goals on climate, responsible consumption and production, and terrestrial and marine biodiversity (Figure 3.1). This is consistent with Finland's own assessment presented in its second Voluntary National Review of the SDGs of 2020 (Prime Minister's Office, 2020).

Finland has a solid policy framework to achieve the SDGs. It established novel institutional mechanisms to support and monitor national implementation of the SDGs and engage civil society. In 2014, the Finnish National Commission on Sustainable Development (Chapter 2) adopted a long-term vision titled "The Finland we want by 2050 – the society's commitment so sustainable development". In 2016, the strategy was updated to align itself with the 2030 Agenda and its 17 SDGs.[1] Rather than a strategy, the document sets a whole-of-government and whole-of-society commitment to sustainable development. It provides a long-term sustainable development policy framework for the government, business community and society. The document outlines policy principles and eight objectives in line with the SDGs.[2]

The Prime Minister's Office is in charge of co-ordinating the national sustainable development policy. All line ministries are part of the Sustainable Development Co-ordination Network. They are required to report to Parliament annually on their policies and measures to achieve the SDGs. The Expert Panel on Sustainable Development provides independent scientific advice. A monitoring system tracks progress towards the SDGs based on a specific indicator set. A citizens' panel is organised every year to complement the progress tracking with qualitative information and views of civil society.[3] A state of sustainable development report is published every four years (the latest was released in 2020). In addition, the National Audit Office has integrated the SDGs into its audit programme.

Figure 3.1. Finland is on the right path towards many but not all SDGs

Note: The full title of Goal 2 "Zero Hunger" is "End hunger, achieve food security and improved nutrition and promote sustainable agriculture". The full title of each SDG is available here: https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoal.
Source: Sachs et al. (2021), *The Decade of Action for the Sustainable Development Goals*, Sustainable Development Report 2021, Cambridge University Press, Cambridge, https://dashboards.sdgindex.org/.

An innovative multi-stakeholder system is used to engage civil society in achieving the SDGs. All actors can announce their own "operational commitments" via a dedicated web portal, thereby participating in the implementation of Finland's vision. Each operational commitment is linked to one of eight national objectives, as well as to the SDGs. As of September 2021, companies, educational institutions, political parties, cities and other actors had made some 2 600 commitments.

Finland could build on its framework for sustainability assessment to move towards green budgeting. A sustainability assessment has been integrated into the annual policy cycle (i.e. planning, budgeting and reporting). Since 2018, the government budget proposals include a sustainable development chapter. This provides a qualitative assessment of the budget contribution to the SDGs and identifies the state expenditure and revenue relevant to the carbon-neutrality goal. However, it only reviews budgetary programmes identified as contributing to green objectives. This is a relatively light approach to green budgeting. In other OECD countries, the budget process appraises the environmental impacts of budgetary and fiscal policies and of their coherences towards delivery of national and international commitments (OECD, 2021a).

Finland's sustainable budgeting has not yet had any significant impact on resource allocation or improved policy coherence (Metsä and Varis, 18 December 2020). An analysis of the Finnish state budget showed that items counterproductive to carbon neutrality and resource circularity were allocated nearly twice the amount of resources as those in line with the SDGs (EEA, 2020). Nonetheless, the sustainability budget assessment has contributed to improving transparency of budget proposals and visibility of sustainable development issues across the government (Prime Minister's Office, 2020).

Finland would benefit from a transparent system to track how expenditure contributes (positively and negatively) to meeting environmental goals. In addition, it could benefit from systematic assessment (*ex ante* and *ex post*) of the environmental and social impact of policy packages and resource allocations. To this end, it needs to build adequate capacity in administration and enhance co-ordination across government branches.

Finland's policy approach to the SDGs – the PATH2030 project – concluded that sustainable development has become a widely accepted goal in Finnish society. However, it also noted that more is needed to truly anchor the SDGs in central decision-making processes (Lähteenoja et al., 2019). Conflict of interest between different stakeholders and an insufficient use of indicators and scientific knowledge in decision making have been a barrier to progress (EEA, 2020). In addition to widening sustainable budgeting, the evaluation recommended to strengthen scientific analysis and monitoring in support of decision making. This would help create consensus around policies and reconcile trade-offs.

As recommended by the PATH2030 assessment, the National Commission on Sustainable Development started working on a 2030 Agenda roadmap in 2021 that will define how Finland will promote achievement of the SDGs nationally, in the European Union (EU) and globally. Since 2017, Finland has developed shorter-term implementation plans for the 2030 Agenda that cover respective government terms. In early 2021, the government released a sustainability roadmap to translate the Government Programme's goal of a "socially, economically and ecologically sustainable society" into specific objectives.

Finland should further integrate sustainable development into development co-operation (Lähteenoja et al., 2019). The level of official development assistance (ODA) fell considerably between 2014 and 2018 as part of fiscal consolidation efforts. The ODA budget cuts affected support to climate change and other environment-related activities. ODA rebounded in 2019 and continued to grow in 2020. It was 0.47% of gross national income (GNI) in 2020. However, this is still well below the level preceding the cuts (0.59% in 2014) and the commitment to achieve a 0.7% ODA/GNI ratio by 2030. In 2019, Finland committed 25% of its total bilateral allocable aid in support of the environment and the Rio Conventions. This is ten percentage points below the average of countries that are members of the OECD Development Assistance Committee (OECD, 2021b).

3.3. Promoting a green and inclusive economic recovery from the COVID-19 crisis

A swift and well-targeted policy response helped limit the health and economic effects of the COVID-19 pandemic. Finnish gross domestic product (GDP) shrank by 2.8% in 2020, less than on average in the Euro Area (-6.8%). The economy is projected to return to pre-pandemic levels at the end of 2021. Furthermore, as containment measures recede and vaccination continues, the economy is expected to grow by 2.7% in 2022. Unemployment is projected to return to pre-pandemic rates by the end of 2022 (OECD, 2021c).

Fiscal support was sizeable. Discretionary fiscal measures (additional spending and forgone revenue) amounted to about EUR 9 billion in 2020 and EUR 6 billion in 2021 (or 3.8% and 2.4% of GDP, respectively). Most of this support aimed at coping with the pandemic and preparing for economic recovery (MoF, 2021a). The budget deficit and the debt deteriorated mainly because of the crisis response (Chapter 1). Once the recovery is firmly established and the pandemic has subsided, fiscal prudence will be required to stabilise the debt-to-GDP ratio, which is projected to exceed 90% in 2022 (OECD, 2021c).

Finland's response to the pandemic has a strong environmental and social sustainability component. A working group on sustainable recovery was set up in April 2020 to help identify measures to promote economic recovery, reduce GHG emissions and reverse the decline in biodiversity. The working group also mapped out longer-term actions to accelerate the transition to a carbon-neutral circular economy in line with the European Green Deal. According to the group, Finland's first fiscal support package (adopted in June 2020 as part of a larger supplementary budget proposal) included EUR 1.5 billion worth of measures that fulfil sustainable recovery criteria (MoE, 2020).

Between the onset of the crisis and mid-2021, Finland allocated 58% of recovery spending (or about EUR 2.2 billion) to "green measures", which is high by international comparison (O'Callaghan, Murdock

and Yao, 2020). As in many other OECD countries, Finland's support has a strong focus on climate mitigation and largely targets the transport and energy sectors, which are main sources of GHG emissions and are candidate for quick roll-outs (OECD, 2021d). Measures included grants to municipalities for sustainable infrastructure projects (e.g. cycling and green areas); large-scale investment in public transport (including in railway and inter-city rail connections); funding for clean energy infrastructure, energy efficiency and charging station for electric vehicles (EVs); investment in national parks and forest biodiversity; and support to research and innovation.[4] However, like many countries, Finland has provided support to rescue its national air carrier, as well as other hard-hit industries. These may be considered to generate negative environmental effects (OECD, 2021d).

In mid-2021, the government started implementing the Sustainable Growth Programme 2021-26. A dedicated inter-ministerial working group oversaw development of the programme. It is also in charge of monitoring its implementation, although indicators are not yet defined. The programme aims to use public funding to leverage private investment and open up new markets and business opportunities. It is funded by the Next Generation EU funds (EUR 2.9 billion in 2021-23). It encompasses the Recovery and Resilience Plan (RRP) funded by the Recovery and Resilience Facility (RRF) (EUR 2.1 billion in 2021-23 or 1% of Finland GDP).[5] The RRF is estimated to boost growth by 0.3 percentage points in both 2021 and 2022 (OECD, 2021c).

The programme builds on four pillars: green transition, digital economy, employment and skills, and access to health and social services. The green transition pillar is allocated over half of the RFF, which is well above the 37% EU benchmark. About a quarter of the programme funding will be for digitalisation (e.g. to facilitate remote working). The programme also includes approximately EUR 700 million in funding for research, development and innovation activities.

Measures for digitalisation and research and development can also contribute to the green transition (MoF, 2021b). Most green measures target the energy, buildings and transport sectors, which is in line with Finland's strategy to achieve carbon neutrality (Chapter 4).[6] The RRP is expected to reduce annual GHG emissions by 6% by 2026 (MoF, 2021c). However, the RRP pays relatively little attention to biodiversity and the bioeconomy (Green Recovery Tracker, 2021).[7]

The scope of the RRP may be too broad and not commensurate to available resources, which may hamper its effectiveness. This calls for a better prioritisation of allocations to support an effective transformation of the economy and society. To be eligible for RRP funding, most projects need to be climate-friendly and/or meet the "do no significant harm" principle. However, it is not clear how this assessment will work in practice. The actual contribution of the Sustainable Growth Programme to the green transition goal will depend on the design and timely implementation of relevant measures. This illustrates the importance of further scrutiny during the planning, review and implementation of recovery measures. Much will also depend on the balance of resource allocation in the government budgets till 2026.

3.4. Investing in environmental and low-carbon infrastructure and services

3.4.1. National environmental protection expenditure

Economy-wide expenditure for environmental protection is relatively low in Finland, partly due to the modest level of public spending. National (public and private) environmental protection expenditure averaged about 1.7% of GDP in 2014-18 in Finland. This was below the EU average of 2% and the level observed in Sweden and Denmark. Environmental protection investment declined slightly during the same period. It was 1.2% of total investment of the economy (gross fixed capital formation) in 2018, compared to 2% in the European Union as a whole (Eurostat, 2021a).

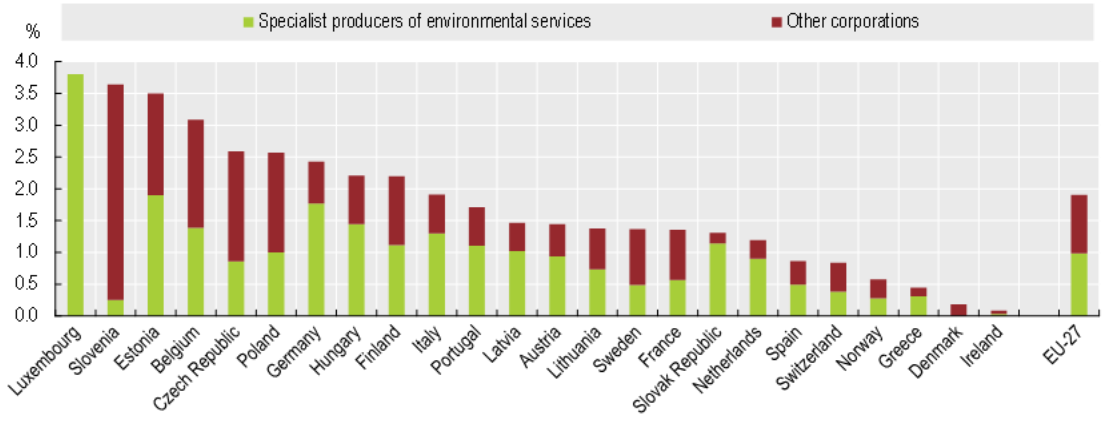
The business sector is the main driver of environmental expenditure in Finland, more so than in most other EU countries. Specialist producers of environmental services and other corporations contributed nearly 70% to economy-wide environmental expenditure in 2018 (the EU average was 56%).[8] The government sector (including the general government and non-profit institutions serving households) contributes comparatively little: 10% of environmental protection expenditure in 2018, or less than half than the EU average. Expenditure in the business sector grew by some 20% in 2014-18 and more than compensated for the decline in government exependiture. Household expenditure – mainly payments for waste and wastewater services – also grew. It was 21% of total environmental protection expenditure in 2018, on par with the EU average (Eurostat, 2021a).

Almost all environmental protection investment is carried out at business level, nearly evenly split between specialist producers of environmental services and other corporations. The government sector contributed just 3% to total environmental protection investment in 2018, well below the EU average of 21%. Only 0.2% of public investment targets environmental protection, the lowest such share in the European Union (Eurostat, 2021a). The strong role of the business sector is linked to the governance of the waste and water sectors. Finland largely relies on private operators to provide waste and water services (Chapter 1).

The share of environmental protection investment in total investment of corporations is high. In 2018, businesses dedicated 2.2% of their investment to prevent and/or limit the negative environmental effects of the main production activity. This was one of the ten highest shares among the European countries of the OECD in 2018 (Figure 3.2). In 2018, air pollution control and climate mitigation accounted for a third of business environmental protection investment. Wastewater management made up for 27% of environmental protection investment, followed by protection of water and soil quality (23%) and waste management (13%) (Eurostat, 2021a).

Figure 3.2. Environmental protection makes up for a large share of business investment

Investment for environmental protection by corporations, percentage of corporations' total investment, selected European countries of the OECD, 2018



Note: Data for EU-27 are estimated by Eurostat. Total investment includes gross fixed capital formation and acquisitions less disposals of non-financial non-produced assets of corporations from annual sector accounts. Luxembourg: environmental investment by specialist producer is not available. Denmark: environmental investment by other corporations is not available.
Source: Eurostat (2021), *Environmental protection expenditure accounts* (database).

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3.4.2. Investment for a climate-neutral and circular economy

Finland has made progress in facilitating investment related to climate change, energy transition and sustainable transport. However, additional investment will be needed for the climate neutrality and circular transition (EC, 2020a). Some Finnish industrial actors have estimated that achieving climate objectives would double investment needs in their industry (MEAE, 2020). Focusing investment promotion policy on the low-carbon energy transition and sustainable transport, along with human capital and innovation, would strengthen Finland's long-term growth potential (EC, 2020a).

Investment will not only be required in clean energy and transport technologies but also in the circular economy and bioeconomy. The shift to carbon neutrality will affect businesses' input and retail markets (e.g. increasing the demand for electricity and alternative raw materials such as biomass, and rising end user prices). This strengthens the case for greater materials efficiency, as well as recycling and reuse of certain products and materials (Material Economics, 2019). Overcoming barriers to circular economy solutions is therefore critical to meeting the carbon neutrality objectives. Investment in the sector needs to focus on waste prevention, separate collection and sorting, as well as on recycling infrastructure (Chapter 1).

The General Government Fiscal Plan 2022-25 allocates 3.1% of budget expenditure to measures targeting the carbon-neutrality goal in 2022 (excluding the RFF). However, this share is planned to decline to 2.3% in 2023 and 2.1% in 2025. The measures include, among others, support for renewable energy generation, transport network development and maintenance, clean technology development, acquisition of nature reserves and sustainable agriculture (MoF, 2021d). Public financial support should target investment that would not occur otherwise, with a view to enhancing cost-effectiveness of public spending and leveraging private investment.

The General Government Fiscal Plan 2022-25 also outlines a number of tax measures that are aligned with the carbon-neutrality goal. These include the gradual removal of some energy tax expenditure and changes in the electricity tax rates for some activities. However, the net effect of a change in peat taxation as from 2022 could be an increase in emissions in the short term (Section 3.6.1).

Renewable energy

Finland has experienced rapid growth of renewable energy in the past decade (Chapter 1). In the power sector, a feed-in premium scheme has applied to renewable electricity projects using wind, biogas and biomass (forest chips and wood fuels) since 2011.[9] In 2018, a technology-neutral tender-based premium scheme replaced the feed-in premium mechanism.[10] Both schemes attracted lots of new onshore wind projects (Chapter 4). In 2018, Finland saw its first wind power investment made without any subsidies (IEA, 2018). A favourable taxation regime has stimulated the use of biomass for power and heat production (Section 3.5.2); mandatory blending quotas have encouraged the use of biofuels for transport (Chapter 4).

Buildings

As Chapter 4 discusses, Finland could further improve the energy performance of its building stock. The long-term renovation strategy aims at decarbonising the building stock through a mix of renovation, phase-out of fossil fuel use and demolition of underused buildings (Chapter 4). A subsidy programme is in place to encourage building renovations. For 2020-22, a budget of EUR 100 million is available to support residential renovation projects that will improve energy efficiency significantly above mandatory standards. Other policies to encourage energy efficiency in buildings include a voluntary agreement with the property sector, energy performance certificates, consumer energy advice, eco-design and energy labelling, as well as a tax credit for abandoning oil heating.

Sustainable transport

Finland set the goal to at least halve GHG emissions from transport by 2030 from the 2005 level (Chapter 4). To this aim, it has subsidised the purchase of EVs (Section 3.5) and the development of public charging stations (Chapter 4). The government estimates that achieving the 2030 target of 25 000 charging stations will require about EUR 415 million in investment by 2030 (MEAE, 2019).

As highlighted in Chapter 4, there is a need to reorient spending towards rail, sustainable modes of transport and active mobility to reduce car dependency. There is also room to improve cost-effectiveness of public transport service provision, especially in rural areas. Finland's public spending on maintenance and investment in transport infrastructure has been heavily skewed towards road transport (Figure 4.5). In a welcome move, the national transport plan 2021-32 attempts to direct investment in new transport infrastructure towards rail. It includes the development of three high-speed railroad lines, with investment costs of over EUR 8.5 billion in the 2020s. In addition, as part of the government response to COVID-19, Finland allocated the highest funds per capita to cycling infrastructure across all European countries (Chapter 4).

3.5. Greening the system of taxes and charges

3.5.1. Overview

The 2019 Government Programme states that "Taxation should take better account of development that is socially, economically and ecologically sustainable" (Finnish Government, 2019). Finland makes extensive use of taxation, user fees and charges that can help achieve environmental goals. However, as recognised by the government, the ambition of becoming a carbon-neutral circular economy calls for reassessing the tax structure.

The government announced a "tax reform for sustainable development". This will involve changes in energy, transport and mining taxation; promotion of the circular economy by tax means; and study of an innovative consumption tax based on emissions. The proposed tax reform is in line with, and in some respects goes beyond, several recommendations from the 2009 OECD Environmental Performance Review about reviewing taxes and subsidies and increasing the cost-effectiveness of economic instruments (OECD, 2009). The government committed to draw a roadmap on sustainable taxation to support the climate neutrality goal, while maintaining stable tax revenue. As of September 2021, work in this area has focused on energy and transport taxation.

Finland's level of taxation is among the highest in the OECD, with total tax revenues amounting to 42% of GDP compared with an OECD average of 34%. This reflects a more extensive welfare system and higher-quality public services than in most other countries. Finland has been moving towards a more growth-friendly tax system in recent years, with cuts in corporate income tax rates, reduced income taxation for lower- and middle-income households, and increasing shares of revenue from environmentally related taxes.

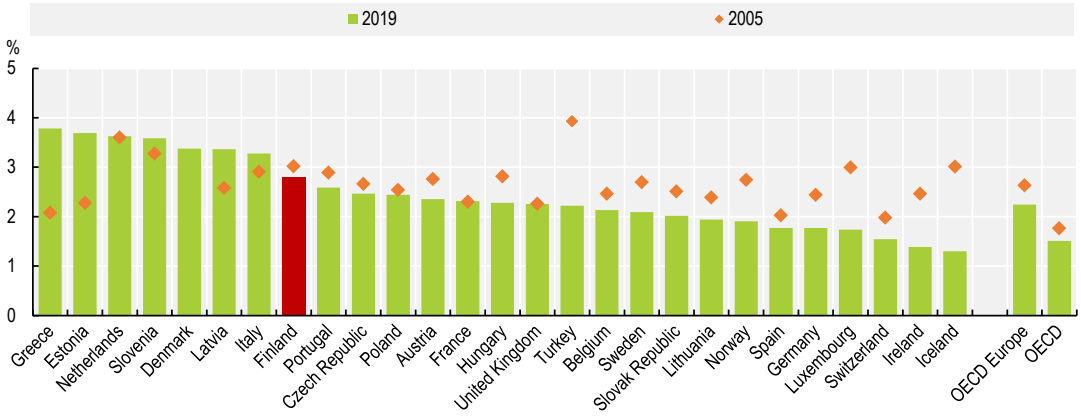
The tax burden on labour, however, remains among the highest in the OECD. Reducing subsidies and tax expenditures and further increasing taxes that do not impose large economic distortions (including environmentally related taxes) could help ease the tax burden on labour, while contributing to achievement of environmental goals (OECD, 2020). Acting in this area would also help achieve fiscal consolidation. This has become more pressing because of the increase in public debt to finance the management of, and recovery from, the COVID-19 pandemic (Section 3.3).

In 2019, environmentally related taxes accounted for 6.6% of total tax revenue and 2.8% of GDP. This places Finland far above the OECD average (Figure 3.3). Energy taxes raise roughly two-thirds of total environmentally related tax revenue. Transport-related taxes account for the remaining third; this is a high

share compared with most other OECD countries. As in many other countries, environmental taxation on pollution or resource use is negligible in terms of revenue.

Figure 3.3. Revenue from green taxes is among the highest in OECD Europe

Environmentally related tax revenue as a percentage of GDP, OECD Europe, 2005 and 2019



Note: Data for 2019 are preliminary and may include partial data.
Source: OECD (2021), "Environmental policy: Environmental policy instruments", *OECD Environment Statistics* (database).

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Between 2010 and 2019, environmentally related tax revenue increased by 13% in real terms, although it declined slightly relative to GDP (Figure 3.3). The increase of nominal rates of energy taxes offset the effect of a decrease in taxable energy consumption and the shift to cleaner fuels, which are taxed less. At current legislation, revenue from energy taxes as a share of GDP is projected to further decline (by 0.6 percentage points by 2030) with electrification and a massive switch to biofuels (MoF et al., 2021). Nominal rates should be regularly adjusted to maintain the tax incentive function and compensate for the decline in the tax base. Establishing a formal mechanism of adjustment (e.g. through an index) would help reduce social and political resistance to otherwise ad hoc tax increases (MoF et al., 2021).

Households pay the highest share of environmentally related taxes. In 2019, households contributed to 33% of energy tax revenue, 76% of vehicle tax revenue, and 42% of pollution and resource taxes (Figure 3.4). Household energy tax bills are nearly twice as high as those paid by other sectors, reflecting tax concessions granted to industry and agriculture. As in other countries, environmental taxation is higher on households and lower on sectors that are more exposed to international competitiveness issues.

Energy poverty is not an acute problem in Finland, with only 1.7% of Finns reporting being unable to keep their homes warm enough (compared with 7.3% in the European Union) (EPOV, 2020). Finland has no dedicated national initiatives addressing energy poverty. However, it provides basic income support for low-income households to cover necessary daily expenses (including heating and electricity costs). There are no social or reduced tariffs for low-income households.

3.5.2. Taxes on energy use and carbon pricing

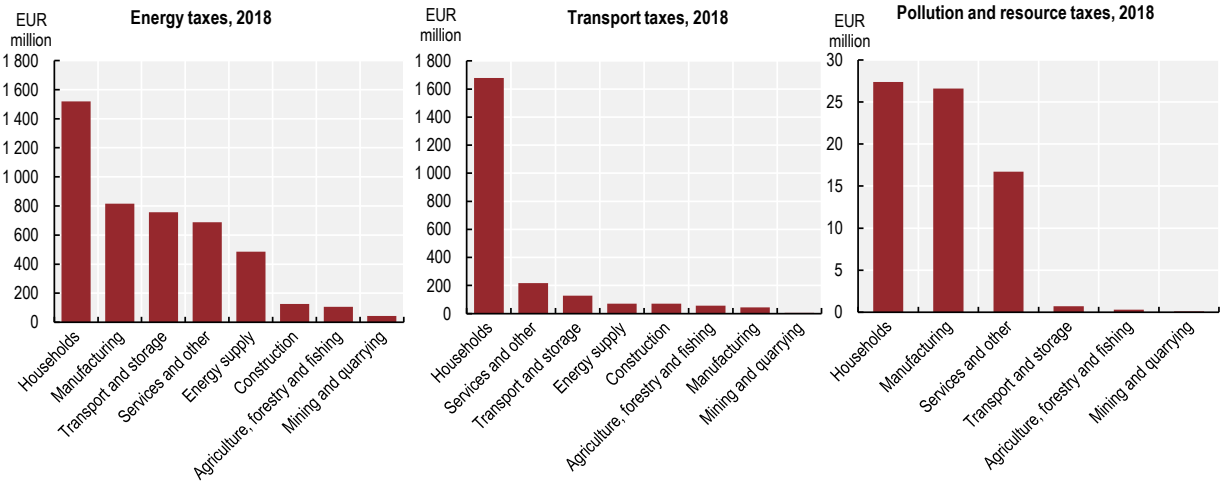
Energy taxes in Finland are levied within the framework of the 2003 EU Energy Taxation Directive, which sets the structure and minimum rates of the taxation of energy products in EU member states. In 2011,

Finland revised its energy taxation to further reflect environmental aspects. Since then, energy taxation has been based on three components:

- An energy tax component, which is based on the calorific value (energy content) of the fuel.
- A carbon tax component, which is based on average lifecycle carbon dioxide (CO_2) emissions of the fuel.
- A strategic stockpile fee component, which is a (small) fixed component used to cover expenses from compliance with international stockpiling obligations.

