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Preface

Even with a small territory, Estonia has large oil shale reserves and extensive forest and water resources. Its EU membership has led to the incorporation of EU directives into domestic environmental legislation and to a greater interconnection with European energy networks. Estonia has achieved considerable progress in decoupling environmental pressures from economic growth. However, its dependence on oil shale, which dominates the energy mix, makes its economy very carbon- and energy-intensive, with low material productivity. Greenhouse gas emissions have risen significantly over the last decade. Estonia will need to align its energy and climate policies to reverse this trend and comply with its commitments under the 2015 Paris Agreement.

It is in this challenging context that we deliver the first OECD *Environmental Performance Review* of Estonia. This *Review* assesses the country's progress in achieving its environmental policy objectives since 2005; it provides 30 recommendations to help Estonia advance towards a greener, low-carbon economy, better manage its natural assets and improve its environmental governance and management. The analysis places particular emphasis on managing waste and materials, as well as environmental impacts of oil shale mining and use.

Oil shale has long been considered essential for Estonia's energy independence. The development of renewable energy and closer integration into European networks now provide welcome alternatives. Managing the transition away from oil shale mining and use is Estonia's most important economic, environmental and social challenge. To ensure the sector's viability in the near to medium term, the country needs to invest heavily to improve the efficiency of oil shale extraction, power generation and shale oil production. Oil shale is Estonia's largest source of hazardous and non-hazardous industrial waste. Reducing the generation and increasing the reuse of such waste would substantially improve environmental quality in the whole country and particularly in the mining region of north-eastern Estonia. This will require a combination of economic incentives and increased targeted public and private-sector research and development.

Municipal waste management is another important issue for Estonia. Since 2005, the country has mobilised private sector investments to move from reliance on landfilling to incineration with energy recovery. Recycling has progressed, particularly in Tallinn, but it has yet to reach European targets. Estonia needs to establish a stable institutional framework at the local level to move towards a circular economy. The *Review* also recommends strengthening data gathering and information systems for waste management.

This *Environmental Performance Review* is the result of a constructive policy dialogue between Estonia and the countries participating in the OECD Working Party on Environmental Performance. We stand ready to support Estonia in the implementation of the recommendations outlined in this study. I am confident that this collaborative effort will be useful in addressing our many common environmental challenges.

Angel Gurría
Secretary-General of the OECD

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 individual governments 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 Estonia's environmental performance since 2000 for data and since 2005 for policies. 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 Estonia's historical environmental record, present state of the environment, physical endowment in natural resources, economic conditions and demographic trends.

The OECD is grateful to the government of Estonia for its co-operation in providing information, for the organisation of the review mission to Tallinn (18-22 January 2016) and for facilitating contacts both inside and outside government institutions.

Thanks are also due to the representatives of the two examining countries, Herman Huisman (the Netherlands) and Riikka Aaltonen (Finland).

The authors of this report are Kathleen Dominique, Alexandria Hastings, Eugene Mazur and Alexa Piccolo from the OECD Environment Directorate, Katrin Pihor and Mari Rell of Praxis Centre for Policy Studies, and Tony Zamparutti of Milieu Ltd. Nathalie Girouard and Eugene Mazur provided oversight and guidance. Mauro Migotto provided statistical support; Jennifer Humbert provided editorial and administrative support; and Mark Foss copy-edited the report. Preparation of this report also benefited from comments from Nils Axel Braathen from the OECD Environment Directorate, Caroline Klein, Andres Fuentes and Paul O'Brien from the OECD Economics Department, Johanna Arlinghaus from the OECD Centre for Tax Policy, and others members of the OECD Secretariat, including the Trade and Agriculture Directorate and the Development Co-operation Directorate.

The OECD Working Party on Environmental Performance discussed the draft Environmental Performance Review of Estonia at its meeting on 7 November 2016 in Paris, 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, 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, Israel, Japan, Korea, Mexico, New Zealand and the United States.

Country aggregates may include Secretariat estimates.

Currency

Monetary unit: Euro (EUR)

In 2015, USD 1 = EUR 0.901

In 2014, USD 1 = EUR 0.754

Cut-off date

This report is based on information and data available up to September 2016.