The energy tax is the largest component in terms of tax revenue. It is levied on both fossil fuels and liquid biofuels with the objective to increase energy efficiency. The tax rates vary across energy uses, with considerably higher rates applying to road fuels than to fuels used for heating or in agriculture.

Figure 3.4. Households bear most of the burden of environmentally related taxes



Note: "Other" includes water supply and waste management, trade and administration.
Source: Statistics Finland (2020), *Environmental Taxes 2018*.

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As in many countries, diesel used for road transport faces a lower energy tax than petrol, despite diesel's higher local air pollution effects; diesel vehicles generally emit more particulate matter and nitrogen oxides per litre used.[11] A higher circulation tax on diesel vehicles aim to compensate for lower rates on diesel fuels (Section 3.5.3). Lower rates also apply to peat; fuels used for commercial shipping and aviation are exempt (as in all EU member countries). Meanwhile, energy-intensive companies and agricultural businesses receive an energy tax refund (which will be phased out; Section 3.6.1). Biogas and biomass fuels are exempt (OECD, 2019).

When Finland introduced the carbon tax in 1990, it became the first country to explicitly tax CO_2 emissions. The carbon tax component is based on lifecycle CO_2 emissions, a feature unique in the world. The tax applies to both fossil fuels and liquid biofuels at a nominal rate of EUR 77 per tonne of CO_2 for transport fuels and EUR 53 for heating fuels. As these nominal tax rates factor in the lifecycle emissions of the fuel, they should be increased by about 20% to be comparable to a tax on CO_2 calculated on the basis of emissions from combustion alone (MoF et al., 2021). This increase would make them among the highest standard explicit CO_2 tax rates among OECD countries.

The carbon tax applies relatively uniformly across all sectors, including to entities covered under the EU Emissions Trading System (ETS). Peat, however, is exempt from the CO_2 tax component (in addition

to benefitting from a lower energy tax component). Biofuels are classified in three categories: i) biofuels that fail to meet sustainability criteria are subject to the same carbon tax as fossil fuels; ii) sustainable first-generation biofuels are subject to 50% of the carbon tax on equivalent fossil fuels; and iii) sustainable second-generation biofuels are exempt. For example, the carbon tax rate on biogasoline sold in Finland is half the standard rate and it is zero for biodiesel. Gaseous and solid biofuels enjoy a zero carbon tax as well (OECD, 2019).

Since 2012, the CO_2 tax for transport fuels has been based on lifecycle emissions. This approach harmonised the tax bases for fossil fuels and biofuels to avoid fiscal state aid problems and made it unnecessary to establish additional tax reductions and exemptions for biofuels (MoF et al., 2021).[12] Finnish tax treatment of liquid biofuels is unique in the European Union. The lower tax levels on biofuels result from the energy and carbon tax methods, as well as sustainability criteria, and not from explicit tax discounts. In January 2019, the lifecycle methodology was extended to fuels for heating and machinery. To limit the additional tax burden due to this change, the carbon tax rate on these fuels decreased to EUR 53 per tonne of carbon dioxide equivalent (CO_2eq).

Finland does not tax fuels used to generate electricity in accordance with the EU Energy Taxation Directive. The EU ETS generally covers the electricity sector. However, the energy tax and the strategic stockpile fee apply to electricity consumption, irrespective of the source to generate the electricity. Two electricity tax rates apply: a lower (class II) rate for industry, agriculture, mining and data centres, and a higher (class I) rate for other users (households, service sector, etc.). Since 2015, electricity produced from small-scale plants benefits from a tax exemption. Table 3.1 presents the energy tax rates applied in 2021.

Table 3.1. Energy excise taxes on selected fuels in 2021

Energy source	Energy tax	Carbon tax	Strategic stockpile fee	Total
Petrol (EUR/litre)	0.54	0.21	0.0068	0.76
Diesel (EUR/litre)	0.35	0.25	0.0035	0.59
Hard coal (EUR/tonne)	71.45	147.81	1.18	220.44
Natural gas (EUR/MWh)	10.33	12.94	0.084	23.354
Electricity – tax class I (EUR/MWh)	22.4	-	0.13	22.53
Electricity – tax class II (EUR/MWh)	0.5	-	0.13	0.63
Peat (EUR/MWh)	5.70	-	-	5.70

Notes: Electricity tax class I is generally levied on business activities such as services, forestry and construction, as well as on electricity used in the public sector and households. Electricity tax class II covers electricity consumed by industry, mining, data centres and greenhouses. Only peat used in power or heating plants with a capacity of more than 5 000 MWh a year is subject to the energy tax.
Source: Finnish Tax Administation (2021), "Excise Taxation", website, www.vero.fi/en/businesses-and-corporations/taxes-and-charges/excise-taxation/ (accessed on 24 August 2021).

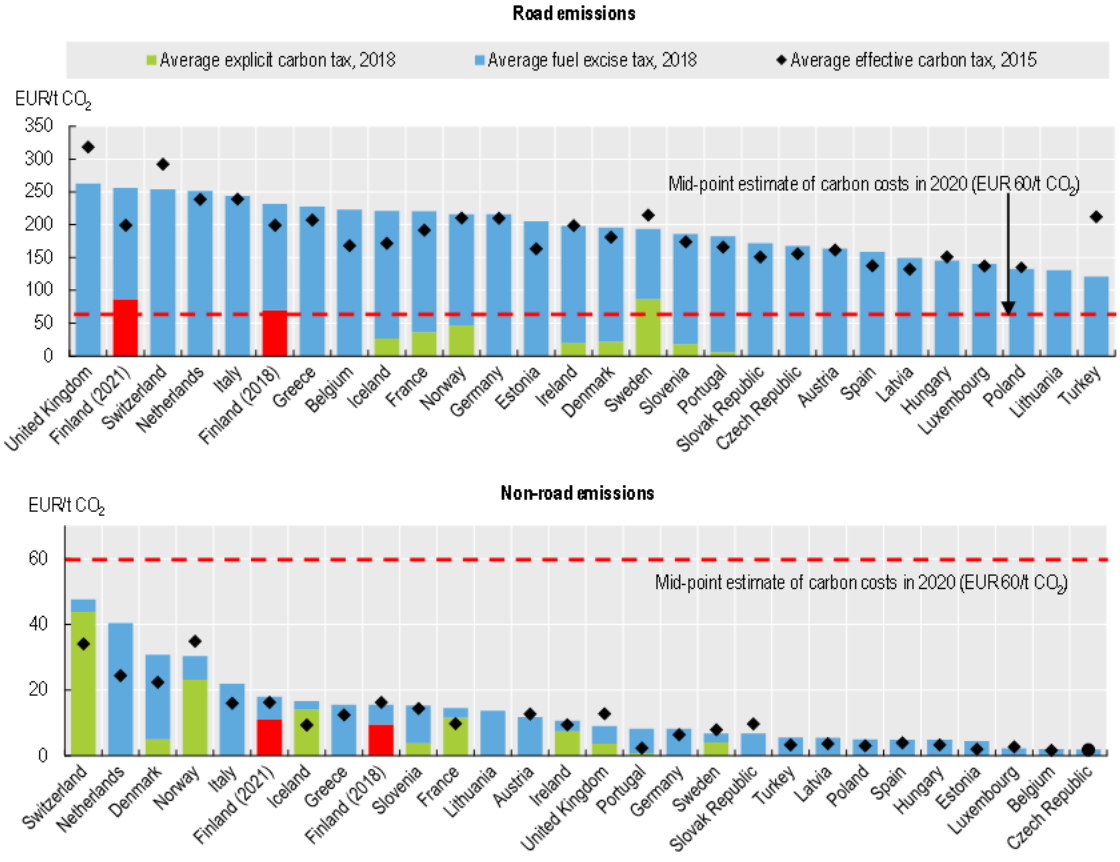
Until 2018, fuels used in combined heat and power (CHP) plants, which are covered by the EU ETS, benefited from a 50% carbon tax exemption. In January 2019, this carbon tax discount was turned into a full exemption from the energy tax to increase the relative tax burden on high-carbon fuels, notably coal (MoF et al., 2021). In 2021, Finland reduced the energy tax discount for CHP based on fossil fuels. Nonetheless, CHP continues to enjoy a favourable tax treatment compared to heat production plants. At the same time, the mix of energy and carbon taxation and ETS allowance prices discourages the use of fossil fuels in CHP plants, while providing incentives for biomass combustion (Chapter 4).

Average effective tax rates on CO_2 emissions from energy use (including from burning biomass) are among the ten highest in the OECD. As such, they provide relatively strong incentives for energy savings and GHG emission reductions across the economy (Figure 3.5). These rates consider both the energy and carbon tax components and various tax reductions and exemptions. Recent increases in the tax rates for

transport and heating fuels have further strengthened the effective carbon tax in both the road and non-road sectors.

Figure 3.5. Effective tax rates on CO_2 emissions from energy use are relatively high

Average effective tax rate on CO_2 emissions in the road and non-road sectors, Finland and OECD Europe



Note: Tax rates as applicable on April 2021 for Finland; tax rates as applicable on 1July 2018 for all other countries. CO_2 emissions are calculated based on energy use data for 2016 from IEA (2018), *World Energy Statistics and Balances*. Emissions from the combustion of biofuels are included in the emission base. The average effective carbon tax rate in 2015 is the sum of the average explicit carbon tax rate in 2015 and the average fuel excise tax rate in 2015, as reported in OECD (2018), *Taxing Energy Use 2018*, converted in 2018 prices using OECD inflation data. Changes in average effective tax rates over time are also affected by inflation, exchange rate fluctuations and changes in the composition of the energy mix.

Source: Calculations of the OECD Centre for Tax Policy and Administration based on OECD (2019), *Taxing Energy Use 2019: Using Taxes for Climate Action*.

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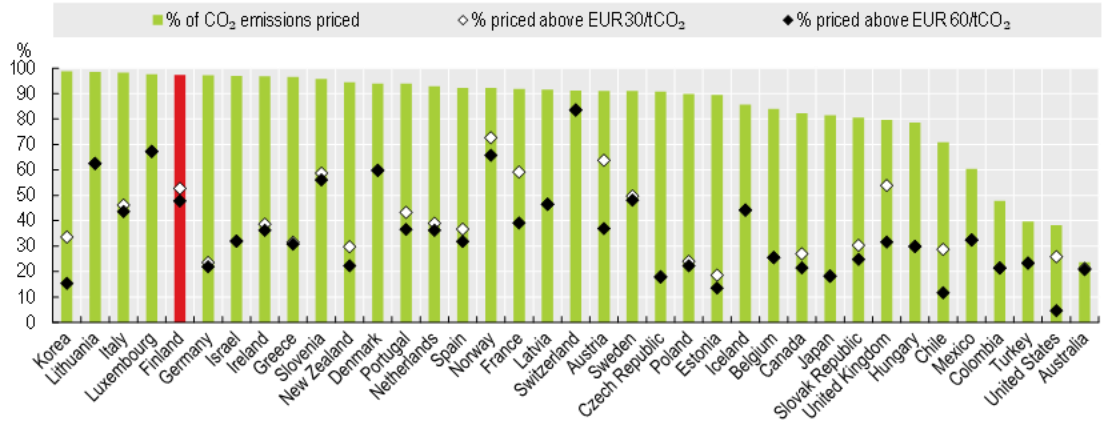
Finland's effective carbon tax rates on road CO_2 emissions increased between 2015 and 2018 (as they have in most countries). However, unlike the trends in most European countries of the OECD, the effective tax on non-road CO_2 emissions in Finland declined in 2015-18 (Figure 3.5). This can be attributed to a considerable increase in the use of (untaxed) biomass combined with less use of highly taxed coal (OECD, 2019). Finland could better assess the potential net effect of taxing solid biofuels on GHG emissions and revenue. It could consider the option of extending the energy and carbon tax structure (based on lifecycle GHG emissions) to solid biofuels.

In addition to the energy tax, some energy uses are subject to carbon pricing through the EU ETS. The EU ETS covered about 45% of Finland's total GHG emissions in 2019, a share that declined over time with the shift to renewables (preliminary data indicate that 41% of emissions were under the EU ETS in 2020) (Chapter 1). The OECD estimates that – accounting for both energy and carbon taxes and the EU ETS – Finland priced nearly all CO_2 emissions from energy use in 2018. However, less than half were priced above EUR 60 per tonne of CO_2 – the mid-point estimate of carbon costs today (Figure 3.6). These numbers disregard the CO_2 emissions from the combustion of solid and liquid biofuels (which are taxed less). If these emissions are included, Finland priced 62% of CO_2 emissions, with merely 24% of emissions priced above EUR 60 per tonne of CO_2 (OECD, 2021e). Emissions priced at EUR 60 per tonne of CO_2 or above were primarily emitted by road transport and, to a lesser extent, industry. By contrast, nearly three-quarters of emissions from residential and commercial energy use are unpriced, reflecting the prevalence of biomass for heating in this sector.

Figure 3.6. There is scope for more ambitious carbon pricing

Share of energy-related CO_2 emissions priced in OECD countries, 2018



Note: Excludes emissions from the combustion of biomass.
Source: OECD (2021), "Environmental policy: Effective carbon rates", *OECD Environment Statistics* (database).

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The government announced an overhaul of energy taxation to help achieve a carbon-neutral economy by 2035 and to benefit renewable energy (Finnish Government, 2019). It started with raising tax rates on transport fuels in 2020. A working group was established to inform the energy tax reform process. The government started to implement other changes to energy taxation in 2021.

Most notably, changes to energy taxation include the phase-out of the industrial energy tax rebate system by 2025 (Section 3.6.1). At the same time, the electricity tax for class II users (industry, mining, greenhouses and data centres) was lowered to the EU minimum rate (from 0.69 to 0.05 cents per kWh) in 2021. The two measures, which aim to support decarbonisation through electrification, are expected to be budget-neutral. With the same purpose, data centres, heat pumps and electric boilers generating heat for district heating networks will be transferred to the lower electricity tax category as from 2022.[13] Moreover, the government increased the energy tax on heating fuels and reduced the tax discounts on paraffinic diesel and fossil fuels used in CHP. It also nearly doubled the energy tax rate on peat.

There is scope to continue moving towards a more stringent carbon pricing policy. As recommended by Parry and Wingender (2021), Finland should consider a progressive increase of the effective carbon price to reach a target level by 2030 (e.g. EUR 125 per tonne of CO_2). It could set a trajectory of future effective carbon prices for each fuel in each sector, with a view to progressively reach an economy-wide price by 2030. This could be done by introducing annual surcharges on fuels. Such surcharge would be equivalent to the difference between the yearly target price and the prevailing effective carbon price resulting from the combination of the carbon tax, energy taxes and the ETS allowance price. This would be similar to the carbon price floor mechanisms in place in the Netherlands and the United Kingdom (OECD, forthcoming). A target carbon price of EUR 125 is estimated to have relatively modest impacts on revenue, welfare and energy prices (Parry and Wingender, 2021). Still, it should be part of a comprehensive fiscal reform that reduces labour income taxes and addresses potential adverse impacts on households and competitiveness.

3.5.3. Transport-related taxes and charges

Finland's vehicle taxation encompasses two taxes: a one-off registration tax (the *car tax*) and an annual vehicle circulation tax. The car tax is calculated as a percentage of the vehicle's retail price, with the tax rate varying according to the vehicle's CO_2 emissions (since 2008). The rate rises from 0% for zero-emission vehicles in one-gramme increments to 360 grammes of CO_2 per kilometre (gCO_2/km), where a tax rate of 50% applies.[14] This is a relatively high maximum registration tax rate compared to most other European countries. Vans used for goods transport and distribution benefit from a reduced tax rate; lorries, buses and tractors are not subject to the tax. Until October 2021, EVs were subject to a 2% tax rate. Since then, EVs have been exempted from the car tax. At the same time, the annual vehicle circulation tax on EVs has been raised, with a view to shift the tax burden on EVs away from the point of sale and encourage purchase of such vehicles.

The annual vehicle circulation tax has two components: i) a base tax that applies to all cars and vans; and ii) a motive power tax that applies to passenger cars, vans and heavy goods vehicles that are powered by other than petrol engines (i.e. diesel, electric and gas-powered cars). The base tax depends on the vehicle's CO_2 emissions intensity and ranges from EUR 53 to EUR 654 per year. The motive power tax intends primarily to rebalance the effect of lower fuel taxes on diesel fuel, natural gas and electricity compared to petrol. For diesel cars, the motive power tax is set at EUR 0.055 for each 100 kg of gross weight for every day the car is registered, while hybrid and electric cars pay lower rates.

A purchase subsidy of EUR 2 000 for EVs of up to EUR 50 000 (not including plug-in hybrid models) was in place between 2018 and 2021. The subsidy is expected to be extended to 2022. In addition, a scrapping bonus of the same amount was granted for the purchase of a new low-emission passenger motor vehicle in 2020-21. A scrapping bonus of up to EUR 1 000 can also be used to purchase a new electric bicycle or a season ticket for public transport. This could provide incentives to use sustainable modes of transport (Chapter 4).

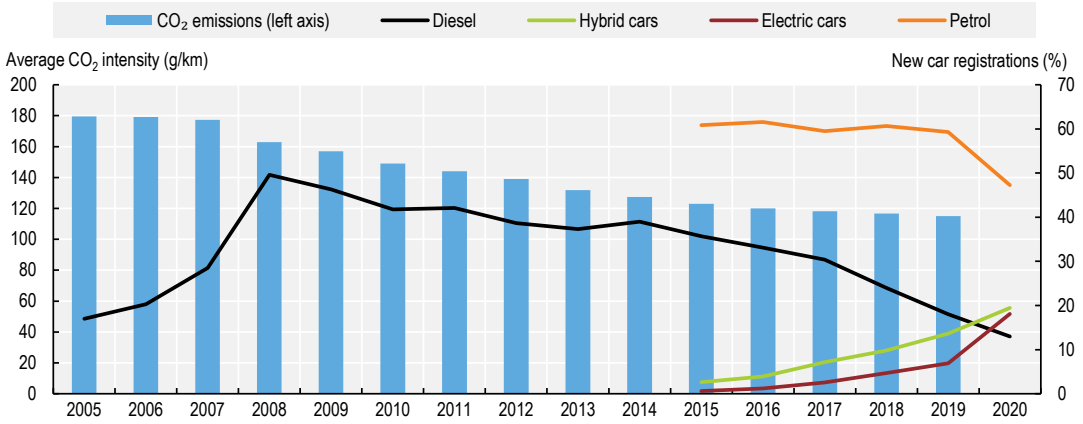
In recent years, the share of internal combustion engine car sales started declining, while that of hybrid and electric cars began to rise visibly. In 2020, hybrid and electric cars jointly accounted for 38% of car sales, compared to 13% for diesel cars and 47% for petrol cars (Figure 3.7). In mid-2021, first registrations of electric cars outnumbered those of diesel cars for the first time. This suggests the combination of vehicle tax design and EV purchase subsidy has contributed to incentivising the purchase of lower-emission cars.

As a result, the average CO_2 intensity of newly registered cars declined steadily over the past decade. It reached 115 gCO_2/km in 2019 (Figure 3.7) – still some 20% above the EU fleet-wide target for 2021. The car tax design was found to have had a positive, albeit small, impact on the CO_2 emissions intensity of newly registered cars (Harju et al., 2018). At the same time, the CO_2 intensity of new diesel cars has been rising in recent years. This is largely due to the growing share of the sport utility vehicle segment and camper vans (Chapter 4).

Similar to other countries, the reform that linked vehicle taxes to CO_2 emissions in 2008 led to a spike in the purchase of diesel cars. Since then, the share of diesel cars in new registrations has been declining steadily (Figure 3.7). However, diesel cars dominate the used car segment. Sales of used (imported) diesel cars continued to grow to reach 60% of all used car sales in 2016. This share dropped to 46% in 2019. Overall, the share of diesel cars in the fleet continued to rise to 28% of total cars in use in 2019, and has started to decline slightly since. In addition, the passenger car fleet is old. The average age of cars was 12.5 years in 2020, above the EU average of 11.5 years and well above the average age of cars in other Nordic countries (FICAS, 2021). Old diesel vehicles are a major driver of air pollution.

Figure 3.7. Electric vehicles account for an increasing share of new car registrations

Average CO_2 intensity of newly registered passenger cars and shares of new car registrations by fuel, 2005-20



Source: Eurostat (2021), *Average CO_2 emissions per km from new passenger cars* (database); FICAS (2020), *Long-term Statistics*, Finnish Information Centre of Automobile Sector; FICAS (2021), "Passenger car fleet by fuel type", *Statistics,* Finnish Information Centre of Automobile Sector.

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The higher motive power tax on diesel vehicles has only partially offset the incentives to purchase diesel cars linked to lower taxes on the fuel and the CO_2-based vehicle taxation. The motive power tax does not reflect the marginal cost of fuel use, including environmental costs. Higher amounts of fuel used by any given vehicle will imply higher emissions for that vehicle. The generally higher efficiency of diesel vehicles results in lower fuel costs for a given distance driven, a benefit that is entirely captured by the owner (Harding, 2014). In addition, the motive power tax for diesel vehicles has not been raised since 2012 and the average energy tax on diesel fuel in 2021 was lower than in 2012.[15]

A higher energy tax on diesel would better reflect the social costs of driving a diesel car.[16] Ideally, fuel and vehicle taxes should be complemented by distance-based charges dependent on vehicle emission parameters and the place of driving to best address air pollutant emissions; road charges based on place and time of driving could complete the mix to tackle congestion where needed (van Dender, 2019).

In its 2019 programme, the government announced its intention to revise the vehicle tax regime in line with the GHG emissions reduction goals for the transport sector, the expected shift towards automation and the spread of mobility as a service. The intention is to develop a tax policy that both supports climate objectives and secures the fiscal base of transport taxation in the long term. Revenues from environmentally related taxes are expected to decline over the next decade. The largest revenue losses will result from declining transport fuel tax revenue due to electrification and use of biofuels, which are taxed less (MoF et al., 2021). OECD analysis suggests the best way to achieve the dual goal of reducing

GHG emissions and supporting fiscal revenue is a gradual shift from energy-based taxation of road transport towards a comprehensive system of road use charges. The charges would be differentiated according to where and when the driving takes place and the type of vehicle used (van Dender, 2019).

Finland does not charge for road use, whether based on distance travelled, time on the road or congestion levels. Finland is one of only three European countries not to have a road pricing scheme in place for heavy goods vehicles. However, the motive power tax is proportional to the time a vehicle is registered. Hence, it could be broadly likened to a time-based charge (vignette).

In 2021, a government-appointed working group investigated possible changes to transport taxation to achieve GHG emission reduction targets. The working group concluded that fuel taxation remains the most cost-effective way to curb CO_2-emissions from transport. It considered that strengthening vehicle taxation is a better revenue-raising solution than introducing a nationwide road pricing scheme, which would imply considerable administrative and technical costs. At the same time, the working group acknowledged that lower costs of driving (once the fleet is electric) may encourage higher vehicle use. This, in turn, may require localised and targeted policy interventions such as congestion charges in regions suffering from high traffic volumes (MoF, 2021e).

Helsinki region – the only region with congestion problems – has been considering congestion pricing. Road pricing would help address congestion, increase use of public transport and reduce environmental impacts of road transport in the region (HSL, 2016). Road charges could be put in place in the Helsinki region within the existing administrative structure. However, the legislation does not permit municipalities to implement such systems.

The government announced its intention to introduce legislation enabling congestion charging in city regions (Finnish Government, 2019). Implementation of congestion pricing would require an assessment of how revenue could be used to improve the effectiveness and social acceptability of the scheme. One possibility, for example, would be investing in public transport and active mobility.

As mentioned in Section 3.5.2, fuels used for commercial aviation are not taxed. Finland does not impose a passenger aviation tax. A citizens' initiative on this issue (aimed at mitigating CO_2 emissions) gathered more than 50 000 signatures, which means Parliament must consider the introduction of a flight tax.

Tax treatment of company cars and commuting allowances

The benefit of using a company-owned car is taxed based on the principle that private use of such cars should be treated like wage income (i.e. taxed at full value). The taxable benefit is based on two components: the vehicle price (with the tax rate decreasing as the vehicle ages) and distance travelled for personal use.[17] Although the true value of the in-kind benefit of company cars could be underestimated, this tax model can be considered good practice. The Finland policy still provides incentives for employees to be paid in the form of a company car (e.g. rather than in cash). However, such incentives are lower in Finland than in many other OECD countries.

Parking space provided by the employer, on the other hand, is not taxed. This risks increasing the demand for on-the-job parking and hence the use of cars for commuting. This is especially the case in urban areas where parking space is scarce and may conflict with other uses, such as in the city of Helsinki.

In January 2021, Finland reduced the taxable value of the in-kind benefit for company-owned zero-emission electric vehicles by EUR 170 per month. According to the working group on the reform of transport taxation, this tax exemption is a costly way to reduce emissions. Costs (in terms of forgone income tax revenue) are estimated at EUR 500-1 000 per tonne of CO_2 over ten years (MoF, 2021e). Nonetheless, the General Government Fiscal Plan 2022-25 extends this benefit to non-electric low-emission company cars (hybrid and gas-powered), which can lead to increased CO_2 emissions from company cars. Finland also exempted the benefit of charging electric cars at the workplace as of January 2021. Both measures remain in place until 2025.

Employees travelling to work benefit from a tax deduction to compensate for commuting expenses. These deductions are up to the amount of the lowest cost of commuting, regardless of the means of transport used. When public transport is available, the deduction is based on the cost of a long-term public transport ticket. However, for many employees the calculation is based on the cost of car commuting because public transport is not available.[18] This commuting allowance scheme aims to avoid distorting choices between means of transport for commuting. However, it still provides a hidden subsidy to live farther from work and public transport services and, in turn, to commute by car. If the employer pays for (or reimburses) commuting costs, they are tax exempt if public transport is used (up to EUR 3 400 per year). However, they are fully taxable if other forms of commuting are used (e.g. private car use). The fringe benefit of a bicycle provided by the employer is tax-free up to EUR 1 200 per year.

3.5.4. Taxes on pollution and natural resource use

Taxes on pollution and natural resource extraction and use account for merely 1% of environmentally related tax revenue (compared with 5% in OECD Europe). Finland levies a number of taxes and charges on material use, waste generation and natural resource use (see below). A noise charge applies to night-time departures of turbo jet aircrafts in the Helsinki-Vantaa airport. The revenue of fishing and hunting licence fees is used to finance fish population and game management. However, no levies apply to water abstraction, water pollution, air emissions, fertilisers or pesticides.

Waste and material use

Since 1996, a landfill tax has aimed to reduce the amount of waste sent to landfills. In line with the recommendation of the 2009 OECD Environmental Performance Review, the tax now also applies to private landfills. In 2016, the tax rate was increased from EUR 55 to EUR 70 per tonne. Waste categories with no technical treatment or feasible use alternative to disposal at landfills are exempt (e.g. mineral and inorganic chemical process waste). The tax has contributed to reducing landfilling. However, it had only limited effects on recycling rates as much of the previously landfilled waste was diverted to incineration plants for energy recovery (Chapter 1).

Increasing the price of waste incineration could help steer waste streams from incineration towards recycling. The EU ETS exempts incineration of municipal and hazardous waste, but Denmark and Sweden, for example, have opted to include it. Finland should consider doing the same. Denmark also applies an incineration tax based on the energy and CO_2 content of the incinerated material to encourage recycling of the most energy-intensive waste, such as plastics. However, a 2021 Finnish study concluded that a weight-based waste incineration tax based on the price of EU ETS emission allowances or equivalent to the energy tax rate would not yield significant increase in recycling and CO_2 emission savings. The extra costs of incineration would be passed on to households via waste fees, but the increase would be insufficient to produce any behavioural change in waste sorting (Prime Minister's Office, 2021).

Any form of pricing incineration should be included in a broader policy package. Such a package should look at the entire waste value chain. It should thus aim to increase waste sorting at source, streamline producer responsibility schemes and promote development of recycling markets (Prime Minister's Office, 2021).

In this respect, the 2021 changes to the Waste Act (Chapter 1) provide a good basis to advance separate collection and recycling. Green Deal voluntary agreements between the government and industry sectors can contribute to achieving circularity and climate neutrality goals (Chapter 2). Among agreements in place as of 2021 were those aiming to decrease consumption of single-use plastic bags; increase recycling of oil waste; promote reuse and recycling of demolition materials; and recycle plastic packaging at construction sites.[19] To be effective and efficient, Green Deal agreements need to engage a sufficiently large number of actors, as well as set clear and ambitious targets and monitoring mechanisms.

Finland also applies other economic instruments for waste management. Deposit-refund systems for beverage packaging have existed for decades. These deposit-refund systems, coupled with a tax (EUR 0.51 per litre) on beverage containers that are not part of the system, have helped increase the recycling and reuse of packaging materials (EC, 2019). A recycling tax is levied on sales of new tyres of EUR 1.85-61.10 per tyre. An oil protection fee of EUR 0.50 per tonne is charged on imported oil and oil transported through Finland. Revenue from the oil protection fee is earmarked to cover the costs of managing oil spills and cleaning up soil and groundwater contaminated by oil.

Finland has been considering other taxation measures to encourage sustainable waste management and the circular economy. The 2018 Plastics Roadmap, for example, announced a feasibility study on taxing single-use plastics. However, government-led analyses on the taxation of plastic products and non-mineral resources (such as sand, gravel, clay) have concluded the environmental benefits of taxation would be either negligible or lower than the costs (MoF, 2012). The 2019 Government Programme announced to "comprehensively investigate the conditions for using taxation policy to promote a circular economy, for example through a broadly based tax on packaging made from non-renewable natural resources, a tax on energy and carbon dioxide emissions from waste incineration, and an increase in the waste tax levied on landfill waste" (Finnish Government, 2019). At the time of writing, the government was planning to reduce the electricity tax on recycling industry as from 2022.

3.6. Removing potentially perverse incentives

3.6.1. Fossil fuel subsidies

Finland has published annual reports on tax expenditures since 2010. The country is a member of the Friends of Fossil Fuel Subsidy Reform, an informal grouping of non-G20 countries established in 2010. The group works to build consensus on ambitious and transparent fossil-fuel subsidy reform.[20]

According to the OECD Inventory of Fossil Fuel subsidies, Finland's expenditure on fossil fuel support equalled 0.55% of GDP and USD 268 per capita in 2019 (OECD, 2021f). Nearly all support measures are tax expenditure items resulting from reduced energy tax rates to lower the cost of energy consumption in industry, transport and agriculture sectors. There is only one small budgetary support measure, which aims at covering the cost for emergency stockpiling of peat (OECD, 2021g). Figure 3.2 reports the main tax expenditures that Finland considers at least partially environmentally harmful.

Table 3.2. Examples of tax expenditure that are potentially environmentally harmful

Values in million EUR, referring to budgets and budget proposals

Measure	2018	Budget 2019	Budget 2020	Budget 2021
Energy tax refunds for energy-intensive enterprises	222	225	235	225
Reduced electricity tax rate for industry, data centres and greenhouses	625	630	633	832
Reduced energy tax rate for peat	180	194	196	190
Reduced energy tax rate for diesel used in transport	422	419	389	745
Reduced energy tax rate for gas oil used in mobile machinery	464	456	451	476
Energy tax refunds for agriculture	62	55	35	35

Source: MEAE (2019), Finland's Integrated Energy and Climate Plan; GoF (2020), State Budget Proposal 2021.

Finland introduced some tax measures in 2020-21 that help reduce fossil fuel subsidies. This is in line with its climate neutrality goal, as well as recommendations from the 2009 OECD Environmental Performance Review (OECD, 2009). Measures include gradually removing the energy tax rebate for energy-intensive

industries, increasing the tax rate on peat, removing the tax discount on paraffinic diesel and reducing the tax discount on fossil fuel used in CHP. The working group on energy tax reform also proposed the gradual removal of tax expenditures for peat, agricultural fuels and mining activities (MoF et al., 2021). However, no plans have been announced for implementation.

While many EU countries apply lower energy tax rates to industry than to households, Finland applies the same standard energy tax rates to business and non-business use of energy. At the same time, it grants an energy tax refund to selected energy-intensive sectors. This is effectively a subsidy for using fossil fuels; peat and natural gas are the most common fuels used in the sectors that benefit from the tax refund. This refund, which was widened in 2012 in response to competitiveness concerns among the Finnish manufacturing sector, will be gradually phased out by 2025.[21] At the same time, the electricity tax for industry, mining, greenhouses and data centres will be lowered to the EU minimum rate in 2021 (Section 3.5.2). As a result, the electricity tax expenditure will increase as of 2021 (to about EUR 830 million) (Table 3.2). Nonetheless, the mix of the energy tax refund phase-out and the electricity tax rate reduction is expected to be budget-neutral. This combination of measures aims to support decarbonisation through electrification by shifting the tax burden from electricity use to fossil fuel use.

There are two other major sources of forgone tax revenue. A lower energy tax is charged for diesel used in road transport. Energy tax rebates are also available for light fuel oil used in mobile machinery (i.e. off-road agricultural, construction, gardening and municipal use).

Peat continues to benefit from a separate, favourable energy tax regime. As the only domestic fossil energy source, peat is considered important for energy security, and peat production sustains more than 2 000 full-time jobs in rural areas (Chapter 4). Only peat used in power or heating plants generating more than 5 000 MWh a year is subject to the energy tax. Moreover, the rate for the energy tax is lower on a per-unit-of-energy basis than for coal or natural gas. Peat is also exempt from the stockpiling fee and the carbon tax component of energy taxation. If peat were subject to the same energy tax model applying to other fuels, its tax level would be nearly six times as high.

Finland should phase out the tax expenditure on peat, as well as the energy tax refund for agricultural fuels (Table 3.2), as recommended by the working group on energy tax reform (MoF et al., 2021). The working group suggested to gradually raise the peat tax rate to reach EUR 10 MWh in 2023. This would still be less than a third than the tax rate that would apply to peat based on its energy and carbon content. In particular, peat would remain cheaper than coal, thereby discouraging operators from replacing peat with coal. However, it may become convenient to substitute peat with timber wood, which is untaxed. Taxing the use of timber for large-scale energy production could help ensure that wood is not diverted from being used as raw material for processing (MoF et al., 2021).

In line with the working group's recommendation, the government raised the energy tax rate on peat in 2021. It has also been considering further changes to peat taxation to support the goal of halving peat use by 2030. These include a carbon price floor for peat as from 2022, under which peat tax would increase if the EU ETS price fell below a certain threshold. The ETS price needs to stays above EUR 20 /tCO2 for Finland to achieve its target on peat. At the same time, to smoothen the transition, peat installations would receive tax-free allowances for the first 10 000 MWh produced from peat (MoF, 2021d). However, the net effect of this measure would be a loss of tax revenue in the short term and more GHG emissions from peat use.

3.6.2. Agricultural subsidies

Finland's agricultural sector receives among the highest producer support payments in Europe. In 2019, agricultural support under the EU Common Agricultural Policy (CAP) reached EUR 1.4 billion. This support accounts for nearly a third of farm gross return, the highest share among EU member states and far higher than the EU average of 13% (Niemi and Väre, 2019). An additional EUR 319 million was paid as national aid,[22] which mostly supports farmers in northern areas by sustaining their agricultural production.

Nearly three-quarters of Finland's CAP budget is channelled through the EU Rural Development Programme (RDP). The RDP had a total budget of EUR 8.3 billion for 2014-20, of which EUR 2.3 billion was financed from the EU budget (EC, 2020b). The largest part of RDP funding (44%) supported "areas with natural constraints". In Finland, these areas largely refer to cold environments with poor soil, where agricultural production is difficult.

Agri-environment-climate measures received the second largest part of the RDP (21%). Farmers receiving such support must limit use of nitrogen and phosphorus in arable farming. Under the RDP, Finland aimed to put 80% of the used agricultural area under water management contracts, 54% under soil management contracts and 18% under biodiversity management contracts (EC, 2020b).

In addition to the RDP, Finland also receives EU agricultural subsidies in the form of income support (i.e. direct payments), amounting to EUR 525 million in 2019. In accordance with EU rules, at least 30% of this support must be allocated to "greening" measures. However, the European Court of Auditors has criticised the low level of requirements of the greening approach. The approach largely reflects standard farming practices and thus has not encouraged substantial changes in agricultural practices (ECA, 2017).

The upcoming CAP reform and Finland's implementation plan provide an opportunity to improve the effectiveness of greening, as well as of agri-environment-climate measures, in promoting sustainable agricultural practices.[23] This should be done alongside a revision of subsidies that negatively affect biodiversity. In 2015, a national review of such subsidies concluded that some harmful subsidies can be reformed at national level. At the same time, it noted the largest subsidies would need to be reformed at European or global level to address concerns of competitiveness or carbon leakage.

3.7. Fostering eco-innovation and expanding green markets

3.7.1. Environment-related research and innovation

Finland's policy framework is conducive to eco-innovation. Several strategies and programmes aim to develop new know-how, business models, markets and technology. Their ultimate goal is to make the country a leader on innovation for the circular and carbon-neutrality transition. These strategies include those on the bioeconomy and clean technology (cleantech), as well as the National Roadmap to a Circular Economy, among others.

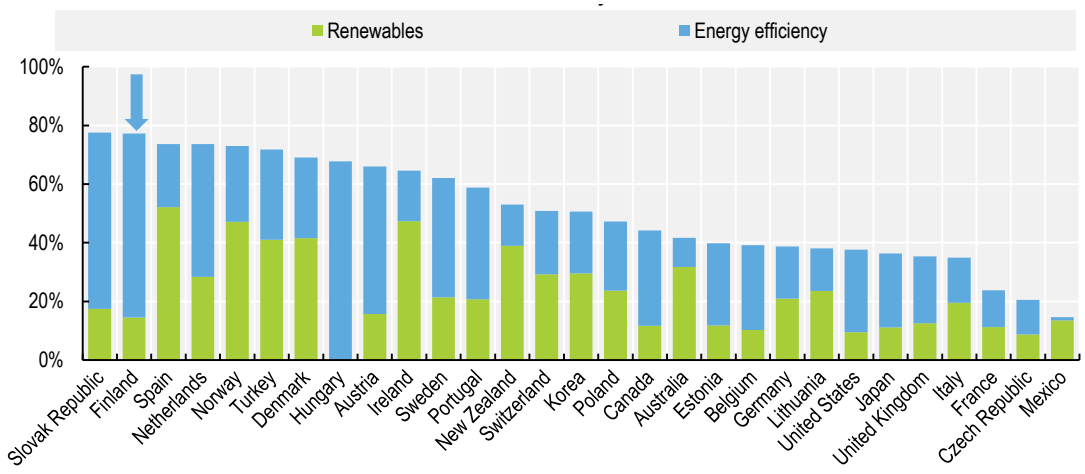
Gross expenditure on research and development (R&D) is high. It is about 2.8% of GDP, above the OECD average (Table of Basic Statistics). The government announced to go further and reach a target of 4% of GDP by 2030, as well as to increase public R&D spending (Finnish Government, 2019). This increase aims to recover from the dramatic drop in R&D expenditure in the aftermath of the global financial crisis and the decline of the Finnish information and communication technology industry.

The government's pledge to increase public R&D expenditure is welcome. Between 2008 and 2017, government R&D funding declined by 17% in real terms. The cuts in public R&D spending exacerbated the drop in business R&D. While public spending has stabilised at pre-crisis levels, private-sector investment has not recovered yet (EC, 2020a). Public spending should focus on accelerating investment in innovation at business level. The Sustainable Growth Programme 2021-26 includes approximately EUR 700 million in R&D for this purpose (Section 3.3).

Finland is a leader in investing in clean energy technology. More than three-quarters of the energy-related public R&D outlays targeted energy efficiency and renewable sources in 2019, among the highest share among the member countries of the International Energy Agency (Figure 3.8).

Figure 3.8. Finland is a leader in public R&D spending on renewables and energy efficiency

Public RD&D budgets for renewables and energy efficiency, percentage of total public energy RD&D, 2019 or latest available year.



Note: 2018 data for some countries. Public energy technology budgets for research, development and demonstration (RD&D).
Source: IEA (2021), *IEA Energy Technology RD&D Statistics* (database).

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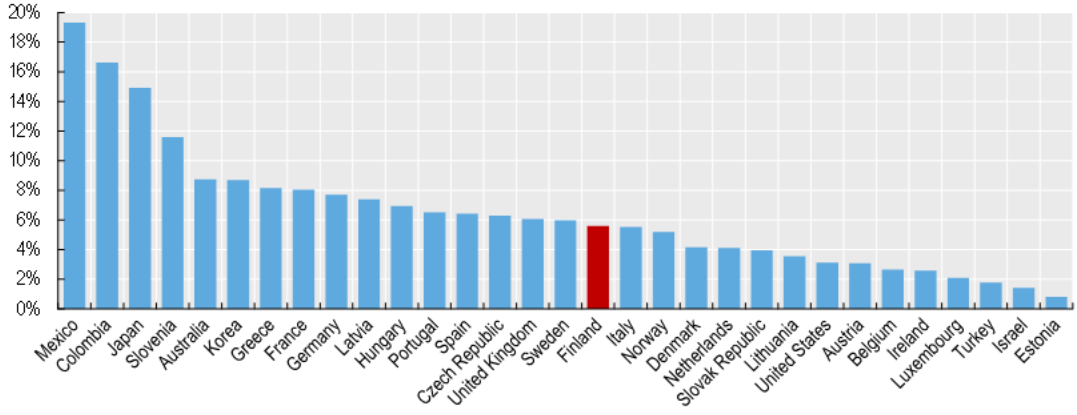
However, environment- and energy-related R&D accounts for 5.5% of public R&D budgets, a relatively low share among OECD countries. This reflects the fact that most R&D spending occurs in the business sector (Figure 3.9).

Figure 3.9. The government R&D budget for environment and energy is relatively modest

Environment-related and energy R&D budgets, percentage of total government R&D budgets, 2019 or latest available year



Note: Government budget appropriations or outlays for research and development (R&D) for energy and environmental objectives; breakdown by socio-economic objective according to the NABS 2007 classification.
Source: OECD (2021), *Government budget appropriations or outlays for R&D* (database).

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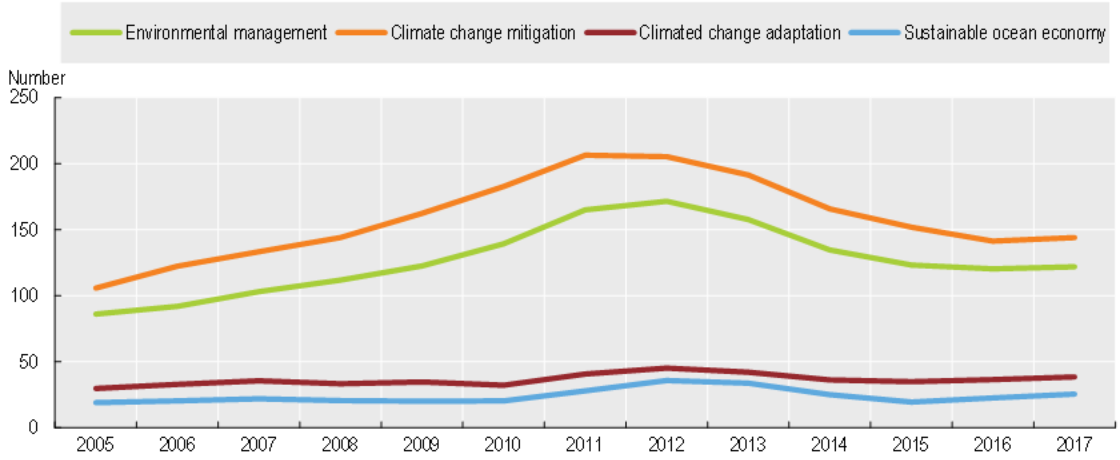
Despite the drop in public and business R&D expenditure, Finland has continued to deliver a high number of patents in environmental technology. Most environment-related patents were for technology to mitigate climate change (e.g. clean energy technologies, low-carbon processing) and general environmental management (e.g. air and water pollution control) (Figure 3.10).

The country is an OECD leader in terms of patents application in environment-related technology. Green patents accounted for about 13% of all patent applications in 2016-18, the ten highest among OECD countries. Finland filed 37 environment-related patents application per capita in the same period (Figure 5 in Assessment and recommendations). Finland has a share of over 1% of the global cleantech market, which is about twice as much as the country's contribution to global GDP (EC, 2019).

Figure 3.10. New technology development focuses on climate change and environmental management

Patent applications by environmental technology group, 2004-18 (three year moving average).



Note: Three-year moving average data. 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 and apply solely to inventions of high potential commercial value for which protection has been sought in at least two jurisdictions.
Source: OECD (2021), "Patents in environment-related technologies: Technology indicators", *OECD Environment Statistics* (database).

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Environmental regulations have been a major driver in shaping the market for low-carbon solutions since the early 2000s. Finland has often pioneered the implementation of EU environmental policies, which has given Finnish companies a first-mover advantage. After the 2009 financial crisis, many businesses started to prioritise investment in low-carbon solutions in response to an increasing customers' demand for cleaner products (Hjelt et al., 2020).

Finnish small and medium-sized enterprises (SMEs) are more innovative than on average in the European Union. About 70% of the cleantech companies operating in Finland are either micro-organisations or SMEs, and have fewer than 250 employees (EC, 2019). However, there is a gap in innovation investment and capacity between them and large companies (EC, 2020).

As in most countries, there is a need to improve collaboration between the basic research institutions and the business sector, particularly SMEs, to bring innovative cleaner technology and products to the commercialisation stage (OECD, 2018). Most public support to private R&D is directed to SMEs. However, this could better target investment in environmental and low-carbon technology, which can pose a higher

financial burden. According to Finnish companies, the insufficient financial support for pilot and industry-scale demonstration projects is a barrier to the climate neutrality transition (MoE, 2020).

Finland has taken steps to remove this barrier. In 2018, the institutions promoting innovation, exports and investment were merged into Business Finland, a one-stop shop that implements innovation support programmes. The agency aims to facilitate collaboration among businesses, research and public organisations. It has launched several programmes to promote investment and innovation in the bioeconomy, circular economy and cleantech sectors. It has provided considerable R&D funding for investment in low-carbon solutions. Energy-related projects accounted for one-third of Business Finland's total innovation funding in 2006-19 (Hjelt et al., 2020). The newly established Finnish Climate Fund (a state-owned company) provides funding for industry-scale demonstration projects of climate and digital technology solutions.[24] In addition, the independent innovation fund Sitra has focus areas on circular economy and carbon-neutral industry.

In addition to applying green public procurement (Chapter 2), Finland is the most advanced EU country in implementing public procurement for innovation (PPI). In 2020, the government launched an action plan to reach 10% of PPI in all public procurement by 2023. This aims to stimulate demand for innovative goods and services, including in the environment field, thereby encouraging industries to produce them commercially on a large scale. As public procurement represents 15% of Finland's GDP, the public sectors can use its large purchasing power to act as an early adopter of innovative goods and services. Finland would benefit from assessing effectiveness of the PPI policy in fostering low-carbon and other environment-related solutions.

3.7.2. The environmental goods and services sector

The environmental industry contributes significantly to the Finnish economy. Finland's environmental goods and services (EGS) sector grew faster than the rest of the economy in 2012-19, in terms of both value added and employment.[25] It also grew more than on average in the European Union (Figure 3.11). EGS contributed nearly 8% to the Finnish GDP and about 10% to exports in 2019, more than in all other EU countries. More than 160 000 people (full-time equivalents) were employed in the EGS sector in 2019 (Statistics Finland, 2020; Eurostat, 2021b).

Resource management activities dominate the EGS sector. These are activities to preserve and maintain the stock of natural resources, including energy, minerals, and forest and water resources. They accounted for nearly 85% of the EGS turnover in 2019. The energy sector (renewables and energy savings) accounted for more than 60% of resource management turnover, reflecting Finland's policy emphasis on the low-carbon energy transition (Figure 3.10). The energy sector is also the single largest source of EGS-related jobs.

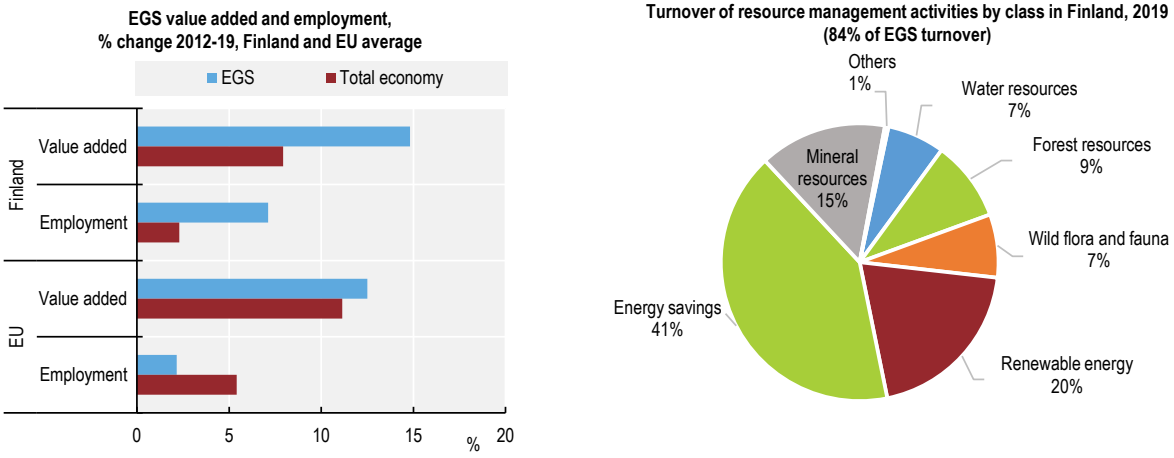
Environmental protection activities accounted for the remaining 15% of the EGS turnover, a relatively minor share compared to most EU countries (Statistics Finland, 2020; Eurostat, 2021b). These are activities to prevent and reduce pollution and environmental degradation (mainly wastewater treatment, waste management, and air and climate protection).

Finland's businesses are particularly active in providing environmental goods and services. The proportion of SMEs offering green products or services is one of the highest in the European Union. One-fifth of SMEs generate more than half of turnover by selling green products or services (EC, 2019).

According to the national impact assessment of the 2035 carbon-neutrality goal, the accelerated deployment of new technologies will lead to growth in exports and manufacturing based on domestic resources, with positive impacts on economic performance and employment. For example, under certain conditions,[26] the value of machinery and equipment production would increase by a factor of 2.5, compared to the business-as-usual scenario. Irrespective of the scenario, the impact assessment suggests there are no trade-offs between achieving climate neutrality by 2035 and citizens' well-being, public finances and

the provision of welfare services (MEAE, 2020). In addition, the circular economy could generate an estimated value added of EUR 2 to 3 billion by 2030 (EC, 2019).

Figure 3.11. Finland's green industry grew, driven by energy resources management



Note: Data for European Union refer to the period 2012-18. Changes in value added are calculated on value added at 2015 prices.
Source: Eurostat (2021), *Environmental goods and services sector* (database); Statistics Finland (2021), *Environmental goods and services sector* (database).

StatLink https://doi.org/10.1787/888934288174

3.7.3. Employment opportunities in the green sectors

The transition to a carbon-neutral and circular economy will bring significant opportunities to create jobs. It is essential to prepare the labour force for this transition to be successful. Finland has an effective system to identify the skills required to address future labour market needs. Circular economy is included in education curricula at all levels.

However, skills shortages are a barrier to innovation and to the uptake of digital and clean technology (OECD, 2020). On-the-job training and lifelong learning opportunities are particularly important for young workers to acquire the right skills, as well as for older workers to maintain their employability throughout their working lives. Finland needs to continue investing in up-skilling and re-skilling its labour force to support deployment of clean technologies and target learning schemes towards the overall greening of the economy (EC, 2020a).

New green jobs are expected mainly in sectors with traditionally limited female representation, such as forestry and cleantech. Education and training schemes need to be adjusted to mitigate existing gender inequalities and encourage women to participate more in science, technology and engineering studies (EC, 2020a).

The transition to a low-carbon economy is expected to entail some job losses in some sectors, areas and communities. The most immediate impact arises from the commitment to halve peat use by 2030. Peat is a domestic energy source and dominates in the interior regions. As of 2020, the peat sector employs between 2 000-2 500 full-time equivalent workers. This number is expected to decrease to 500 by 2025 (Chapter 4).

While job opportunities can emerge in green sectors, the challenge is to ensure these new jobs are created in the same regions facing the risk of job losses. This would help avoid a relocation of workers with potentially negative consequences on family life and communities (OECD, 2021h). An inter-ministerial working group was tasked with proposing ways to help the transition out of peat. Proposed measures

include a programme to support entrepreneurship in the bioeconomy and nature management. In addition, some jobs may be created in the bioenergy sector to replace peat for energy production (Chapter 4). Finland plans to use the EU Just Transition Fund (about EUR 750 million in 2021-27) to finance investment in training and infrastructure to strengthen the local economy and support the local workforce.

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Notes

[1] Finland's first sustainable development strategy dates to 2006.

[2] The eight objectives defined in the 2050 commitment are: equal prospects for well-being; a participatory society for citizens; sustainable employment; sustainable society and local communities; a carbon-neutral society; a resource-wise economy; lifestyles respectful of the carrying capacity of nature; and decision-making respectful of nature (https://kestavakehitys.fi/en/commitment2050).

[3] There have been three citizens' panels, in 2019, 2020 and 2021. About 500 citizens participated in each panel on a voluntary basis. They replied to an online questionnaire on the state of sustainable development and the results of the survey were made public at closing events.

[4] The package also increased capitalisation of the National Climate Fund by EUR 300 million.

[5] In addition to the RFF, Finland will receive funding from other programmes under the Next Generation EU funds, such as those under the Just Transition Mechanism and the European Agricultural Fund for Rural Development.

[6] For example, the RRP provides funding for phasing out oil heating in single-family houses and for building charging infrastructure for electric cars. GHG emission reductions are also expected from investment in the reuse and recycling of industrial sidestreams.

[7] The European Commission describes a bioeconomy as involving “the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy”.

[8] Specialist producers are corporations that offer environmental protection services (e.g. waste or wastewater management) on the market. Other corporations (or ancillary producers) are businesses that do not sell environmental services on the market. Rather, they undertake environmental protection activities in-house and for own use to limit the negative environmental effects of their main production activity.

[9] Under the scheme, electricity producers received a premium on top of the wholesale electricity price for a period of 12 years.

[10] Under this scheme, winners of the tenders will receive a premium when the average three-month market price of electricity is lower than EUR 30/MWh. If the market price exceeds EUR 30/MWh, a portion of the tariff will be awarded on a sliding scale; no aid is paid if the market price is higher than the sum of the reference price and the approved premium.

[11] Emissions of local air pollutants, with the exception of sulphur dioxide, depend on the combustion technology and are not based on the amount of the pollutant in the fuel. Emissions of these pollutants for a given fuel quantity will differ considerably between different vehicle types. Combustion of diesel fuel typically emits higher levels of nitrogen oxides, particulate matter and volatile organic compounds, although the amount of these pollutants is gradually being reduced as diesel technology improves (Harding, 2014).

[12] The state aid rules prevent simultaneous use of tax reductions to promote biofuels and biofuel distribution obligations, which have been in force in Finland since 2008.

[13] Data centres outside the district heating network that meet the criteria for energy efficiency and energy utilisation and building-specific heat pumps of industrial size are also entitled to a reduced electricity tax. The electricity tax reduction also applies to recirculating water pumps in geothermal heating plants. It also planned to transfer recycling industry to the lower electricity tax category from 2022.

[14] The car tax is levied on passenger cars, vans, motorcycles, tricycles and quadra-cycles, and buses. The tax schedule is based on a modality introduced in 2012, but tax rates have changed several times since (Harju et al., 2018).

[15] The nominal rate of the energy tax for transport fuels has been raised several times since 2012. However, the average tax level for diesel has not changed significantly in nominal terms, mainly due to the increasing share of biodiesel (which enjoys a lower energy tax). Taking into account the change in the general price level, the average tax level for diesel in recent years has been lower than in 2012 (MoF et al., 2021).

[16] Most local air pollutant emissions depend on diesel combustion technology and on the composition of the whole vehicle fleet, including older and higher-emitting vehicles, as well as vehicle maintenance and driver behaviour (Harding, 2014).

[17] It is assumed that a company car has an annual mileage of 25 000 km, of which roughly two-thirds are for private trips. If the calculation is not based on the estimated mileage of private use per year, the benefit is calculated on a per kilometre basis. This ranges from EUR 0.07 to 0.20/km (depending on the age of the vehicle and whether the employer or employee pays for fuel). The employee needs to substantiate the values based on kilometres by keeping records (Finnish Tax Administration, 2020).

[18] If no public transport is available, a per-kilometre deduction can be made, where the per-kilometre rate is intended to estimate the actual cost of commuting. Employees biking to work can deduct EUR 85 per year.

[19] Green Deal agreements on CO_2 emissions from waste incineration and on reducing single-use food packaging were under negotiation at the time of writing.

[20] The group brings together Costa Rica, Denmark, Ethiopia, Finland, New Zealand, Norway, Sweden, Switzerland and Uruguay.

[21] Energy-intensive companies that pay more than 1% of their annual value added in fuel and electricity tax are entitled to a tax refund of 85% of the amount paid above that threshold.

[22] When Finland joined the European Union, it negotiated the right to provide additional subsidies to agriculture to those available through the EU Common Agricultural Policy.

[23] Due to negotiations between the European Parliament and the Council of the European Union, the provisional start date of the proposed CAP reform has been postponed to 1 January 2023. A transitional regulation has been agreed for 2021 and 2022.

[24] In December 2020, the State Business Development Company VAKE was transformed into the Finnish Climate Fund.

[25] Environmental goods and services are those produced for the purpose of environmental protection (i.e. preventing, reducing and eliminating pollution and any other degradation of the environment), as well as resource management (i.e. preserving and maintaining the stock of natural resources and hence safeguarding against depletion).

[26] The example refers to the “Continuous Growth Scenario” described in Finland’s Long-term Low Greenhouse Gas Emission Development Strategy. Under the scenario, emission reductions will be achieved by accelerated deployment of new technologies, including robust electrification, digitalisation and industrial renewal (but excluding carbon capture and storage technologies, or CCS). In the alternative “Savings Scenario”, emission reductions will be achieved through the circular and sharing economies, energy efficiency, bioeconomy and CCS.

Part II. Progress towards selected environmental objectives

Chapter 4. Climate change mitigation

Finland has overachieved its national and international mitigation goals thanks to a considerable decline in greenhouse gas (GHG) emissions over the past decade. The country should be commended for its ambitious goal to achieve carbon neutrality by 2035. This chapter discusses emission trends and the challenges of meeting the carbon neutrality target. It highlights how refocusing climate action through a well-being lens and systems redesign can help Finland achieve this target. The chapter reviews climate policy in three sectors – transport, electricity and buildings – that jointly account for about 60% of Finland's GHG emissions. For each sector, the chapter examines strategies to help advance systems redesign and deliver on multiple well-being outcomes.

Recommendations on climate change and well-being

Enhancing coherence of climate mitigation policy

- Strengthen cross-sector co-ordination and embed the carbon neutrality target into the framework of sustainable development; explore GHG emission mitigation scenarios characterised by low energy demand; further emphasise system redesign and behavioural change.
- Improve projections and assessment of the bioeconomy – including the forest industry and use of domestic bioenergy – and of its impact on the potential of carbon removal and on biodiversity; develop a clear strategy for demand and supply of biofuels.

Ensuring a high-accessibility and low-emission transport system

- Reduce car dependency by removing policies that encourage car ownership (e.g. tax-free workplace parking, minimum parking requirements), mainstreaming road management tools (e.g. reallocating road and parking space) and urban redesign (e.g. mixed land use); continue developing multi-modal networks (e.g. through MaaS) to unlock the mitigation potential of shifting towards more sustainable modes.
- Develop metropolitan transport authorities across the country to better co-ordinate transport across municipalities; extend the purview of new and existing ones, e.g. by enhancing capacity for strategic planning or broadening the scope towards other sustainable transport modes.
- Continue to financially support the deployment of public and smart charging stations for EVs; increasingly target support to public charging hubs that enable charging for a variety of users (e.g. shared and private cars, e-bikes, e-scooters) and speed (slow and fast charging), with a view to promoting the shift towards multimodality.
- Apply strong sustainability criteria to domestic and imported liquid biofuels, as well as raw materials for biofuel production; include electricity from EVs into the fossil-free fuel obligation, with a view to accelerating transport electrification and channelling liquid biofuels towards harder-to-abate sectors, e.g. heavy freight, aviation and shipping.

Decarbonising the electricity sector

- Announce a clear phase-out date for peat extraction to provide certainty for stakeholders; strengthen assessment of the cost and benefits of the proposed measures to support workers and communities in the transition out of peat, with a view to maximising alternative business and job opportunities; consider setting up a commissioner or a multi-stakeholder commission to promote dialogue with all relevant stakeholders and ensure consensus about the transition.
- Consider more fine-grained spatially electricity pricing to provide incentives for deploying wind farms closer to consumption centres, and strengthen financial support for offshore wind.
- Improve sector integration by integrated energy system planning, reforming electricity tax rates to support electrification of transport, and improving regulation of distribution system operators (e.g. removing barriers to third-party provision of flexibility, updating tariff design).

Improving the energy performance of buildings and neighbourhoods

- Continue to promote deep retrofits, including through one-stop shops, mandatory energy savings targets, strengthened voluntary agreements with housing companies and industrialisation of deep retrofits, following the Energiesproong model; continue to promote joint procurement of building elements and joint renovation projects; explore alternative financing mechanisms for deep retrofits (e.g. through energy service companies or on-bill financing).

- Further strengthen financial support for non-combustion technologies (e.g. large-scale electric heat pumps) in the decarbonisation of DH networks, including through hybrid systems; further develop mitigation strategies beyond the dwelling level (e.g. promoting compactness, mixed land use and green spaces at the neighbourhood or city level) to unlock the residential sector's potential to reduce energy demand and emissions, recycle waste heat, store carbon, enhance climate resilience and deliver well-being; improve the green factor method and mainstream it across Finland.

4.1. Introduction

Finland should be commended for its ambitious goal to become carbon neutral by 2035 and carbon negative soon after that date. The 2019 Government Programme also aims for Finland to be the "world's first fossil-free welfare society" (Finnish Government, 2019). The government plans to achieve carbon neutrality by accelerating emissions reduction and strengthening carbon sinks. However, under current and planned measures, Finland will fall short of meeting this target. In response, it is updating major climate strategies.

A well-being lens to climate action could help Finland accelerate climate mitigation while improving the wider well-being agenda (e.g. equity, health, biodiversity). The well-being lens is a process developed by the OECD that allows governments to think innovatively about climate action, prioritising policies that redesign systems (Box 4.1). Acting at the level of the system structure rather than with system parts enables transformational rather than incremental change, which is key to achieve Finland's target (OECD, 2021a). The recovery from COVID-19 represents an opportunity to reprioritise policies and advance transformational change through system redesign.

This chapter first discusses emission trends and outlines the challenges of meeting the carbon neutrality target. It then details how a well-being lens to climate action can help Finland achieve its target. Subsequently, it dives deep into three selected sectors – transport, electricity and buildings – that jointly account for around 60% of Finland's greenhouse gas (GHG) emissions (OECD, 2020a). The chapter highlights sectoral strategies to help advance systemic change and deliver on multiple well-being outcomes.

4.2. Achieving GHG emission reduction targets

4.2.1. Key GHG emission trends

Finland has successfully met internationally agreed targets. It reached its Kyoto Protocol target (20% emissions reduction by 2020 compared with 1990) in 2018. According to preliminary data, Finland is also positioned to meet the 2020 target of reducing emissions in the effort sharing sector, i.e. emissions outside the European Union (EU) Emissions Trading System (ETS) and coming mainly from transport, buildings and agriculture (MoE, 2021). Finland's target in the effort sharing sector was 16% reduction by 2020 compared with 2005, higher than that of the EU average (-10%). According to the 2019 National Energy and Climate Plan, existing and planned measures combined with the use of flexibility mechanisms will also allow Finland to meet its current 2030 target of cutting non-ETS emissions by 39% from 2005.

Box 4.1. Climate action through a well-being lens

The well-being lens is a process that allows governments to think innovatively and design climate strategies with the potential to accelerate climate change mitigation while improving wider well-being outcomes.

The well-being lens defines outcomes in terms of well-being (e.g. health, affordability, equity, biodiversity) and makes these outcomes the central criteria for guiding policy decisions. In so doing, it mainstreams well-being considerations in the decision-making process of climate strategies from the onset.

Building on systems thinking, the process allows emission reduction opportunities to be unleashed through policies targeting the redesign of systems. Such policies are often absent or at the margin of current climate strategies. By seeing whole systems, policy makers can unleash the potential for emission reductions that originate from the interactions between elements. In this way, they focus on redesigning the way these elements are organised rather than just on optimising parts.

For example, policy makers can concentrate on reversing the dynamics behind car dependency, which is at the source of high emissions (and other undesirable results such as poor health, inequitable access to services and opportunities) in most transport systems. This approach would replace a concentration solely on electrifying vehicles within car-dependent systems. Through a well-being lens, electrification of vehicles will still be key, but its power to achieve net-zero goals and contribute to wider well-being objectives depends on embedding improvement of vehicle technologies in a wider process of systemic redesign leading to better systems for better lives (Section 4.4).

The well-being lens process is structured along three steps*:

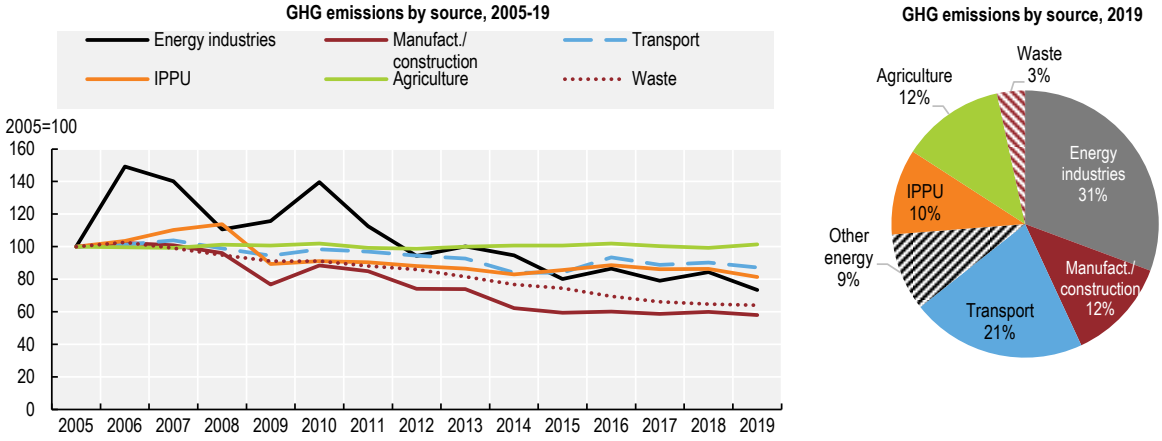
1. **Envision** the outcomes that a functional and sustainable system would achieve.
2. **Understand** the key dynamics underlying undesirable results and identify key stakeholders and barriers to systemic change.
3. **Change** the policy package to centre policies around reversing undesired dynamics. As needed, modify governance, budget allocation and monitoring frameworks so they enable and are conducive to systemic change.

Note: * This EPR mainly focused on step 3. OECD is applying the entire well-being lens process on the Irish transport sector.
Source: OECD (2021), "The Well-being lens: An innovative process for net-zero strategies", (brochure), www.oecd.org/climate-change/well-being-lens/well-being-lens-brochure.pdf.

Finland's GHG emissions declined by 24% between 2005 and 2019. Emissions decreased in all sectors but agriculture. The energy industry and manufacturing sectors showed the largest declines due to a shift from fossil fuels and peat to low-carbon energy carriers (electricity, biofuels). The decline was driven by the sluggish economic performance following the global financial crisis, as well as supportive policies (e.g. carbon pricing through carbon taxes and the EU ETS, and renewable support and mandates). Overall, emissions included in the EU ETS (mainly power plants and energy-intensive industry) declined much more than the emissions in the effort sharing sector in 2010-19 (by 44% compared to 12% in the non-ETS sectors). However, the decrease of both groups of emissions slowed down with the more sustained economic growth of the second half of the 2010s, until the COVID-19 pandemic hit the world economy in 2020. According to preliminary data, GHG emissions in 2020 decreased by 9% compared with 2019. This reflects a warmer winter, a further shift from fossil fuels in power generation and reduction in transport activity due to the COVID-19 pandemic (MoE, 2021).

In 2019, the EU ETS covered 45% of Finland's GHG emissions, calling for focusing mitigation efforts in the non-trading sectors. In 2019, the energy industry, transport and manufacturing accounted for the largest shares of emissions, followed by agriculture and residential (Figure 4.1).

Figure 4.1. Finland's GHG emissions decreased in all sectors in the last decade except agriculture



Note: Excluding land use, land-use change and forestry. IPPU = Industrial processes and product use.
Source: Statistics Finland (2021), "Greenhouse gas emissions in Finland, 1990-2019".

StatLink https://doi.org/10.1787/888934288193

As in most OECD countries, carbon dioxide (CO_2) emissions account for the largest share of GHG emissions (81%). These are followed by nitrous oxide (N_2O, 9%), methane (CH_4, 8%) and others (2%) (OECD, 2020a). CO_2, N_2O and CH_4 emissions have decreased by 25%, 24% and 42%, respectively, compared with 1990. CH_4 emissions declined thanks to improvements in the waste sector and reduced animal husbandry, which were also responsible for the decline in N_2O emissions. N_2O emissions also decreased thanks to deployment of abatement technology in nitric acid production and less use of nitrogen fertiliser in agriculture.

The land use, land-use change and forestry (LULUCF) sector is a net sink in Finland. Forests (trees and soil) absorb a significant proportion of Finland's CO_2 emissions, amounting to on average 20 megatonnes of carbon dioxide equivalent ($MtCO_2$) (38% of 2019 GHG emissions) per year between 2005 and 2019. Yet absorption decreased from 20 $MtCO_2$ to 14 $MtCO_2$ in 2014-18, mainly because of higher harvest levels in the forestry sector. The net sink improved significantly in 2018-20 thanks to lower forest removals (MoE, 2021).

4.2.2. The carbon neutrality target to 2035

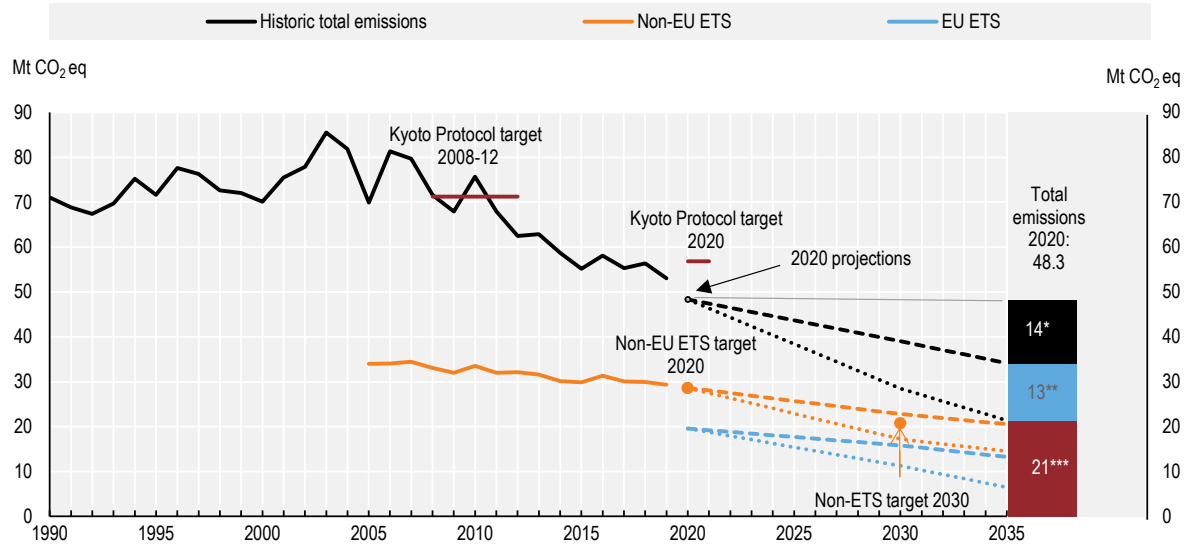
The climate neutrality target is widely supported across the political system. The climate neutrality target will be included in the update of the Climate Change Act, which is expected to pass Parliament in early 2022, along with updated climate targets for the years 2030, 2040 and 2050.

Reaching the climate neutrality target would require annual emission reductions of 5.6% between 2019 and 2035. This represents more than 2.5 times the rate observed between 2005 and 2019. With existing measures, Finland will likely miss the target by 13 $MtCO_2e$ (Figure 4.2). However, work on introducing the required additional measures is ongoing. Ministries have developed sector-specific decarbonisation roadmaps in co-operation with relevant stakeholders. At the time of writing, Finland was also updating key cross-sectoral strategies and plans to reflect their enhanced ambition. In September 2021, the government

decided on policy measures for these key strategies to close the gap with the carbon neutrality target. The EU climate package, which sets out proposals to reduce EU emissions by at least 55% by 2030, will also help Finland achieve its climate neutrality target by, for example, strengthening emissions trading.

Figure 4.2. Finland met its past climate targets, but achieving carbon neutrality by 2035 will be challenging

GHG emissions and projections



Note: Dashed lines refer to national projections with existing measures; the dotted lines refer to national projections with additional measures. * Emissions reductions by 2035 with current development and policy measures; ** Emissions reductions by 2035 with additional measures; *** Remaining emissions in 2035 to be neutralised by carbon sink.
Source: Country submission; EEA (2021), *Member States GHG Emission Projections* (database); EEA (2021), *ESD and ETS Data Viewers* (database); Statistics Finland (2021), *National Inventory Report to the UNFCCC.*

StatLink https://doi.org/10.1787/888934288212

Finland's carbon neutrality target relies on carbon removal of forests to offset emissions from hard-to-abate sectors, expected to amount to 21 $MtCO_2e$ in 2035 (Figure 4.2). Climate change will increase forest productivity in Finland due to higher atmospheric CO_2 content, higher temperatures and longer growing seasons, notably in Finland's northern part. There are trade-offs between forests' potential as a carbon sink and forest harvesting levels, including for biomass (FCCP, 2019a). Most of the woody biomass comes from forest residues and thus depends on harvest levels.[1]

Adding up the future demands for woody biomass from the forest industry and sectoral roadmaps, including the energy and chemistry sector (e.g. for the production of liquid biofuels), is estimated to require a harvest level of 140 million cubic metres (Mm^3). This is well above the current annual sustainable logging maximum[2] of 83 Mm^3 (Vadén et al., 2021). In addition to the impact on the carbon sink, there are a number of issues with increased bioenergy as also noted by the European Commission (EC, 2020):

- Increased wood use may come at the expense of other sustainability objectives, including land-use change (and related emissions), biodiversity, soil health and water quality. This, however, depends on forest practices in use. Most importantly, the effect of increased biomass use depends on the raw material used. Impacts are expected to be lower for using forest residues, which is current

practice. Excessive tapping of forest residues, however, can harm soils and biodiversity as local fauna use residues for shelter. Adding nutrients could compensate for lost soil productivity, but this could generate water pollution to which Finnish lakes are particularly sensitive (MoEAE, 2020a). Leaving dead trees to a greater extent in regeneration areas and avoiding fellings in valuable nature areas would mitigate some negative effects (MoEAE, 2019).

- Imported biomass may have detrimental effects on biodiversity and land-use change with related emissions abroad. Finland's imports of wood have fluctuated between 10-20 Mm^3 during the past 20 years. The Russian Federation (hereafter "Russia") and the Baltic states are the biggest sources (Luke, 2021). To minimise negative effects, imported biomass and raw materials for biofuel production should be subject to robust sustainability criteria.
- Burning biomass could increase local air pollution, notably from particulate matter (PM) and nitrogen oxides (NO_x) emissions with negative effects on health and biodiversity (AQEG, 2017). While air pollution in Finland is one of the lowest in the world (Chapter 1), the impacts of switching to biomass on local air pollution should be carefully assessed and quantified. This analysis should identify potential trade-offs or synergies between mitigation and public health.

Given the limited supply of sustainable woody biomass, Finland should consider concentrating biomass in hard-to-abate sectors as announced in the Government Programme (Finnish Government, 2019). These sectors include aviation, maritime and heavy freight. Meanwhile, it should opt for other energy sources for sectors where alternatives to biomass are readily available (e.g. heat, cars).

Biomass could also be prioritised for development of technologies that would remove CO_2 from the atmosphere, including bioenergy carbon capture and storage (BECCS).[3] BECCS could be important for becoming carbon negative, increasing the chance of limiting global warming to "well below 2°C", preferably to 1.5°C as agreed in the Paris Agreement. Yet BECCS would require captured CO_2 to be transported abroad due to lack of suitable geological formations (IEA, 2018).

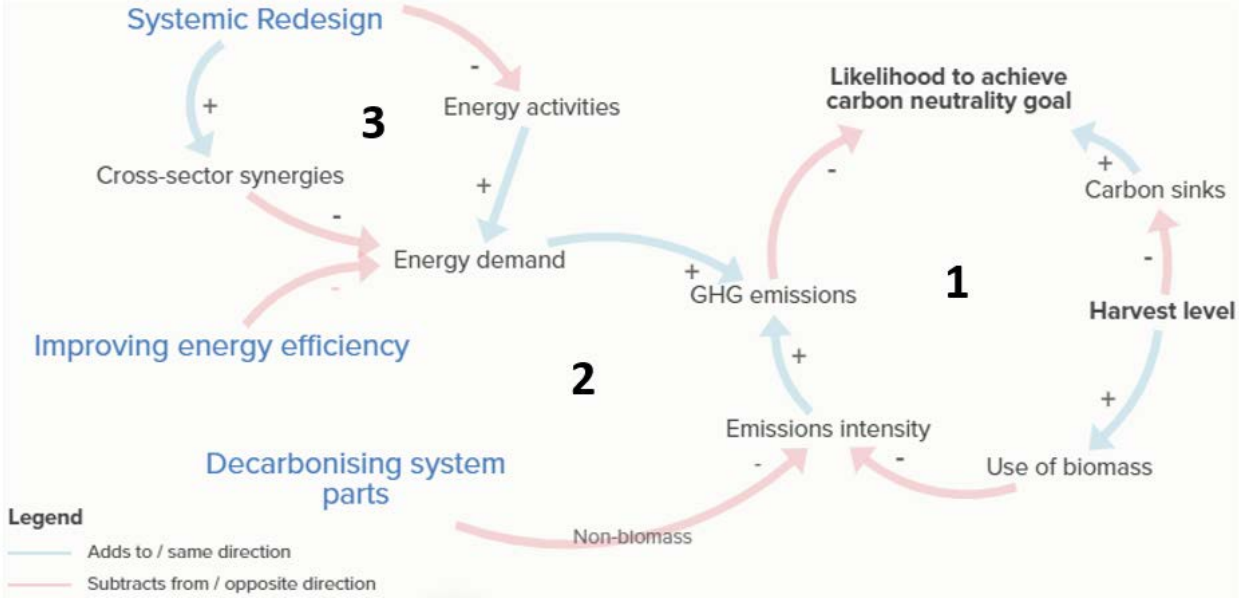
4.3. Refocusing climate action through a well-being lens

A well-being lens to climate action, including systemic redesign, can help Finland reach its carbon neutrality target. Transitioning towards economic and societal systems with lower energy and material demand is key to reducing the emissions gap. In addition, it can help reduce trade-offs from using biomass (Figure 4.3). Refocusing climate action through a well-being lens can also support Finland to ensure that lower demand and net-zero emissions systems are also higher well-being systems. Figure 4.3 shows three dynamics:

- Dynamic 1 on the right hand side of Figure 4.3 depicts the trade-off between biomass use and the absorption potential of forests, both of which depend on harvest level (as explained in Section 4.2.2).
- Dynamic 2 shows the most common policy approaches to climate mitigation in Finland and in other OECD countries. Decarbonising system parts (e.g. through non-combustion technologies in energy production) directly reduces the emissions intensity of economic activities. Improving the energy efficiency of system parts (e.g. through deep retrofits of buildings) reduces energy demand. Thus, it also reduces energy-related GHG emissions for a given emissions intensity.
- Dynamic 3 shows systemic redesign (Figure 4.3) which is underexplored in Finland. Lowering energy demand through systemic redesign implies enhancing cross-sector synergies. For example, low-energy neighbourhoods with district heating can benefit from multiple heat sources, including renewable sources, electric heat pumps and waste heat from other sectors. It is also about reducing energy consumption and emissions by shifting from systems' dynamics that are at the source of high levels of both, and that also yield poor results in terms of wider well-being. For

example, Finland could move from car-dependent transport and urban systems towards transport systems that are sustainable by design. This would lower overall mobility by increasing proximity or shifting trips to more sustainable modes of transport while improving accessibility and lowering emissions (OECD, 2021c). To achieve such a shift, strategies need to prioritise reversing the dynamics (e.g. from sprawl to proximity) behind car dependency (Section Transport System). Systemic redesign is, thus, a high leverage point that can lead to deep emission reductions compared to climate strategies focusing on system parts (OECD, 2021a). Systemic redesign could also make policies focusing on system parts more effective (e.g. by reducing rebound effects or enhancing the effectiveness and acceptability of policy instruments such as carbon pricing) (OECD, 2021a).

Figure 4.3. Systemic redesign is an important lever to reach the carbon neutrality target



Note: Blue arrows (+) refer to positive relationships and can be read as "the more, the more" (e.g. the higher emissions intensity, the higher GHG emissions). Red arrows (-) refer to negative relationships and can be read as "the more, the less" (e.g. the more GHG emissions, the lower the likelihood to achieve the carbon neutrality goal).
Source: OECD Secretariat.

As in most OECD countries, Finland's climate policy plans to date have mainly focused on decarbonising system parts (e.g. vehicles). This is also reflected in more recent plans or plans under development. The 2017 Medium-term Climate Change Policy Plan (KAISU), for example, expects more than two-thirds of estimated emissions reductions in the transport sector to derive from changes in system parts. This includes increasing the carbon efficiency of vehicles and increasing the biofuel share in fuels (MoE, 2017a). More recently, 17 of 20 measures of Finland's roadmap to fossil-free transport (published in 2021) focus on decarbonising system parts whereas only 3 would trigger systemic change (MoTC, 2021a).

Finland is, however, planning to make more use of systemic redesign. Finland announced that "(s)olving the sustainability crisis will require prompt, systemic changes in society" (Finnish Government, 2019). In a welcome step, Finland's roadmap to fossil-free transport emphasises that in urban areas "a determined shift away from the current car-centric system must be made toward a sustainable mobility system" (MoTC, 2021a). The roadmap also aims for halting the increase of vehicle kilometres in the 2020s.

Redesigning the transport system helps reduce traffic volumes by balancing the key dynamics that lead to increased traffic (Section 4.4).

Finland has advanced towards a whole-of-government approach, including by increasing cross-sector co-ordination and planning. The country needs to bring all sector-specific decarbonisation roadmaps together in a coherent way to achieve the carbon neutrality target effectively. Cross-sector co-ordination helps ensure that emission reductions in one sector do not lead to emission increases in other sectors. The government established the Ministerial Working Group on Climate and Energy Policy, which includes representatives from several ministries. It is identifying additional measures needed to achieve the climate neutrality target. The working group provides an excellent opportunity to revisit policies, prioritising those expected to deliver deep emission cuts through systemic change.

Climate aspects are increasingly integrated in decision-making processes related to energy, transport, agriculture, forestry and land-use planning. More precisely, every law requires a climate impact assessment. Climate change is also considered in the development of sustainability pathways, which were updated by the National Commission on Sustainable Development in 2016 (Chapter 3). The Commission, the Climate Policy Roundtable and other bodies, also help facilitate dialogue and co-ordination between the government, stakeholders and citizens.[4]

At the time of the writing, Finland was updating cross-sector mitigation strategies and the Climate Change Act to reflect the carbon neutrality target (Table 4.1). The 2015 Climate Change Act is the central piece of climate legislation. It lays out major national climate policy planning, including KAISU until 2030 (MoE, 2017a), the Long-term Low-emissions Development Strategy (LT-LEDS) until 2050 (MoEAE, 2020a) and an adaptation plan (Chapter 1).

Table 4.1. Finland's major climate mitigation strategies

Strategy	Sectoral coverage	Time horizon (currently)	Year of publication	Status (as of July 2021)
National energy and climate strategy	Energy sectors	2030	2016	Under revision
Medium-term climate change policy plan	effort sharing sectors (transport, buildings, agriculture)	2030	2017	Under revision
Climate change plan for the land-use sector	Land-use sector	2035	2022	Under preparation
Long-term low-emissions development strategy	All sectors	2050	2020	Published
Sectoral low-carbon roadmaps	Several key sectors	2035-45	2020-22	Published/under preparation

Source: OECD Secretariat.

The policy plans are complementary. KAISU lays out measures for the effort sharing sector, specifying and complementing the measures of Finland's 2016 National Energy and Climate Strategy (NECS). NECS outlines actions in the emissions trading, effort sharing and land-use sectors to achieve Finland's previous medium-term and long-term targets (MoEAE, 2017a). Both KAISU and NECS were subject to a long-established public consultation process, involving the national parliament, regional and local authorities, social partners, civil society and the general public (EC, 2020). In addition to KAISU and NECS, Finland was also updating the climate change plan for the land-use sector in 2021 (MoE, 2021).

Revisiting Finland's LT-LEDS could be an important step to guide action towards systemic redesign. Finland submitted its LT-LEDS to the European Union[5] in 2019 and to the United Nations Framework Convention on Climate Change (UNFCCC) in 2020. The strategy lays out two techno-economic scenarios ("Savings" and "Continuous Growth") that would meet the carbon neutrality target by 2035 and reduce

GHG emissions by around 90% by 2050 (MoEAE, 2020a). Both scenarios, however, show only modest reductions in energy use, amounting to 10-15% between 2020 and 2050 (MoEAE, 2020a).

Exploring a low energy (and low material) demand scenario could be an alternative and beneficial narrative (OECD, 2021a). Such a scenario would draw on the well-being lens. Low-energy demand pathways tend to show most synergies and the lowest number of trade-offs with other well-being dimensions and Sustainable Development Goals (SDGs) (Buckle et al., 2020).

Developing a low-energy demand scenario could also better inform about the scope for synergies between climate mitigation and other social, economic or environmental goals across sectors. Quantifying the social, economic and environmental effects could support this narrative and ensure buy-in from multiple stakeholders. Finland could also review the LT-LEDS to include indicative and flexible sectoral reduction targets to provide more clarity and accountability on sectoral abatement (Aguilar Jaber et al., 2020). Finland's Climate Change Panel could play a more important role in guiding this effort (Box 4.2).

Box 4.2. Finland's Climate Change Panel

Finland's Climate Change Panel was established in 2011 as an independent body. It supports planning and decision making on climate policy while strengthening co-ordination between research and policy making. The panel, which has 15 members, was appointed by the government in 2019 for four years. It advises on development of key climate strategies and publishes reports on climate-relevant topics (e.g. carbon neutrality, climate education, adaptation to climate change and climate impacts of land use, land-use change and forestry).

In 2019, Finland's panel received much less funding (EUR 0.3 million) than advisory councils in Denmark (EUR 1.2 million) and Sweden (EUR 1 million) (FCCP, 2019b). In a welcome move, the government increased the annual budget to EUR 0.75 million per year in 2020.

In contrast to other panels (e.g. the UK Climate Change Committee), the Finnish panel is not tasked to monitor progress towards achieving government's targets. Nor does it recommend how to close potential emission gaps. However, the annual reports – first issued in 2018 – inform on the achievement of climate targets and the impact of measures taken. Finland's Climate Change Act requires the government to issue an annual report to Parliament. The Ministry of Environment co-ordinates the annual report in co-operation with all relevant ministries.

4.4. Going for a high-accessibility and low-emission transport system

The surface transport sector is the most challenging sector for decarbonisation largely owing to the highly dispersed population and above-average mileage per capita. The transport sector accounted for 20% of Finland's GHG emissions and 38% of the effort sharing sectors in 2019 (OECD, 2020a). Most (94%) transport emissions originate from the road sector. Transport emissions were increasing until 2007, but decreased by 16% in 2007-19 (OECD, 2020a). GHG emissions from transport declined in the first half of the 2010s. They have since fluctuated around 2015/16 levels, before declining by 8% in 2020 due to the COVID-19 pandemic (MoE, 2021).

The decrease in transport emissions occurred despite rising vehicle kilometres of passenger cars. The reduced emissions were thanks to a growing share of biofuels in road transport and improvements in vehicle fuel efficiency (MoE, 2017b). This shift has been encouraged primarily by biofuel mandates, as well as by vehicle and fuel taxation (Chapter 3), and more recently by supportive polices to electric vehicles (EVs). Yet, despite the progress, Finland's per capita transport emissions and per capita car travel are

among the highest in OECD countries. This is mainly due to long travel distances resulting from low population density, notably in rural parts of Finland.

Finland's target is to reduce transport-related GHG emissions by at least half by 2030 from the 2005 level. Existing and planned measures of the KAISU policy package fall short of meeting the 2030 target by 1.5 $MtCO_2e$, calling for a refinement of policies (MoE, 2020a). Finland's roadmap on fossil-free transport, published in May 2021, would close this gap. However, large uncertainties remain on estimating the potential for emissions reductions.

Applying a well-being lens to climate action in the transport sector can help Finland reduce transport-related emissions by shifting territories from car dependency. The scope for this is greater in urban and suburban areas where 55% of the Finnish population live. However, the recommendations included in this section can also be useful to rethink rural areas.

Through a well-being lens, the focus of transport policy is on the sustainable delivery of accessibility rather than on mobility of use. In other words, the policy focuses on ease of accessing services, jobs and opportunities. It focuses less on mobility per se (i.e. the physical movement of people and vehicles).[6]

Shifting the focus of transport policy acknowledges the need to achieve a better balance between mobility and proximity. Such a balance promotes systems where the bulk of trips are made through the most sustainable modes. Conversely, less sustainable modes are chosen for less frequent trips (OECD, 2021c). Car travel is channelled towards the trips in which its value would exceed its costs (ITF, 2021).

As discussed in OECD (2021b), induced demand, sprawl and the erosion of sustainable modes are three key dynamics at the source of car-dependent systems.[7] To reverse these dynamics, Finland needs a stronger focus on accessibility and prioritisation of policies that can trigger systemic change. This would allow Finland to deliver a transport system that yields less mobility, energy consumption and material use, while allowing to enhance well-being. Reverting the dynamics that lead to car dependency would help reduce emissions, for example. At the same time, it would increase safety, health outcomes (beyond air quality improvements), improving use of public space and, thus, quality of life.

Advancing this systemic change requires rebalancing the policy mix. Finland needs to move from policies that deliver incremental change (those that optimise system parts) towards those that deliver transformational change (by redesigning the system's structure).

Making systemic change central to climate action is key for delivering deep emission cuts and well-being. Policies focused on improving parts in the system (i.e. improving vehicle technologies) will still be needed. However, climate action through system redesign would ensure that policies reinforce rather than undermine each other.

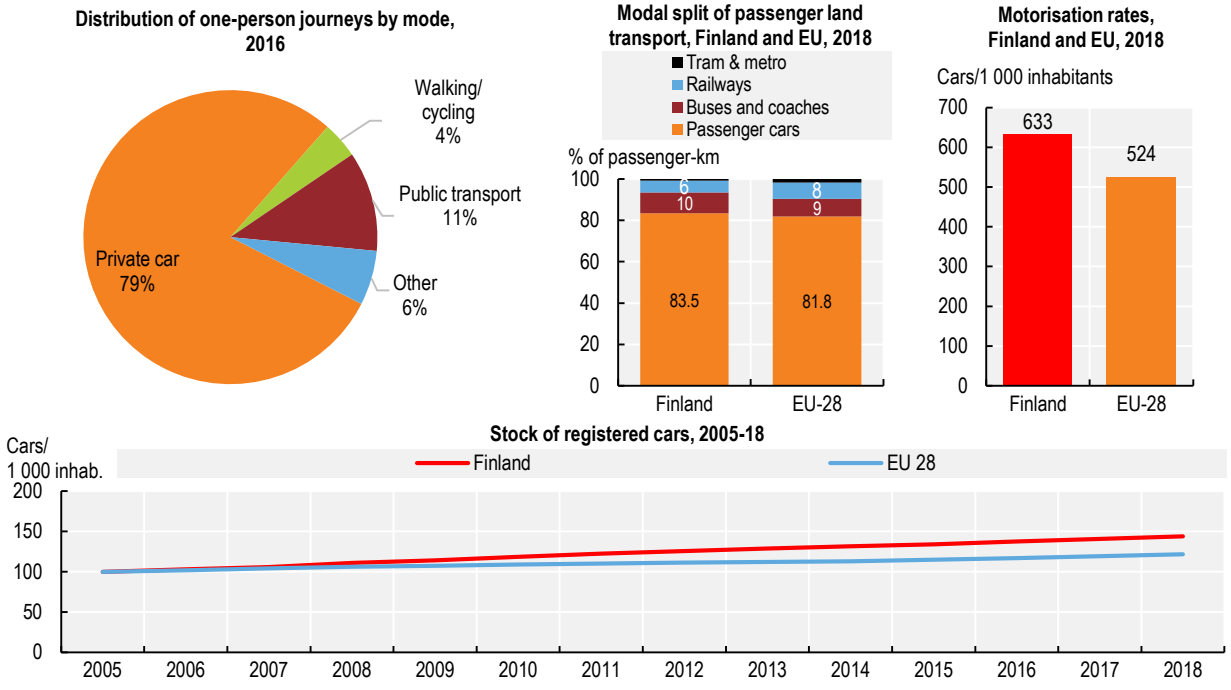
4.4.1. Key mobility trends

As in most OECD and EU countries, car use is the primary mode of land transport in Finland. Finland's modal share of car use is slightly higher than the EU average (as well as the average of other Nordic countries). The car ownership rate is 20% higher than the EU average, indicating high levels of car dependency (Figure 4.4). Car ownership has expanded more quickly than the EU average since 2005. Car dependency is a major driver of transport-related energy demand and emissions. As such, it is associated with significant social costs, including health costs from air pollution, accidents and congestion. While car traffic on city street networks decreased slightly between 2016 and 2018, car traffic increased on outer city roads (MoE, 2020a).

Modal shares of sustainable transport modes (active modes, public transport and shared mobility) are low. Finland did not meet its National Strategy for Walking and Cycling 2020 target (set in 2011). This strategy sought to increase journeys completed by walking and cycling by 20% compared with 2005 (equivalent to 300 million additional trips). It is also unlikely to meet the 2030 target of a 30% increase (MoE, 2017a). Yet

shares of walking and cycling are high in urban areas with accommodative infrastructure and high proximity, including Oulu (22% bicycle) and Helsinki (35% walking). High car dependency indicates significant emission reduction potential from systemic change.

Figure 4.4. Finland has high and increasing levels of car dependency



Source: EC (2020), EU Transport in Figures – Statistical Pocketbook 2020; Finnish Transport Agency (2018), SUMPs in the Finnish Context.

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4.4.2. Finland's low-carbon transport strategy

As in most OECD countries, Finland's climate policy focuses on decarbonising system parts (e.g. electric vehicles or biofuels) to reduce emissions. Finland's early strategy to achieve its 2030 goal builds on three pillars: i) improve the carbon efficiency of vehicles; ii) improve the energy efficiency of vehicles; and iii) shift towards more sustainable transport modes and avoid trips through integrated land-use planning (MoE, 2017a).

More than two-thirds of estimated emissions reductions are attributed to the first and second pillars. This is clearly related to decarbonising system parts and accounts for 1.5 $MtCO_2e$/year and 0.6 $MtCO_2e$/year, respectively. In contrast, the third pillar, which is closely related to transformational change, is predicted to reduce emissions by only 1 $MtCO_2e$/year (MoE, 2017a).

In a welcome development, Finland's roadmap on fossil-free transport suggests that vehicle kilometres of passenger cars will no longer increase in the 2020s. However, 17 of 20 measures announced for the first phase focus on decarbonising system parts. Conversely, only three measures would trigger systemic change (e.g. promotion of public transport; and an investment programme for walking and cycling (MoTC, 2021a).

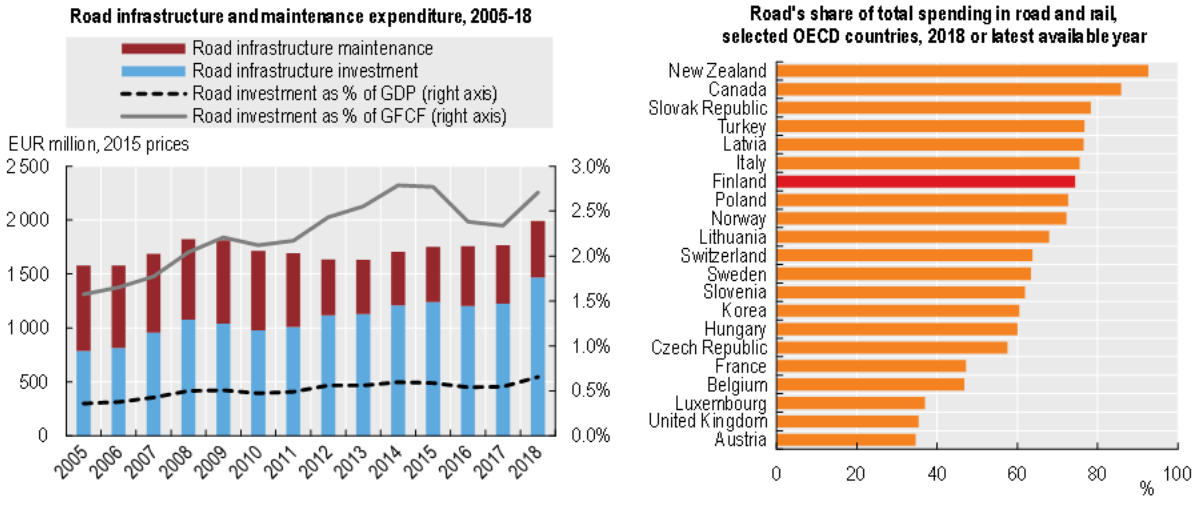
4.4.3. Placing policies to reverse car dependency at the core of climate action

Reducing car dependency and car traffic requires a larger shift towards more sustainable modes of transport. These include active modes (walking, cycling, micro-mobility), public transport and shared mobility. In addition, car dependency can also be reduced substantially by redesigning public space at the local level and by integration of land use and transport.

Increasing competitiveness of sustainable modes to reverse their erosion

Reducing car dependency requires a reorientation in transport infrastructure from road to more sustainable modes of transport. Public investments in road infrastructure increased between 2005 and 2018 both in absolute and relative terms (e.g. percentage of gross domestic product [GDP]) (Figure 4.5). In addition, Finland's public spending on maintenance and investment in transport infrastructure is heavily skewed towards road transport, accounting for 75% of total road and rail spending. This is one of the highest shares in OECD countries and higher than that of other Nordic countries (Figure 4.5). Reorienting spending towards rail and sustainable modes of transport would reverse the erosion of sustainable transport modes.

Figure 4.5. Road infrastructure investment and maintenance spending are high and increasing



Note: GFCF = gross-fixed capital formation.
Source: ITF (2021), *ITF Transport Statistics* (database).

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Increasing financial support for sustainable modes of transportation is one of the key recommendations of the roadmap to fossil-free transport (MoTC, 2021a). COVID-19 has led many passengers to shift away from public transport, causing a funding crisis for transport operators (MoTC, 2021a). As part of the government response to COVID-19, Finland allocated the highest funds per capita (EUR 7.76/capita) to cycling infrastructure across all European countries (Watson, 2020). The first recovery package includes large-scale investment in public transport infrastructure, notably inter-city rail connections (Chapter 3).

Both the government and the Finnish Transport and Communications Agency (Traficom) also grant subsidies for large and medium-sized urban areas for the purchase of transport services and tariff obligations. For example, the 2020 Government Programme pledges an annual amount of EUR 20 million, mainly focused on decarbonising system parts (e.g. greening public transport fleets and fuels) (MoE, 2020a).

In addition, the central government reserved EUR 24.9 million for investments in walking and cycling infrastructure in 2020. This represents a significant increase compared with previous years (MoE, 2020a). The roadmap to fossil-free transport envisions doubling public transport subsidies for large and medium-sized urban areas for 2022-24 and setting up an investment programme for walking and cycling in municipalities for 2022-24 (MoTC, 2021a).

A national transport system plan was developed by 2021 under the lead of a parliamentary steering group to provide, among other things, long-term guidance for road and rail investments. The plan aims at delivering accessibility to all parts of Finland. It highlights that people should be able to choose sustainable modes of transport, notably in urban areas (MoTC, 2021b). The new plan covers 2021-32, addressing criticisms of stakeholders for its previously short-term approach (EC, 2020). It includes plans for three high-speed railroad lines (a western rail line from Helsinki, an eastern rail line from Helsinki and investment in the main line network). The investment costs of the main line and the western rail line from Helsinki are estimated at EUR 8.5-8.9 billion in the 2020s (MoEAE, 2019).

Metropolitan transport planning could be strengthened. At the metropolitan level, the Helsinki Region Transport System Plan (HLJ) is the long-term strategic transport plan for the Helsinki region. It was developed in co-ordination with 14 municipalities, the Metropolitan Transport Authority (HSL) and the central government (e.g. Finnish Transport Agency, Ministry of Transport and Communication, Ministry of Environment).

The plan of the Helsinki Metropolitan Area provides a vision of the transport system for the longterm (2050) while carving out tangible short-term actions. These actions focus on needed infrastructure investments for public transport but increasingly encompass a broader set of actions. Such broad actions include making pedestrian areas more attractive; enhancing the bicycle network; implementing digital tools (e.g. to facilitate Mobility as a Service [MaaS]); strengthening parking policies; and introducing congestion pricing (HSL, 2015). This is a welcome step and should be increasingly mainstreamed in plans both for Helsinki and other metropolitan areas. Importantly, the development of the HLJ was closely linked to the Helsinki Region Land Use Plan and the Housing Strategy (MAL).

Finland needs to build on its pioneering role in MaaS to develop multimodal networks across the country after exploring practical challenges. Built around public transport as a key pillar, MaaS engages the public sector, private transport operators and service users. Together, they offer seamless mobility by creating a sustainable multimodal transport system (e.g. public transport, bike and car sharing, micro-mobility), enabled through smart technologies (MoE, 2017a).

The Ministry of Transport and Communications launched the Transport Code project in 2016, which overhauled transport market legislation and supported development of new services, including MaaS. Moreover, experiments and pilot projects have been launched in different areas to re-organise passenger transport services into larger entities. Monitoring activities concerning implementation of the Act on Transport Services have continued, and legislation was developed as a response to changes in the operating environment.

All of these activities were key enablers for the uptake of MaaS, notably in the Helsinki Metropolitan Area, where MaaS is a key pillar of the HLJ. Simulations for the Helsinki Metropolitan Area integrating shared on-demand mobility services (e.g. shared taxis or shared taxi buses such as Kutsuplus in Helsinki) into MaaS suggest significant savings in CO_2 emissions through replacing car travel (ITF, 2017). In addition, shared mobility options would also enhance accessibility and service quality while freeing up public space used for parking.

Despite the progress in MaaS, more is needed to mainstream this innovative service to all Finns. Public and private actors need to enhance communication and co-operation to overcome silo thinking based on individual transport modes, paving the way to a multimodal sustainable transport system. Public and

private actors also need to ensure sufficient levels of investment in transport infrastructure to meet users' needs.

Fully unlocking the benefits of MaaS needs to go hand-in-hand with creating the right conditions to develop multi-modal networks across Finland. For example, it needs to enable infrastructure for sustainable modes and road management tools. Without such an enabling environment, MaaS risks limiting benefits to places like Helsinki, while exacerbating low occupancy vehicle travel in other areas (e.g. through ride-hailing that is not shared).

Shared on-demand mobility services could also enhance accessibility and quality of services in Finland's rural areas. Mobility services are more important in urban areas, where the potential for reducing emissions is also the highest. However, people in sparsely populated areas more often depend on a private car. The Finnish government had made efforts to maintain high levels of public transport services in these areas. Accessibility, however, is increasingly a problem. This is especially true for vulnerable population groups with limited access, such as the elderly.

Public expenditure on public transport has been increasing with the ageing and declining rural population, increasing the funding gap for government-supported rural public transport (Kauppila, 2015). More efficient procurement and planning of public transport services could realise savings, which would help sustain high-quality services. In some areas, moving from support for public transport towards supporting on-demand services could be more cost-effective and lead to higher accessibility. However, regulations must be in place related to areas such as monitoring of service provision and safety. Furthermore, any strategy must promote awareness of on-demand services to customers.

Redesigning public space and road management to shift from induced demand to disappearing traffic

Local authorities play a key role in delivering mitigation in the transport sector through enabling the shift to more sustainable modes of transport and reducing car dependency. Within their respective territories, local governments are responsible for transport system planning, as well as regulation on land use and zoning. Strategic local and regional plans, co-ordinated between municipalities and across different levels of government, are the foundation for improving the competitiveness of sustainable modes of transport.

Several cities (e.g. Turku) have a long history in developing long-term strategies for spatial and transport planning that are updated every ten years. While these plans usually align transport and urban development effectively, they typically do not integrate the energy system (e.g. heat or electricity) into the planning process. This results in missed opportunities to further leverage synergies, such as planning for public electric vehicle (EV) charging infrastructure.

Finland could make more use of redesigning public space and road management, which is key to a paradigm shift towards more sustainable modes of mobility. This would involve a shift from the traditional "predict and provide" approach towards more efficient management of available road space. Redesigning public space includes reallocating and redesigning road and parking space that can better promote sustainable transport modes. Road management encompasses the efficient use of road and parking space, including through parking policies and road pricing.

Reallocating road space can trigger the shift away from a car-based mobility system. With such a policy, streets or parking can be turned into urban space such as green space or buildings. It also makes space for new users, including public transport, cyclists and pedestrians. At the same time, the shift can liberate space for other urban functions, increasing the well-being of city dwellers.

Many cities in Finland reallocate road and parking space. Helsinki is planning to transform inner city highways into urban boulevards. This will create new mixed neighbourhoods of housing and new infrastructure for sustainable modes of transport (City of Helsinki, 2015).

Many Finnish cities have converted parts of their city centres to pedestrian areas, a trend expected to continue. Helsinki is planning to extend pedestrian zones, making some of the streets car-free while restricting access of cars for other streets. However, it is also planning an underground distributor road beneath the centre that enables driving around the city centre. While this road could reduce congestion in the short term, it would support car dependency in the long term, with the risk that Helsinki falls short of its mitigation targets.

Redesigning streets, following a "complete street approach" both in urban and rural areas, would bring the largest well-being benefits (OECD, 2021c). The design of complete streets safely balances space between multiple users (e.g. walking, cycling, public transport, private vehicles) and activities (e.g. commercial and residential) (Litman, 2015). By redistributing user hierarchies, complete street approaches have been shown to reduce GHG emissions, contribute to public health and increase road safety. They also deliver economic benefits such as increased property values, tax collections and business activity (OECD, 2021c).

Parking policies differ widely across cities and regions in Finland. Some cities increasingly use parking policies to deter car use through removing on-street parking. To that end, they increase parking fees or reduce minimum parking requirements for different land-use types. These efforts need to be adopted across the country, notably in urban and suburban areas.

Helsinki is planning to increase parking fees by up to 100%, which is expected to contribute to more than 5% towards the city's 2035 reduction target in transport emissions (City of Helsinki, 2018). Helsinki is also substituting on- or off-street parking through underground parking to free up public space for urban development (e.g. transport infrastructure for sustainable modes, residential buildings).

The availability of underground parking in Helsinki, while expected to be more expensive for users, continues to perpetuate car dependency. Similarly, free parking at the workplace is a non-taxable fringe benefit and encourages the use of cars for commuting (Chapter 3). Phasing out this parking subsidy and reducing minimum parking requirements (notably in areas with good accessibility) or shifting from minimum to maximum parking requirements would further reduce available parking space and car dependency (OECD, 2021c). On the other hand, the tax treatment of commuting expenses and allowances goes in the direction of reducing car dependency, as it makes commuting by public transport or bike more attractive than driving (Chapter 3).

To date, Finland has not implemented road or congestion pricing (Chapter 3). However, the Government Programme aims to introduce legislation that would enable the implementation of congestion pricing, notably in urban areas (Finnish Government, 2019). The working group on the reform of transport taxation acknowledged that lower costs of driving (once the fleet is electric) may increase vehicle use. This, in turn, may require policy interventions such as congestion charges in regions suffering from high traffic volumes (MoF, 2021a).

Helsinki has considered congestion pricing but has taken no steps to implement the policy (City of Helsinki, 2018). Congestion pricing would alleviate congestion in the city, reducing its external costs. These costs include time for drivers, air pollution and GHG emissions. At the same time, congestion pricing can play a key role in reducing car dependency.

Pricing of vehicle traffic could contribute more than 10% to Helsinki's transport-related emissions target by 2035 compared to business as usual (City of Helsinki, 2018). Congestion pricing should be embedded in a broader policy package to manage road space with a focus on re-ordering user priorities. In this way, it can enhance accessibility and limit urban sprawl when coupled with investments in public transport (OECD, 2021c).

Integrating land-use and transport systems to shift from urban sprawl to proximity

Urban form and effective functioning of urban regions are expected to have one of the biggest potentials to reduce emissions in Finland (MoE, 2017a). According to the working group on fossil-free transport,

“community planning is at the centre of sustainable mobility”. As such, community planning creates the conditions to shift mobility from private cars to sustainable modes of transportation (MoTC, 2021a). As land use and urban structure are slow to change, the impacts of decisions concerning these dimensions can be expected to be long-lasting (MoE, 2017a).

Urban sprawl in Finland increased between 1990 and 2014 (OECD, 2018). Finnish cities experienced a decrease in population density of urban areas. At the same time, the share of urban land allocated to low population density areas increased (OECD, 2018). Urban sprawl, along with increasing commuting distances and service-related mobility due to the location of retail centres outside the city core, have been key drivers for increasing travel distances and transport-related emissions (MoE, 2017b). Finland started promoting densification of urban cores (Section 4.6.3) only recently. It has pursued infill construction and development of a polycentric urban structure with regional centres and sub-centres around public transport nodes (MoE, 2017a).

In a welcome approach, Finland has identified the need to steer jobs and services around public transport nodes in addition to residential buildings (IEA, 2018). Mixed land use integrates housing, shopping, offices and leisure activities. By bringing these closer together, it creates proximity and reduces travel demand and transport emissions while enhancing quality of life. Encouraging commercial activities in city cores rather than on or outside city fringes would further reduce travel demand.

Finland has enhanced co-ordination of urban and transport systems through agreements between the central government and multiple municipalities of functional urban areas concerning land use, housing and transport (MAL). The central government concluded MALs with the four largest metropolitan areas (Helsinki, Tampere, Turku and Oulu) from 2020 to 2031. It also signed MALs with three other areas (Jyväskylä, Lahti and Kuopio) in 2021.

MALs are negotiated between the competent municipal and state authorities that are relevant to the three themes. In Helsinki and other urban areas, the MAL aims at developing a dense urban core. This would be connected to district centres of neighbouring municipalities with mixed land use through sustainable modes of transport (co-funded by the central government). This reduces transport-related GHG emissions while providing access to services, jobs and businesses.

MALs have successfully enhanced co-ordination on land use, housing and transport at the metropolitan level. However, they have been insufficient to prevent further urban sprawl (Tiitu, Naess and Ristimäki, 2020). Reasons for this include tax competition of municipalities; the relatively powerful position of municipalities; and the voluntary nature of MALs, which are not legally binding (Tiitu, Naess and Ristimäki, 2020).

Finland could expand the scope of metropolitan transport authorities to enhance co-ordination across municipalities and between different levels of government on transport. Metropolitan transport authorities, such as HSL in the Helsinki Metropolitan Area, are key to co-ordinate planning, investment and operation of transport infrastructure and services. HSL mainly plans, organises and procures public transport services, while managing the region’s bike-sharing system. Extending the mandate of HSL beyond public transport would enhance coherence of the infrastructure beyond municipalities’ borders. In so doing, it would improve the competitiveness of sustainable modes of transport (ITF, 2018). An expanded mandate could include co-ordination of cycling networks, road management and road safety (as Transport for London in the United Kingdom).

In addition, evidence from other European countries suggests that metropolitan transport authorities can also successfully co-ordinate planning for sustainable modes of transport across municipalities for smaller metropolitan areas (e.g. in France). This could be key to developing strategic plans for restoring proximity and developing multimodal networks. It would need to consider the specific contexts of different territories (ITF, 2018).

4.4.4. Improving vehicle technology and decarbonising fuels

Improve-type policies focus on increasing energy efficiency or decreasing the carbon intensity of transport modes, predominantly cars. Such polices must not undermine the systemic change to reduce car dependency. In addition, the policies need to be underpinned by strong sustainability criteria. This must ensure that technologies are indeed low carbon and sustainable, such as by considering life-cycle emissions.

Policies to decarbonise system parts are expected to deliver most of the emission reductions in Finland through EVs and biofuel mandates (MoE, 2017a). Given Finland's low-carbon intensity in the power sector (Section 4.5), electrification is a cost-efficient option to improve the carbon efficiency of car transport. Finland aimed to have 250 000 EVs (7% of the car stock in 2020) by 2030 (MoE, 2017a). The roadmap to fossil-free transport updated this figure to 700 000 EVs, which represented some 25% of the car stock in 2020.

The roll-out of EVs is not expected to increase peak power demand with the right incentives in place (e.g. smart charging) (Section 4.5). Instead of an absolute target, a relative target (e.g. a share of 30% EVs in 2030) would increase the policy levers to achieve this target, including through policies to deter car use (Section 4.4.3).

Promoting the uptake of electric vehicles

Finland's vehicle taxation is partly based on vehicles' CO_2 emissions, thereby favouring EVs (Chapter 3). Finland also introduced a purchase subsidy (not including plug-in hybrid models) of up to EUR 2 000 in 2018 and extended the subsidy through 2022. Uptake of EVs has increased after introduction of the subsidy. In 2020, Finland had around 60 000 EVs, fewer than Sweden or Norway on a per capita basis. Despite the upper limit of the purchase price of EUR 50 000, rebates for EVs tend to disproportionately benefit richer households in urban areas. They are thus highly regressive (Guo and Kontou, 2021).

In 2020-21, Finland introduced a scrapping bonus of up to EUR 2 000 for the purchase of a new low-emission passenger motor vehicle (e.g. electric vehicle) (MoTC, 2021c). In a welcome move, a scrapping bonus of up to EUR 1 000 can also be used to purchase a new electric bicycle or a season ticket for public transport. This could provide incentives to use sustainable modes of transport.

Finland aims to have installed 25 000 EV charging stations by 2030. The target will be updated in light of revisions to the EV target in the roadmap to fossil-free transport. The development of the private and public charging infrastructure needs to be embedded in the wider strategy of reducing car dependency. It must also be co-ordinated with the redesign of public space to prevent stranded assets.

In accordance with the Energy Performance of Buildings Directive, Finland also plans to implement a national obligation. This would require provision of EV chargers whenever a large-scale building renovation is completed (Finnish Government, 2019). The number of charging points per building could be lower where accessibility of public and active modes of transport is greater. It could also be embedded in a wider reform of minimum parking regulation (Section 4.4.3).

Finland supports development of public charging infrastructure. At the time of writing, it was exploring the option of obliging petrol stations to provide charging points for EVs. This would advance the public charging infrastructure (Finnish Government, 2019).

Between 2017 and 2019, in another positive move, Finland also subsidised the deployment of public and smart charging stations. The subsidy was 30% for normal chargers and 35% for fast chargers (MoEAE, 2017b). In July 2020, the government amended the policy to award financial support (EUR 5.5 million in 2020) based on competitive tenders. In this way, it could channel financing to projects with the greatest impact (e.g. in municipalities lacking charging stations) (MEAE, 2020).

Finland plans to increase the amount of grants (Finnish Government, 2019). Public support, however, could be increasingly targeted towards enabling conditions for the charging infrastructure, including distribution grid upgrades (Bannon, 2020). Public charging stations would support Finland's ambition towards a sustainable transport system based on MaaS and multimodality. At the same time, they would reduce the risk of stranded assets if mobility patterns increasingly shift towards more sustainable or shared modes. These public stations, or charging hubs, would service a variety of users (private cars, car sharing fleets, e-bikes, e-scooters) and speeds (slow and fast charging).

Increasing biofuel obligations

Since 2010, Finland has used blending obligations for fuel suppliers to create demand for biofuels. The obligation (defined as a percentage of energy content) increased from 4% to 20% over 2010-20. This included double counting of advanced biofuels in 2020.[8] This policy effectively halted the growth of gasoline and diesel demand of Finland's road transport sector (IEA, 2020). In 2019, Finland passed legislation increasing the share to 30% by 2030 (excluding double counting for advanced biofuels). According to the roadmap to fossil-free transport, the share may even increase to 34% or 40% to achieve the 2030 target depending on expected emission reductions from other measures (MoTC, 2021a). Finland's plans to include biogas and non-biological fuels such as hydrogen in the fossil-free fuels obligation are also welcome (MoEAE, 2021a). However, there is no plan to include electricity from EVs.

Stronger focus on transport electrification would reduce demand for the limited supply of biofuel feedstock and second generation biofuels. EVs could be included in the obligation and trade allowed between fuel distributors and electric charging operators as in Germany (CLEW, 2020). This would increase the flexibility of compliance in a technologically neutral way, while reducing compliance costs. Under such a system, charging EVs with low-carbon electricity would generate tradeable credits and revenues. These would enhance the business model of public-charging operators and accelerate EV uptake, reducing demand for biofuels.

Some biofuels and associated feedstock also raise issues of biodiversity, land-use change and related emissions. Finland expects most biofuels (both transport and non-transport) to be domestic, sourced from biodegradable waste, side streams of the forest industry and logging residues. Finland is a global leader in the production of second generation biofuels from woody biomass. However, according to the LT-LEDS, biofuel imports could be as high as 10 petajoules in 2035 in the "Savings" scenario (MoEAE, 2020a).[9]

While Finland refines a large portion of biofuels domestically, it imports a significant fraction of raw materials from other countries (T&E, 2020). To that extent, imported raw materials and biofuels must also comply with strong sustainability criteria to avoid pressure on food prices or deforestation abroad. One controversial issue is the treatment of Palm Fatty Acid Distillate (PFAD), which is part of the raw material portfolio of Neste oil (Finland's state-owned refiner). In contrast to other European countries (e.g. United Kingdom, Norway, Germany and Sweden), Finland classifies PFAD as residue rather than as co-product. This reduces the sustainability criteria with respect to the traceability of the feedstock under the EU Renewable Energy Directive II (T&E, 2020).

4.5. Towards a flexible, zero-carbon electricity sector

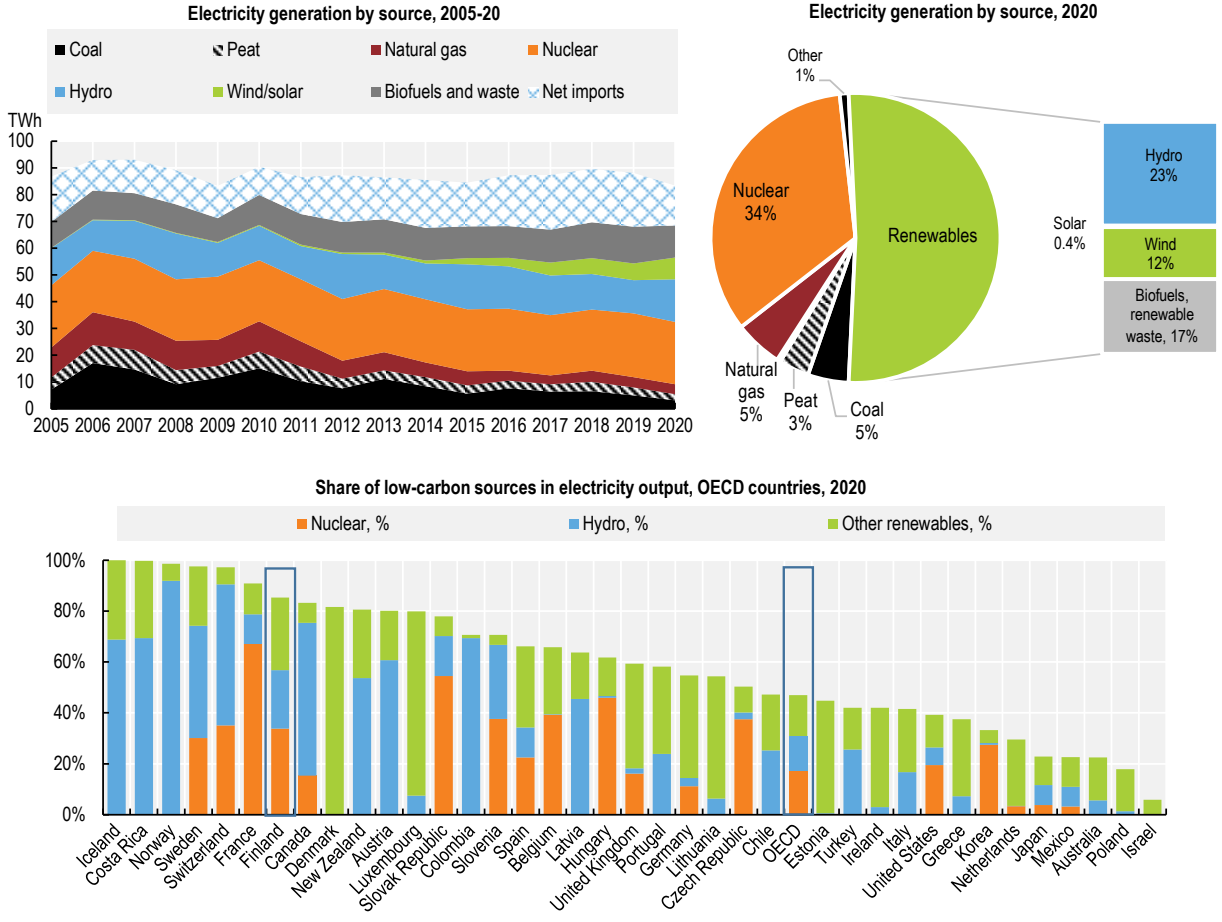
Electricity demand in Finland decreased between 2006 and 2015 but started to increase by more than 5% thereafter. Due to COVID-19, electricity demand in 2020 decreased by 6% (Statistics Finland, 2021). Increased demand due to economic growth, digitalisation and electrification has been moderated by improvements in energy efficiency. As of 2019, the industry sector accounts for almost half of electricity demand, while the buildings sector accounts for the other half (IEA, 2020). Transport accounts for just 1%, primarily reflecting public transport (rail, tramway).

Electricity demand is expected to grow from 86 terawatt hours (TWh) in 2019 to 91-93 TWh in 2030 and to 105-127 TWh in 2050, depending on the scenario (MoEAE, 2020a). Demand growth is primarily due to several factors. There will be increased electrification of end uses, including for electric heat pumps in the building sector, electric vehicles and electric motors in industry. Other factors include digitalisation, energy storage and anticipated production of electrofuels such as hydrogen. Much of the expected growth also depends on the climate strategies in the end-use sectors, notably transport (Section 4.4) and buildings (Section 4.6).

Finland aims to make electricity (and heat) generation "nearly emissions-free" by the end of the 2030s (Finnish Government, 2019). GHG emissions in the electricity sector – including combined heat and power (CHP) plants – decreased by 33% between 2005 and 2019. However, they still account for almost 30% of total GHG emissions in Finland (OECD, 2020a).

Most (85%) of Finland's electricity generation is low-carbon (including nuclear), among the highest shares in the OECD (Figure 4.6). This is up from 66% in 2005. Wind and biomass replaced coal and peat in power plants thanks to the EU ETS, CO_2-based fuel taxation (e.g. coal and peat) and renewables support.

Figure 4.6. Finland has high and increasing shares of low-carbon electricity generation



Note: Right panel: The category "Other renewables" includes marginal quantities of oil and non-renewable waste. Percentage shares of low-carbon electricity do not add up to 85% (as reported in the text) due to rounding.
Source: IEA (2021), *IEA World Energy Balances and Statistics*.

StatLink https://doi.org/10.1787/888934288269

In 2020, the share of renewables was 52%, with biofuels and waste (predominantly used in CHP plants) and hydro accounting for the bulk of this share (Figure 4.6). Nuclear accounted for 34%, but this share will increase when Olkiluoto-3, a 1 600 MW nuclear power plant unit, comes on line in 2022. This unit is 12 years behind schedule and three times over its original budget (Edwardes-Evan, 2020). The delays and extra costs highlight the uncertainties of using nuclear power to decarbonise the power sector. Fossil fuels (coal, peat and natural gas) accounted for the remaining 13.5% of electricity generation in 2020.

Fossil generation and thus electricity-related GHG emissions fluctuate substantially depending on the availability of hydro resources in neighbouring countries. In years with low annual precipitation, hydropower production in Sweden and Norway decreases, requiring larger domestic fossil-based generation. Electricity net imports decreased by 12% between 2005 and 2020, accounting for 18% of total electricity demand in 2020.[10]

A well-being lens to policy making in the electricity sector can support Finland to further decarbonise the electricity sector. This would increase the chances of achieving the carbon neutrality target. At the same time, it would deliver a number of well-being benefits, including better health, green jobs and higher resilience due to a more decentralised power system.

Systemic change, notably the shift from a centralised to a more decentralised grid, would enable customers to play a larger role through onsite generation, storage and demand response as envisioned by Finland's Smart Grid Working Group. This, in turn, would empower consumers. At the same time, it would reduce energy bills and investments in low-carbon plants (e.g. wind) and network infrastructure, reducing trade-offs with biodiversity (Gasparatos et al., 2017).

The transition to a zero-carbon power system also requires managing the phase-out of fossil power infrastructure and addressing the impacts on affected workers, communities and regions (Section 4.5.1). As electricity demand is expected to increase, further renewable power capacity needs to come on line (Section 4.5.2). The demand side, including small customers, can play an increasingly active part to provide flexibility, which is limited in Finland (Section 4.5.3). Sector integration increases the potential of demand response while decarbonising end-use sectors. This requires integrated strategic planning of the entire energy sector. Examples of integration include electrification of end uses and production of electrofuels such as hydrogen.

4.5.1. Managing the transition for phasing out peat and fossil fuels

Finland plans to phase out coal in energy generation by 2029 and to cut peat consumption by at least 50% by 2030 (MoEAE, 2020a). Finland could consider adjusting the coal phase-out date in view of the carbon neutrality target. Due to the availability of (low-cost) alternatives, reducing peat and coal consumption for energy production is one of the measures with the lowest abatement costs across all sectors (Sitra, 2020).

Both coal and peat, which are mainly used in CHP plants, are increasingly being replaced by solid biomass. Coal and peat consumption in electricity generation decreased by 28% and 36%, respectively, between 2005 and 2019. These decreases stem from higher EU ETS prices and CO_2-based fuel taxes, and more support for renewables. Projections indicate this trend would continue. Only minor additional measures would be needed to reach the coal phase-out and peat reduction targets.

Due to the permit price uncertainty of the EU ETS, the Finnish government has been considering a floor price. This would ensure reduction of peat use, under which energy tax on peat will increase if the EU ETS price falls below a certain threshold. This, in turn, can help increase price certainty. However, the floor price will be combined with an increase in the tax-free allowance for peat use. The net effect of these measures is an increase in GHG emissions in the short term.

The government has been working on an energy tax reform that includes peat. As a first step, it nearly doubled the energy tax on peat in 2021, from EUR 3/MWh to EUR 5.7/MWh (Chapter 3). Peat has long

enjoyed lower energy tax rates than other fossil fuels, in addition to an exemption from the carbon component of the energy tax. These benefits reduce the incentives for utilities to switch to more sustainable generation technologies. Energy taxes that better reflect external costs, including climate change, would be a cost-effective way to reduce the consumption of peat. CO_2 emissions from burning peat are higher than those from coal and natural gas (IPCC, 2014).

While coal is imported and mainly used in coastal regions close to harbours, peat is a domestic energy source and dominates in the interior regions. As of 2020, the peat sector employs between 2 000-2 500 full-time equivalent workers, 0.1% of total employment in Finland (MoEAE, 2020a). With multiplier effects, the figure rises to about 4 200 full-time equivalent workers.

While the macroeconomic impact of phasing out peat extraction can be expected to be small, it will affect some local economies in Finland's rural areas. Peat consumption is directly related to employment in peat extraction. Under a business as usual scenario, the number of full-time equivalent jobs for peat production is expected to decrease to 500 by 2025 (Patronen, 2020). Managing the transition away from peat will be key to gaining broad support from and beyond affected communities, which are mostly in rural areas with few other job opportunities.

Finland takes the just transition of the peat industry and affected regions and workers seriously. In a welcome step, the Ministry of Economic Affairs and Employment has appointed a working group to propose ways to help the sector transition. However, other strategies may be more effective. As in Ireland, Finland could appoint a commissioner to engage with all relevant (local) stakeholders (OECD, 2021b). Alternatively, it could set up a commission to determine the path of peat production and peat use for energy. Such a commission would encompass multiple stakeholders, including local representatives, trade unions, energy suppliers and scientists. As such, it would be more likely to ensure broad support for the transition.

Experience from previous transitions related to fossil fuel extraction (e.g. coal) suggests the need for a clear phase-out date for use of peat, complemented with a transition plan. This would provide certainty for investment and education decisions for workers and firms, preventing lock-in of high-carbon educational choices. Preparing territorial transition plans in co-operation with relevant local stakeholders would create tailored alternative economic futures beyond peat. At the same time, they would outline spatially fine-grained timelines and targeted measures.

The working group proposals emphasise improving the situation of peat industry operators while strengthening the security of energy supply. This would be achieved notably through reducing peat consumption at a "moderate rate" during the transition (MoEAE, 2021b). While the latter could maintain some jobs in peat production, the approach would prolong substantial GHG emissions. Indeed, peat production through drainage or groundwater extraction caused 1.8 Mt of GHG emissions in the land-use sector in 2018 through release of methane or marsh gas emissions (Sitra, 2020). In addition, peat production irreversibly damages sensitive peatland ecosystems. This damage reduces biodiversity, while polluting and acidifying water bodies with iron or nutrients (Sitra, 2020).

The working group also proposes a one-off package for peat industry operators to shut down their operations. Among other measures, it would compensate peat producers for unsold stock and for disposal of peat production machinery. It would offer adjustment allowances to operators who discontinue peat extraction. In addition, it would offer early retirement arrangements for older peat workers.

This one-off package is expected to reduce peat extraction effectively. However, the use of public funds needs to be weighed against other uses. Some funds could create alternative economic futures, for example, including new business opportunities. The working group could inform about the measures with the highest social returns depending on local factors. Key factors could include age distribution and skill level of peat operators.

The working group also proposes a controlled transition to new business activities that go in the right direction. For example, the "From peat to bioeconomy, nature management and multi-sectoral

entrepreneurship" programme (MoEAE, 2021b) is expected to create green jobs in affected areas. This could offset some negative employment effects from reduced peat extraction. Local green jobs would avoid relocation of workers to mitigate potential negative effects on family life and communities more broadly. Incentives for peatland restoration would create local jobs, while increasing the capability of peat to store carbon, and enhance adaptation and biodiversity (OECD, 2021b). In addition, some jobs may be created in the bioenergy sector to replace peat for energy production (Sitra, 2020).

Finland plans to tap at least EUR 750 million from the EU Just Transition Fund (JTF) over 2021-27 to finance investments in training and infrastructure (MoEAE, 2020a). The government has decided to top-up the JTF contribution with an additional EUR 70 million. In line with JTF guidelines, Finland will direct most of the funds towards strengthening the local economy and the local workforce apart from peat.

This welcome move to strengthen the local economy includes various measures. It will invest in energy efficiency of public and private buildings or distributed energy generation (e.g. mini CHP). It will also train and reskill workers to enable them to seek job opportunities in other sectors. In addition, training for entrepreneurship can help workers set up their own businesses. Investments in physical infrastructure (e.g. information and communication technologies) or soft location factors (e.g. culture, public services, civil society) could attract human capital, as well as new and innovative businesses. If the local economy cannot absorb all workers, mobility programmes could facilitate job search and matching in other regions (OECD, 2017).

4.5.2. Shifting support from mature to non-mature technologies

Decarbonising the electricity grid requires more investment in renewables. Use of renewables in electricity generation is expected to increase from 48% to 53% over 2019-30. In the "with additional measures" (WAM) scenario, this will translate into projected capacity for wind of 5.5 gigawatts (GW) (up from 2 GW in 2018) and of 1.2 GW for solar (up from 120 MW) (MoEAE, 2019). These figures will be updated in view of the carbon neutrality target.

Generation from wind power increased by more than tenfold between 2011-19 thanks to feed-in-tariffs (FiTs). To spur wind development in the early years, wind energy was eligible for an increased FiT rate until the end of 2015 (Wikberg, 2019). In 2018, Finland changed the support system for renewables from sliding FiTs to technology-neutral auctions for feed-in-premiums to enhance cost-effectiveness and price discovery.[11] The first auction was oversubscribed by a factor of three, with all bids coming from onshore wind. The premium tariffs awarded averaged at EUR 2.52/MWh. The auction awarded contracts to projects capable of generating 1.36 TWh of electricity.

In a welcome move, Finland shifted support for onshore wind (both operating aid schemes and auctions) to less mature technologies for both generation and flexibility in 2019 (MoEAE, 2019). Onshore wind is a mature technology with generation costs around EUR 30/MWh (MoEAE, 2019). Therefore, project developers would continue investing in wind using power purchase agreements or on market terms if wholesale prices (between EUR 20 and EUR 40/MWh) are sufficiently high. In 2018, Finland saw its first wind power investments made without any subsidies (IEA, 2018). As of 2021, the pipeline of planned wind power projects amounts to more than 21 GW (18 GW onshore, 3 GW offshore) (FWPA, 2021a). This is almost four times the expected wind capacity in 2030 according to the WAM scenario. While removing financial support, Finland continues to remove administrative, zoning-related and other barriers to onshore wind.

There is a location mismatch between onshore wind generation and power consumption. Most of the planned onshore capacity is expected in Finland's Central part (e.g. Li, Kaajani, Haapavesi) far from the major consumption centres in the south. Eventually, the transmission network will need an upgrade (FWPA, 2021b). More granular spatial pricing would provide incentives for project developments closer to consumption centres while avoiding investments in transmission infrastructure (IEA, 2016).

Further support for offshore wind may be needed. The levelised cost of electricity for offshore wind is almost four times higher than that of onshore wind (EIA, 2021). Finland has excellent wind conditions for offshore wind, but conditions in the Finnish sea require specialised technical solutions due to ice. A maritime spatial plan outlines potential areas of offshore wind production that would have least impact on underwater natural and cultural values (MoE, 2020b).

Finland will improve conditions for construction of offshore wind. In a first step, Finland reduced the property tax that offshore wind developers pay to municipalities for the foundations of the plants. Finland's national recovery and resilience plan submitted to the European Union includes support for a first large-scale (6 GW) demonstration wind park in the Åland area, combined with a power-to-X solution (MoF, 2021b).[12] Further financial support for offshore wind, such as competitive tenders, would spur deployment.

Distributed generation and prosumers (i.e. households that both consume and produce electricity) are playing an increasing role in the Finnish grid even with limited direct financial support from the government. Across the European Union, Finland has the most favourable conditions for prosumers (SmartEN, 2020). Finland has a long tradition of distributed generation. Notably, this includes off-grid solar photovoltaic (PV) to power a significant share of electricity use for lighting, refrigeration and consumer electronics for around 500 000 summer houses.

Utility-scale solar PV is not yet cost-competitive in Finland, while solar PV is mainly considered as an element to enhance the energy efficiency of buildings. In 2019, the Finnish government granted investment subsidies worth EUR 13.2 million to support 500 small-scale PV installations in companies, communities and public organisations (IEA-PVPS-TCP, 2019). Households can get a tax credit for the work cost component of the PV installation, equivalent to 10-15% of total PV costs.

Electricity generators under 100 kW are exempted from the electricity tax and value added tax. Most of the financial incentives for onsite electricity generation, however, come from onsite optimisation and self-consumption of electricity. These incentives bypass network tariffs and taxes, which account for roughly 60% of the retail price (SmartEN, 2020).

Some distribution system operators (DSOs) offer imbalance settlements in housing companies. This ensures that self-generated electricity is first consumed onsite and, thus, exempted from tariffs and taxes. Overproduction of onsite generation can be sold to electricity suppliers at market prices. From 2022, DSOs are required to offer imbalance settlements for housing companies, which is welcome. In addition, Finland will introduce the datahub, a centralised information exchange system, covering all 3.7 million electricity accounting points in Finland. This is expected to support imbalance settlements while reducing barriers to market entry of new energy service companies (Fingrid, 2021).

4.5.3. Enhancing power sector flexibility

Power system flexibility ensures that electricity demand and supply are balanced at all times. Flexibility demands are expected to increase with larger penetration of variable renewable energy such as wind both in Finland and in the Nordic market. On the supply side, flexibility from nuclear plants is limited, while that of CHP and hydro plants is higher (IEA, 2018).

The primary source of Finland's flexibility is through interconnections to other electricity systems (notably Sweden). As of 2019, the level of interconnectivity (e.g. the ratio of interconnection capacity and domestic power plant capacity) was 22% (excluding interconnection capacity to Russia). This exceeded the EU's target to reach interconnections between member states of at least 15% by 2030. The interconnection level will decrease to 18% once Olkiluoto 3 comes on line. Jointly with Sweden, Finland is planning an 800 MW transmission line between their northern frontiers to be operational by 2025 (MoEAE, 2019).

Finland is well integrated in the Nordic wholesale market Nordpool. Further strengthening inter-regional co-operation with neighbouring system administrators could increase the benefits of electricity trading and network planning. For example, increased co-operation on balancing services and reserve markets would enhance flexibility and reliability in a cost-effective way, while addressing peak capacity needs (IEA, 2018). In addition, co-ordinated electricity system planning and regional electricity security assessments would improve utilisation of resources (IEA, 2018).

Finland is a pioneer in the development of smart grids and demand response, which are expected to play an increasingly important role for flexibility. Finland has been emphasising the role of demand-side flexibility for many years. Notably, this includes smart grids, aggregation, demand response, storage and distributed generation. The Smart Grid Working Group presented major proposals in electricity markets in 2018, including increased demand-side participation and enhancing cross-sectoral co-operation[13] (MoEAE, 2018).

Finland was a frontrunner in the roll-out of smart meters in the European Union, reaching over 99% of all consumers by the end of its roll-out in 2013. Many smart meters will reach the end of their lifetime in the next few years. Replacing them with next-generation devices that include load control functionality would enable many customers to engage in demand response more cost effectively (MoEAE, 2018). Preparing for data and cybersecurity threats is essential to enhance uptake and customer confidence. Comprehensive roll-out of next-generation smart meters would ensure that all customers, including low-income households, could benefit from the new energy architecture.

Implicit demand response through time-based electricity retail rates is well established in Finland. All Finnish electricity customers can choose an electricity contract with time-of-use or real-time pricing. As of 2018, approximately 9% of retail customers had a dynamic electricity price contract (MoEAE, 2019).

Switching the default electricity contract from opt-in to opt-out (as in Spain) would considerably increase dynamic pricing participation rates. Complementing this change with information on the functioning and risks of dynamic pricing would improve effectiveness. At the same time, it would protect vulnerable consumer groups that may be unable to shift electricity consumption (e.g. elderly or disabled people) away from high-price hours.

Explicit demand response (i.e. demand response participating in electricity markets) is available but not yet mainstream in Finland. As of 2020, around 20 aggregators were active in Finland. Aggregators are third-party entities that cumulate a variety of small-scale generation or flexible loads against a payment. More households, notably large consumers (e.g. for electrical heating) with time-of-use tariffs, are expected to shift to market-based load control schemes through aggregators (MoEAE, 2020b).

Finland was one of the first countries that enabled small customers to participate in electricity markets through aggregators. Technical barriers for aggregators and other resources in markets tend to be low (SmartEN, 2020). Explicit demand response and storage are already participating in balancing and reserve markets (MoEAE, 2019). For example, demand response contributes 22 of 729 MW in Finland's strategic reserve for short-term supply shortages (IEA, 2018).

In addition, Finland reduced barriers for smaller players in the balancing market through lower minimum bid sizes and electronic automation of bids, among other measures. Finland also increased funding for research and development in smart energy solutions. Measures included storage, microgrids, smart EV charging, smart homes, power to gas or aggregators through TEKES' Smart Energy Program (2017-21). Finland is among the leading IEA member states in terms of energy-related research, development and deployment expenditure as a percentage of GDP (IEA, 2018).

In 2019, Finland announced the removal of double taxation for storage (battery and pumped hydro). This is a welcome step to increase investments in large-scale or behind-the-meter storage. Further reducing entry barriers for demand response and storage, including for aggregators and renewable energy communities, would unlock additional flexibility potential. For example, the tariff structure for DSOs may

present a barrier for third-party entry (IEA, 2018). Greater consistency and harmonisation of distribution tariff methodologies would reduce these barriers.

Sector integration, such as the electrification of end uses and the production of electrofuels like hydrogen, could add further flexibility potential while decarbonising end-use sectors. Exploiting cross-sector synergies though sector integration are key aspects of systemic redesign (Figure 4.3). Finland sees electrification as a key strategy to reduce emissions in end-use sectors given the limited scope for large-scale replacement of fossil fuels with sustainable bioenergy (MoEAE, 2020a). In 2020, Finland appointed a working group on sector integration to explore opportunities and barriers to enhance sector integration and to promote the hydrogen economy and other power-to-X applications. Support for power-to-X is also included in Finland's national recovery and resilience plan.

Although Finland has one of the highest electrification rates, electrification of transport and heating is lower than in Norway and Sweden (NER, 2019). Electricity taxes may discourage electrification, notably when competing fuels for energy services (e.g. peat for heating) are not taxed according to their full social costs. Finland had the seventh highest average electricity tax rate across all OECD and G20 countries in 2018 – almost three times higher than the average rate across all OECD and G20 countries (OECD, 2019b). Electricity taxes encourage consumers to improve energy efficiency. However, they do not directly provide incentives to decarbonise power supply because they put a price on all electricity sources regardless of the carbon content (OECD, 2019b). In a welcome move, the government started to reduce industrial energy tax rebates in 2021 (which will be fully phased out by 2025). At the same time, it lowered the electricity tax for class II users (or those benefitting for a lower tax rate, i.e. industry, mining, greenhouses and data centres) to the EU minimum rate (0.05 cents per kWh). These measures aim to support decarbonisation through electrification. To speed up electrification, Finland also plans to transfer large-scale heat pumps and electric boilers that generate heat for district heating (DH) networks to the lower electricity tax category in 2022 (Chapter 3).[14] This is a welcome step. The reduced rate should be extended to public EV and multimodal charging stations to provide incentives for transport electrification.

The structure of distribution network tariffs increasingly favours electrifying end uses. DSOs recover some of their costs through the fixed part of the tariff and the remaining share through the variable part. Low variable costs provide incentives for consumers to electrify end uses. However, they reduce incentives for investments in energy efficiency as per unit consumption costs are low.

Finland's retail electricity prices for households are around the EU average. With increasing self-consumption of prosumers (Section 4.5.2), DSOs could further reduce the variable part while strengthening the fixed part (MoEAE, 2019). Introducing capacity-based components as in Norway would help avoid or postpone distribution grid upgrades. To that end, it would provide incentives for customers to reduce peak electricity consumption and to participate in demand response. Both of these would reduce consumers' distribution network bill (MoEAE, 2018).

Finland could consider amending its network management and regulation of DSOs to save network costs and strengthen the role of innovative energy services such as aggregators. So far, DSOs have focused on reinforcing the distribution grid to alleviate network congestion (IEA, 2018). However, an output-based approach would be more flexible. This would allow procurement of storage, demand response or energy efficiency as an alternative to grid reinforcements (as is partially the case for the transmission operator).

DSOs should not actively engage with these activities but rather procure flexibility in a competitive and technological-neutral manner when needed. Consumers and aggregators would thus need to be allowed to participate in local network management markets in addition to national electricity markets. Procuring flexibility could be more cost-effective than traditional investments in distribution network upgrades in many cases. If investments in distribution networks are more cost-effective, then the capacity of the distribution grid should be upgraded substantially due to favourable economies of scale and in view of increasing electrification (Vivid Economics, Imperial College London, 2019).

4.6. Towards a zero-carbon building sector with low-energy buildings

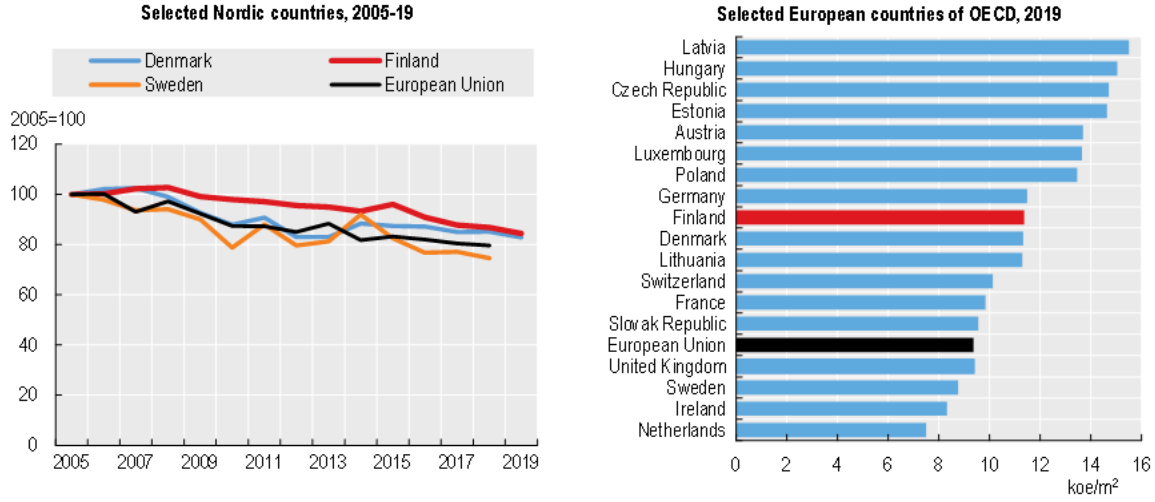
Direct and indirect emissions in Finland's building stock accounted for about 15% of total GHG emissions (MoEAE, 2019). Energy use for heating of the Finnish building stock in 2020 is estimated at about 20% of total final energy consumption (MoE, 2020c). Energy consumption of residential buildings increased by 2% between 2005 and 2019 (IEA, 2020). Energy savings from energy efficiency largely mitigated increased energy demand. Demand rose due to the increasing number of dwellings and increase in floor area per person, which climbed from 35.3 m^2 in 2000 to 40.8 m^2 in 2018 (Statistics Finland, 2019). Average dwelling-occupancy has decreased constantly. Between 1970 and 2018, the number of people per dwelling fell from three to below two, with 44% single-person dwellings (Statistics Finland, 2019).

Finland has a large stock of old buildings and 30% of floor area was constructed before 1970. None of this stock faces any regulation on energy efficiency (IEA, 2018). Finnish housing units are in extremely good condition (e.g. no leaking roof, damp walls or rot in window frames) when compared to other European countries (Eurostat, 2020). However, the energy performance of the building stock leaves room for improvement. Depending on building type (single-family dwelling, terraced house, block of flats), only 22-26% of buildings are classified as energy efficient (energy labels A, B or C on a scale up to G) (MoE, 2020c).

Progress in improving energy efficiency was lower than in other countries. Between 2005 and 2019, climate-corrected[15] energy consumption per square metre for space heating in Finland decreased by 15% (Figure 4.7). This is below the European average (21%) and lower than in Denmark (17%) or Sweden (25%). In 2019, Finland had higher energy consumption per square metre for space heating than the EU average (Figure 4.7). This is, however, primarily related to the harsh climatic conditions. In fact, if Finland would face the average European climate, its energy consumption for space heating per square metre would be among the lowest in the European Union.

Figure 4.7. Building's energy consumption decreased but less than in other countries

Energy consumption of space heating per m^2 with climatic corrections



Note: Climate corrections adjust annual energy consumption to represent the average country-specific climatic conditions. Data in the right panel refer to 2019 or latest available data.
Source: Odyssée-Mure (2021), *Energy Efficiency* (database).

StatLink https://doi.org/10.1787/888934288288

A well-being approach to policy making in the residential sector can support Finland to reduce energy demand through energy efficiency (Section 4.6.1). It can also exploit cross-sector synergies and decarbonise heat supply (Section 4.6.2) while systematically advancing well-being outcomes. These include limiting climate change, alleviating energy poverty, ensuring housing quality and enhancing the affordability of dwellings and their supply (OECD, 2019a).

Achieving these priorities requires a systemic view between sectors (e.g. electricity and transport) and scales (e.g. dwellings, neighbourhoods and cities). It also demands understanding of how urban forms evolve and interact within their ecosystems. This gives decision makers multiple levers of action to advance the systemic change in the residential sector beyond the dwelling. Such changes could include creating green spaces as carbon and rainwater sinks, improving quality of neighbourhoods, protecting biodiversity and adapting to climate change (Section 4.6.3).

4.6.1. Increasing energy performance of buildings through renovation

Enhancing buildings' energy performance by scaling up deep retrofits

In 2020, Finland published its long-term renovation strategy that aims to reduce emissions by 90% by 2050. The strategy also provides an overview of the building stock in 2020 and indicative targets for the years 2030 and 2040 (MoE, 2020c). To achieve the targets, Finland is planning a mix of efficiency improvements through renovation, phasing out fossil fuel use (see below) and demolishing buildings that are underused and not expected to be used again. This process, which targets regions with decreasing population, will consider demographic change and within-country mobility. The renovation strategy does not consider possible additional reductions in energy demand at the neighbourhood or city level, e.g. through green infrastructure (Section 4.6.3).

By 2050, the renovation strategy aims to increase the share of nearly-zero energy buildings (NZEB) from 10% in 2020 to 82% (apartment buildings), 99% (single-family homes) and 100% (terraced houses) (MoE, 2020c). Where buildings cannot achieve the NZEB standard, a combination of renovation and low-carbon heat could ensure that buildings have net-zero emissions. However, Finland uses a relatively low primary energy factor values in its calculation (Kurnitski, 2019).[16] Therefore, its definition of NZEB is less ambitious than the EC recommendation for Nordic countries.

The lower NZEB standard leads to a continuation of above-average energy consumption. For example, energy consumption of apartment buildings would decrease between 2020 and 2050 according to the renovation strategy. However, consumption would be still more than 100 kWh/m^2/year in 2050. This is much more than what the EC recommendation considers as technically feasible for apartment buildings in Nordic countries (65 kWh/m^2/year) (Kurnitski, 2019).

Achieving low-energy demand neighbourhoods with high shares of NZEBs by 2050 requires deep retrofits that would deliver a number of well-being outcomes. Deep retrofits are whole-building renovations that cut energy use by more than half. The retrofits achieve this goal through a bundle of measures that look at elements of renovation holistically rather than in isolation.[17] Compared to shallow retrofits (e.g. a one-off replacement of a boiler), deep retrofits can enhance the quality of buildings by lowering energy demand (e.g. through improved insulation and window replacements), improving the health of occupants.

Deep retrofits can also help further reduce long-term energy poverty. In 2019, 1.8% of the Finnish population reported problems keeping their homes warm enough. Meanwhile, 7.8% had arrears on their utility bills (EU Energy Poverty Observatory, 2021), one of the lowest figures across the European Union. Energy poverty is directly linked to the income situation of households. Low-income households can apply for a government subsidy for their housing costs through the Social Insurance Institution of Finland (MoE, 2020c). Deep retrofits could potentially reduce government subsidies overtime.

Finland's policy approach is mixed, encouraging both deep and shallow retrofits of buildings. As in most OECD countries, some of Finland's fiscal incentives have encouraged shallow or staged deep renovation of buildings. For example, Finnish households can deduct the labour costs of renovating detached houses from their income tax to increase demand for renovation services and reduce the informal economy. The annual deduction limit (EUR 2 250 in 2020) provides incentives to modernise building parts over multiple years. Ideally, it should encourage holistic retrofits that could exploit synergies by modernising multiple components at the same time. In addition, Finland introduced grants to phase out oil heating, specifically targeting one building component rather than buildings as whole.

Finland has voluntary energy efficiency agreements with rental housing companies. These agreements, in place since 2002, aim to increase individual energy efficiency measures related to heating, ventilation or lighting. Voluntary agreements cover around 250 000 housing units, approximately 17% of apartment blocks and terraced in Finland. The agreements' energy saving target for 2017-25 is at least 7.5%, in line with the EU Energy Efficiency Directive, i.e. less than 1% annual reduction. Voluntary agreements alone are not enough to be in line with the renovation strategy. The renovation strategy calls for annual energy savings in apartment blocks of 2.5% between 2020 and 2030.

In a welcome step, Finland introduced mandatory energy performance certificates. These certificates are required when selling or renting a building, or a part thereof (MoE, 2020c). Following the example of the United Kingdom, Finland could also consider requiring property owners to retrofit rentals to a higher energy performance. For example, it could set an energy performance rating of at least "E" to enhance incentives for deep retrofits (Energy Saving Trust, 2019).

Finland is, however, moving in the right direction regarding deep retrofits. In an ambitious move, Finland requires major renovations to fulfil the same energy performance standard that applies to new buildings (MoE, 2020c). Energy subsidies for retrofits of residential buildings are conditional on improving the energy efficiency of the building as a whole. Subsidies require energy performance of the building to be 20% (apartment block) or 30% (detached house) better than in the building regulation (Decree 4/13). A larger subsidy is available if the energy efficiency of the whole building is at least equivalent to the energy efficiency requirement for a new NZEB building.

Finland also offers targeted subsidies. One set of subsidies targets retrofitting residential buildings with humidity damage or indoor air problems. Another set offers subsidies for improving the living conditions of elderly or disabled people. These two subsidies target synergies between reducing energy demand and improving public health and equity (MoE, 2020c). Providing more clarity on those subsidies beyond 2022 would help prevent short-term market distortions and rising prices. At the same time, it would improve predictability and long-term planning of relevant stakeholders.

Efforts to industrialise retrofits, following the Dutch/EU Energiesproong model, could significantly reduce the costs of deep retrofits. High costs are a key barrier to deep retrofits. Finland tested industrialising retrofits in the past, but the project failed due to high costs. Yet Finland could replicate other examples from the European Union.

In a welcome step, Finland piloted joint building ventures that combine multiple renovation projects in the same neighbourhood (MoE, 2020c). If embedded in a broader effort of urban renewal, this could upgrade entire neighbourhoods, increasing residents' quality of life. Aggregating multiple projects into one large project creates economies of scale, attracts a larger number of contractors and allows for a tendering process. This could reduce costs or improve the quality of the renovation.

Finland should continue promoting joint procurement of building elements (e.g. rooftop solar PV) and joint renovation projects with a view to reaching scale to industrialise retrofits. It could also explore alternative financing mechanisms for deep retrofits. These could include financing through energy service companies or on-bill financing to address high up-front costs.

Implementing Finland's long-term renovation strategy would create an additional 12 000 full-time jobs in the manufacturing, service and construction sector (MoEAE, 2020a). Finland's workforce, however, needs better training to keep up with new requirements on buildings and new technologies. Energy efficiency of buildings constitutes an integral part of the construction industry's education curriculum at all levels (MoE, 2020c). A few undergraduate-level degrees focus exclusively on retrofitting or energy efficiency. Finland offers a variety of lifelong learning opportunities through vocational schools or public education facilities at all levels of government. Enhancing digital learning, including through the provision of free digital teaching materials and online courses, would support lifelong learning of the workforce.

Applying best-practice standards for new buildings along the life cycle

Ahead of the EU's Energy Performance of Buildings Directive (EPBD, 2010/31/EU) 2021 deadline, Finland implemented a regulation in 2018 requiring all new buildings to be NZEB. Energy use of buildings is responsible for around 80-90% of life-cycle emissions. Conversely, 10-20% of emissions occur during the construction phase (including embodied carbon in materials) and the demolishing phase (OECD, 2020b).

Finland plans to double the use of wood in construction (Finnish Government, 2019), which is welcome. Wood already accounts for 40% of all building materials, including in 90% of detached houses and in virtually all summer houses. However, concrete and steel, which are more carbon-intense than wood, are dominant in multi-storey residential and commercial buildings. Increasing the share of wood in construction would store carbon captured by forests for a long time, while improving the health of occupants due to better indoor air quality.

Finland is a pioneer in tackling the life-cycle emissions of new buildings. In 2017, the Ministry of Environment published a roadmap to low-carbon construction, laying the foundation for legislation on low-carbon buildings (Kuittinen and Häkkinen, 2020). Finland is planning to include carbon limits on buildings' life-cycle emissions for different building types before 2025. Based on the European Commission's Level(s) method, Finland has developed an assessment method to determine the carbon footprint and handprint (i.e. the net benefits in terms of carbon storage or production of renewable energy) of new buildings (MoE, 2019). Finland may extend the calculation method to renovation (MoE, 2020c). On a local level, cities like Helsinki already incorporate the carbon footprint and eco-efficiency of construction projects as procurement criteria for buildings and infrastructure. They also use it to assess plot conveyance (i.e. for selling or renting city plots for private or commercial users) (City of Helsinki, 2018).

4.6.2. Decarbonising heat with a stronger focus on non-combustion technologies

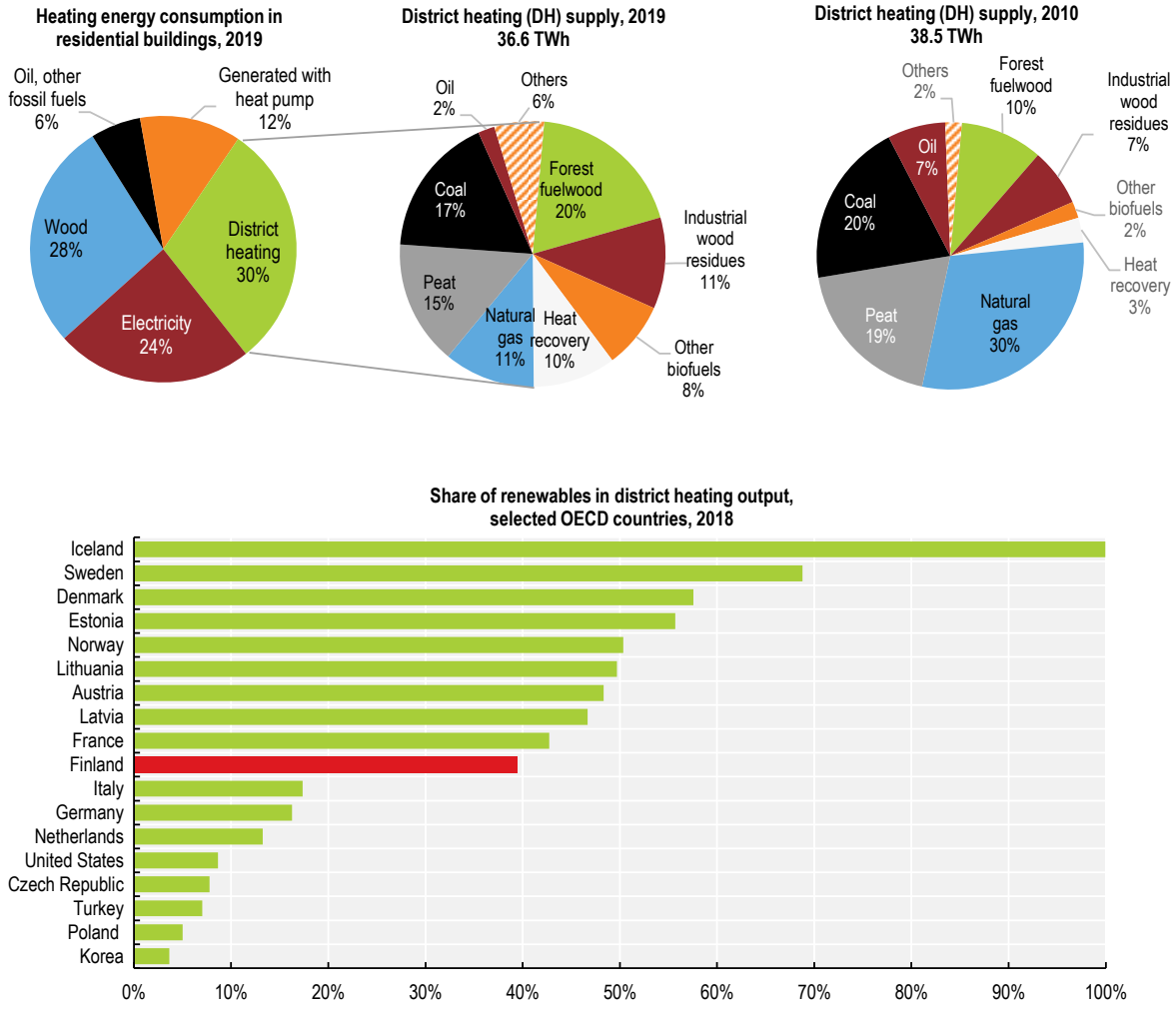
Finland's heating technologies differ between rural or urban areas and building type. In rural areas and single detached houses, small-scale wood-based (35%), electric heating (30%), electric heat pumps (16%) and fossil-based heating (10%) dominate heating technology (MoE, 2020c). Electric heat pumps have started to replace electric heating and fossil-based heating. Finland already has a well-established heat pump market (IEA, 2018). Consequently, direct residential CO_2 emissions more than halved between 2005 and 2018 (IEA, 2021). Finland introduced a 10% liquid biofuel blending obligation for light fuel heating (MoEAE, 2019). Oil heating will be phased out by the start of the 2030s (MoE, 2020a). In addition, the central government and municipalities will cease using oil heating by 2024 (Finnish Government, 2019).

District heating is the major heating source for residential buildings in Finland (Figure 4.8). In urban and suburban areas, the share of DH is as high as 89%. Due to ongoing urbanisation and expansion of the DH network, the number of households with access to DH is expected to increase. CO_2 emissions from heat plants and CHP plants decreased by 20% between 2005-18 (IEA, 2021). The share of fossil fuels and peat in Finland's DH production decreased from 76% in 2010 to 45% in 2019 (Figure 4.8). Coal and peat have been replaced by biomass, other energy sources (e.g. waste) and increasingly waste heat recovery.

Renewables and other energy sources (e.g. heat recovery, heat pumps) in DH accounted for 39% and 16%, respectively, in 2019. Based on WAM projects, they are expected to reach 50% and 20%, respectively, in 2030 (MoEAE, 2019). Among renewables, solid biomass from wood and wood residues from side streams of the forest industry account for the largest share (>85%).

The share of renewables on DH energy supply was still lower than in other Nordic countries in 2018 (Figure 4.8). Almost 70% of DH production is based on CHP plants, which minimise energy losses in terms of waste heat (MoEAE, 2019). Trigeneration, the simultaneous production of heat, cooling and power, further minimises energy losses and has been successfully implemented in Helsinki.

Figure 4.8. The share of low-carbon heating fuels in district heating increased but is below that of other countries



Note: Left panel: Data refer to energy heating consumption from single-family and semi-detached houses, terraced houses, blocks of flats and rental housing.
Source: *Finnish Energy* (2021), *Energy Year 2020 – District Heating*; *REN21 Policy Database* (2020); *Statistics Finland* (2021), "Energy consumption in households".

StatLink https://doi.org/10.1787/888934288307

The switch from fossil fuels and peat to biomass and other energy was largely driven by policies. Fossil fuel use in CHP and DH is taxed. However, despite energy tax rates on peat nearly doubled in 2021, peat still faces substantially lower tax rates than other fossil fuels (Chapter 3). Aligning tax rates to reflect the real social cost would accelerate the pace of the fuel switch. The EU ETS covers most of the CHP and DH plants (i.e. those with a rated capacity exceeding 20 MW). Thus, they also face the ETS permit price. While the permit price applies to fossil generation, biomass is assumed to be carbon neutral. This effectively exempts biomass from carbon pricing and provides incentives for biomass combustion.[18]

Finland's operating aid for electricity and heat from forest chips also triggered the fuel switch to renewables. The maximum aid for electricity produced from forest chips is EUR 18 per MWh (MoEAE, 2019). The aid depends on the EU ETS permit price. No aid is paid if the price exceeds EUR 23.7/tCO_2 per tonne, which has been mostly the case since 2019.

To support phase-out of coal in CHP plants (Section 4.5.1), the government supported the early switch of CHP plants to biomass (EUR 90 million) and non-combustion technologies (EUR 45 million). It thus indicated a preference for fuel substitution with biomass over non-combustion technologies.

Non-combustion technologies, including heat pumps, heat storage and waste heat recovery, have fewer trade-offs with well-being dimensions (Section 4.2.2). The extensive DH network in urban areas allows for exploiting cross-sector synergies through recovery of wasted and recycled heat, further reducing primary energy demand. The share from heat recovery increased from 3% to 10% over 2010-19 (Figure 4.8). Early non-combustion projects explored options to recycle heat from data centres (e.g. Mäntsälä) or wastewater (e.g. Turku) (Sitra, 2019). For example, the data centre in Mäntsälä delivers around 20 gigawatts per hour (GWh) heat to the local DH system, covering roughly half of DH demand (Patronen, Kaura and Torvestad, 2017). In Espoo, waste heat accounts for 20% of heat production.

The DH market is unregulated. Finnish law does not guarantee or regulate third-party access to DH networks. Consequently, bilateral agreements set out conditions for third-party access. Absence of guaranteed access could add uncertainty to third-party heat providers, preventing heat sources to be tapped.

Decarbonising heat supply of DH networks within a short period is challenging. Although DH is a key infrastructure to deep decarbonisation, DH companies face increasing financial challenges. First, energy efficiency improvements are expected to reduce heating demand. This means that revenues for DH companies to maintain the infrastructure will also decline (MoEAE, 2019). Second, customers in some regions increasingly switch from DH to decentralised solutions (e.g. heat pumps) in response to rising DH prices due to higher fossil fuel prices (both policy and market driven). While DH prices are moderate compared to other Nordic countries, they have been rising disproportionately between 2007 and 2017 (IEA, 2018).[19]

Hybrid systems that combine DH with large-scale electric heat pumps and water thermal storage. These could enable DH companies to generate new revenue streams by participating in electricity markets and providing flexibility (Averfalk et al., 2017). Hybrid systems are commercially viable in most places and Finland could consider supporting these systems where they are not. It is therefore welcome that Finland plans to reduce the electricity tax rate for large-scale heat pumps, electric boilers and data centres to the minimum level of the EU Tax Directive (Section 4.5).

4.6.3. Reshaping the built environment: Adaptation and mitigation at city level

Urban form significantly determines GHG emissions. Most of Finland's urban areas only started to see rising population density after 2010. For example, Helsinki's development was characterised by low-density housing development and the creation of jobs outside the city centre. This led to a polycentric city structure until the 2010s (Tiitu, Naess and Ristimäki, 2020).

Densification in the Helsinki region started only after 2010. The process was guided by national land-use guidelines (e.g. Land Use and Building Act) that aimed to reduce carbon emissions while preserving biodiversity. More recently, densification has become a key part of Helsinki's climate action plan to reach carbon neutrality by 2035 (City of Helsinki, 2018). The plan foresees continuing development of housing in inner-city brownfield areas (Tiitu, Naess and Ristimäki, 2020). Some Finnish cities are increasing or are planning to increase density. They will achieve this goal by demolishing and replacing old, energy-inefficient and low-density apartment buildings through multi-storey buildings with a substantially higher numbers of flats.

As in other OECD countries, Finland would benefit from improving its built environment through better urban and regional planning, mixed-use development and integrated, multimodal transport. Increasing the compactness of cities and creating proximity would reduce mobility and thus transport emissions. Moreover, compactness is also associated with lower energy use for buildings. Evidence from modelling global building-related energy use suggests that urban density influences future energy use as much as energy efficiency (Güneralp et al., 2017). Higher urban density is associated with smaller dwelling size (in terms of floor space per capita) and thus lower per capita energy use for heating and cooling (Güneralp et al., 2017). Energy savings are also due to synergies in heating apartment blocks compared to single-family houses. Evidence from the United States suggests that doubling population density in cities could reduce CO_2 emissions from household travel by 48%, and those from residential energy use by 35% (Lee and Lee, 2014). Energy savings from more compact forms tend to be larger in cool climates (Güneralp et al., 2017).

In addition, denser areas offer more potential for a diverse pool of heating supply options. Options like DH need a sufficiently high heat density demand to be cost-competitive with other heating solutions. In addition to density, mixed land-use (i.e. the integration of multiple forms of land-use, including housing, shopping, offices and leisure activities) would further reduce travel demand and transport emissions. At the same time, it provides opportunities to recycle waste heat streams from different urban functions within buildings or neighbourhoods.

Increasing the compactness of cities can come at the expense of other well-being priorities. These include reducing access to green spaces, ecosystem services, city carbon sinks or climate change resilience. Less access to these priorities reduces the well-being of citizens. The lockdowns during the COVID-19 pandemic have made the negative well-being effects of being confined in (small) apartment buildings visible.

Holistic spatial plans can minimise trade-offs between different goals. For example, to increase density, Helsinki plans 30% of new building developments for urban infills. They will also be close to public transport hubs, following transit-oriented developments to minimise car dependency and leverage on existing transport infrastructure. At the same time, Helsinki aims to preserve the most significant carbon sinks while reforesting open spaces. This will complement the city structure with trees, keeping forests vegetative and diverse (City of Helsinki, 2018).

In addition, Helsinki applies the green factor method. This method ensures sufficient green spaces while mitigating flood risk, storing CO_2, cooling down heat islands of built environments and enhancing the well-being and health of citizens (Inkiläinen, Tiihonen and Eitsi, 2016). Improving monitoring and evaluation of the green factor method would strengthen its effectiveness. In this regard, the diversity of green infrastructure projects should be a priority (Juhola, 2018).

The green factor method is a step in the right direction for Helsinki and could be mainstreamed to other cities and municipalities. Green space planning looks beyond individual green spaces, considering them as functionally interconnected units. This further improves the ability of green spaces to deliver on the SDGs, including clean air and biodiversity (e.g. avoiding fragmentation of habitats) (Andersson, 2018).

Housing in urban areas is costly. Among all dimensions of the OECD well-being framework, Finland scores worst in housing affordability compared to other OECD countries (OECD, 2020c). In the last years, housing prices have further diverged regionally, notably between the Helsinki Metropolitan Area and the rest of the country (Putkuri, 2018).

Lack of affordable housing is also considered a major bottleneck for people seeking employment opportunities (Putkuri, 2018). To mitigate short-term affordability problems, Finland is offering state-subsidised rental housing (council housing) or general housing allowances for low-income households (both tenants and owner-occupied).

New (green) housing developments are needed to reduce pressure on urban housing prices from increased urbanisation, notably for low-income families. In a welcome move, many cities are locating different housing types in the same area (e.g. private ownership, rental housing, social housing). This practice, which prevents segregation of new development areas, ensures access to modern housing for low-income housing and strengthens social cohesion. In addition, spatial plans for new developments such as in Helsinki increasingly ensure that green infrastructure complements housing developments. This provides important ecosystem services and enhances the well-being of inhabitants.

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Notes

[1] An increase of harvesting of 1 million Mm^3 would reduce the carbon sink by approximately 1.5 $MtCO_2e$ within the next 40 years.

[2] The sustainable logging maximum ensures stable forest growth and keeps a forest's absorption capacity in line with the carbon neutrality target.

[3] Finland does not have a strong focus on carbon capture, utilisation and storage (CCUS) and BECCS. Finland also banned onshore storage due to lack of suitable geological formations, but captured CO_2 could be transported abroad through ships. Cost calculations for BECCS suggest that biomass CHP and DH plants and the pulp and paper industry would be most cost-effective (Kouri et al., 2017). Finland neither provides financial incentives for CCUS nor includes this option in its energy planning (IEA, 2018). However, the "Savings" scenario of Finland's LT-LEDS assumes the deployment of BECCS, which forms an integral part to meet both the carbon neutrality target and the 90% emission reduction in 2050 target (MoEAE, 2020a). According to this scenario, CCUS would amount to emission reduction of 14 $MtCO_2e$ in 2050. If CCUS were to play an increasingly important role, a clear commitment to that technology along with a policy roadmap and incentives would be needed to provide certainty for project developers and investors.

[4] The Roundtable convenes nominated representatives across society to create a common understanding of a just transition towards a carbon neutral society.

[5] As required under Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action.

[6] Mobility is a bad proxy or performance indicator of the contribution of transport systems to well-being for a number of reasons. In fact, growing mobility may be a symptom of deteriorating accessibility (ITF, 2019). Total mobility can grow when people and places of interest (e.g. schools, shops, hospitals, gardens, etc.) are badly connected, and when connections by active and shared transport modes are limited. For example, mobility increases if children cannot go to school by walking or cycling due to safety concerns, or when the proximity to shops decreases (e.g. local shops close), and people need to drive to meet their basic needs. Also, as motorised private vehicles become the most attractive or only way to get to places, access to opportunities may be reduced for less affluent households. This widens the inequality gap and reduces well-being. Yet because those who drive do so for more and longer distances, overall mobility can indeed increase (OECD, 2021c).

[7] Induced demand refers to the phenomenon by which investments in road expansion increase rather than reduce congestion. This is because more roads increase the attractiveness of cars so that more people choose to drive. Urban sprawl is the phenomenon by which people move farther from cities when they can get to city centres within a reasonable time budget (e.g. 30 minutes by car). Urban sprawl increases daily travel distances and reduces the attractiveness of active modes such as walking, cycling or micro-mobility. As density decreases, and single-use development is fostered, public transportation is also less of an option as it is difficult to maintain good service quality. Both dynamics lead to the erosion of alternative modes either because these modes are not safe, and/or because they are less convenient than driving a car.

[8] The energy content of advanced biofuels (e.g. produced from waste material) is taken into account as double its actual energy content when calculating the share of biofuels for the purposes of the distribution obligation.

[9] Meeting the biofuel targets (along with other bioliquids targets) domestically would require additional biofuel production capacity of 400 000 tonnes of oil equivalent (toe), almost double the amount of the current capacity of 500 000 toe.

[10] While the high share of net imports is not a problem in itself as Finland is well-connected to neighbouring electricity systems, resource adequacy during winter peak hours is increasingly a concern. Generation during winter peak demand (10 600 MWh in 2018) falls short of peak winter demand (14 000). Olkiluoto 3, the 1.6 GW nuclear power plant, is expected to be operational in 2021. This would reduce the gap in the medium term, while supporting Finland's target to be 55% energy self-sufficient by 2030. Another 1.2 GW nuclear power plant (Hanhikivi I) is proposed for construction but is not expected to be operational before 2028. Peak demand is expected to increase to 16 200 MW by 2030 and to 17 000 MW by 2040 (MoEAE, 2019). This will require higher levels of flexibility, including through demand-side management.

[11] Under the new scheme, winners of the tenders will receive a premium when the average three-month market price of electricity is lower than EUR 30/MWh. If the market price exceeds EUR 30/MWh, a portion of the tariff will be awarded on a sliding scale; no aid will be paid if the market price is higher than the sum of the reference price and the approved premium.

[12] Power-to-X refers to the conversion of electricity to other energy carriers, including hydrogen, methane or ammonia.

[13] The working group proposed to enhance action in the following areas: i) clarifying roles and rules in the electricity market; ii) enabling market-driven incentives; iii) creating technical preconditions to increased consumer participation; and iv) enhancing cross-sectoral co-operation (MoEAE, 2018).

[14] Data centres outside the district heating network that meet the criteria for energy efficiency and energy utilisation and building-specific heat pumps of industrial size are also entitled to a reduced electricity tax. The electricity tax reduction also applies to recirculating water pumps in geothermal heating plants.

[15] Climate-corrected consumption refers to consumption that would have occurred, with a normal climate (e.g. the average climate observed in the past 20 years) over the heating and cooling periods.

[16] Finland uses primary energy factors of 1.2 and 0.5 for electricity and district heating, much lower than those recommended by the European Union for Nordic countries and applied in other Nordic countries, including Sweden (Kurnitski, 2019).

[17] Techniques include building envelope improvements or Heating Ventilation Air Conditioning optimisation. These technologies, when applied as a bundle, will often cut total energy demand by at least half (Zhivov and Lohse, 2020).

[18] The European Union is updating rules regarding the carbon neutrality and sustainability of biomass. If biomass was not considered carbon neutral and faced the same price as fossil combustion under the EU ETS, then forest owners would need to be subsidised for carbon stored in forests. Otherwise, woody biomass supply would be inefficient and too low (Kooten, Binkley and Delcourt, 1995).

[19] In contrast to Denmark, Norway and most other countries, the DH market in Finland is unregulated. DH companies are local natural monopolies. Customers cannot switch their DH providers, which usually warrants price regulation to prevent abuse of market power. Finland (like Sweden), however, does not put any rules on the price setting of DH companies. It emphasises the free competition of DH with other heating technologies (e.g. heat pumps) to discipline DH companies (IEA, 2018). If abuse of market power is suspected, the Finnish Competition Authority can initiate investigations, the last of which was carried out in 2012 (IEA, 2018).

OECD Environmental Performance Reviews

FINLAND

Finland has a strong reputation as a leader in environmental policy and sustainable development. It committed to become carbon neutral by 2035 and to pioneer the world's first circular economy. However, it is not fully on track to meet its ambitious goals. Greenhouse gas emissions fell in the last decade, but they need to decline at a much faster pace to meet the target. Waste generation, material consumption and nutrient losses to water bodies have continued to rise. Agriculture and a large forestry sector exert pressures on the country's biodiversity. Targeted policy measures are needed to provide adequate incentives, boost investment and innovation and steer the economic recovery from the COVID-19 crisis towards the green transition. Finland should move from good strategy making to effective and coherent implementation. It needs to get the right policies in place, to secure sufficient resources and ensure continued and broad public consensus.

This is the third Environmental Performance Review of Finland. It evaluates progress towards green growth and sustainable development, with a special chapter focusing on climate change mitigation and well-being.

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