Disclaimer

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Abbreviations and acronyms

BAT	Best available techniques
BERD	R&D expenditures by businesses
BOD	Biochemical oxygen demand
CBD	United Nations Convention on Biological Diversity
CHP	Combined heat and power
CO	Carbon monoxide
DAC	OECD Development Assistance Committee
DMC	Domestic material consumption
EC	European Commission
ECA	Environmental Code Act
EEA	European Environment Agency
EGA	Environmental Goods Agreement within the WTO
EGS	Environmental goods and services
EI	Environmental Inspectorate
EIA	Environmental impact assessment
EIC	Estonian Environmental Investment Centre
ELD	EU Environmental Liability Directive
ELVs	Emission limit values
EMAS	European Eco-Management and Audit Scheme
EMS	Environmental management systems
EPR	Extended producer responsibility
ESD	Effort Sharing Decision
ESTEA	Estonian Environment Agency
EU ETS	European Union Emissions Trading System
GDP	Gross domestic product
GERD	Gross domestic expenditure on R&D
GHG	Greenhouse gas
GPP	Green public procurement
HELCOM	Baltic Marine Environment Protection Commission (Helsinki Commission)
ICT	Information and communication technology
IEA	International Energy Agency
IMPEL	EU Network for the Implementation and Enforcement of Environmental Law
IPPC	Integrated pollution prevention and control
LRTAP	Long-range Transboundary Air Pollution
MBT	Mechanical-biological treatment
MoE	Ministry of the Environment
MoI	Ministry of the Interior
MSW	Municipal solid waste
Mt	Million tonnes
NAO	National Audit Office
NDP	National Development Plan
NDPES	National Development Plan of the Energy Sector
NGO	Non-governmental organisation
NH_3	Ammonia
NMVOC	Non-methane volatile organic compounds
NO_x	Nitrogen oxides

NREAP	National Renewable Energy Action Plan
NWMP	National Waste Management Plan
ODA	Official development assistance
PM	Particulate matter
PRO	Producer responsibility organisation
R&D	Research and development
RBMP	River Basin Management Plan
RES	Renewable energy supply
RDF	Refuse-derived fuel
SEA	Strategic environmental assessment
SEI	Stockholm Environment Institute
SME	Small and medium-sized enterprise
SO_x	Sulphur oxides
TFC	Total final consumption
TPES	Total primary energy supply
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollars
VAT	Value added tax
WEEE	Waste Electrical and Electronic Equipment
WFD	Water Framework Directive
WHO	World Health Organization
WTO	World Trade Organization

BASIC STATISTICS OF ESTONIA (2015 or latest available year)*

(OECD values in parentheses)

PEOPLE AND SOCIETY

Population (million)	1.3	(1 274)	Population density per km²	29.0	(35.1)
Share of population by type of region:			Population compound annual growth rate, latest 5 years	-0.4	(0.6)
Predominantly urban (%)	11.4	(48.7)	Income inequality (Gini coefficient)	0.36	(0.32)
Intermediate (%)	79.2	(26.0)	Poverty rate (% of population with less than 50% med.income)	12.3	(11.3)
Rural (%)	9.5	(25.3)	Life expectancy	77.2	(80.6)

ECONOMY AND EXTERNAL ACCOUNTS

Total GDP (national currency, billion)	20.5		Imports of goods and services (% of GDP)	75.7	(29.2)
Total GDP (billion, current PPPs)	31.7	(51 165)	Main exports (% of total merchandise exports)		
GDP compound annual real growth rate, latest 5 years	3.6	(1.9)	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	20.2	
GDP per capita (1 000 USD current PPPs)	24.2	(40.1)	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes	11.2	
Value added shares (%)			Wood and articles of wood; wood charcoal	9.1	
Agriculture	3.0	(1.7)	Main imports (% of total merchandise imports)		
Industry including construction	23.1	(23.1)	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	17.3	
Services	73.8	(75.2)	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes	13.2	
Exports of goods and services (% of GDP)	79.8	(29)	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof	9.8	

GENERAL GOVERNMENT

as percentage of GDP[a]

Expenditure	39.5	(44.4)	Education expenditure	5.6	(5.4)
Revenue	40.0	(42.4)	Health expenditure	5.1	(6.5)
Gross financial debt	13.6	(86.5)	Environment protection expenditure	0.6	(0.8)
Fiscal balance	0.4	(-2.0)	Environmental taxes: (% of GDP)	2.6	(1.6)
			(% of total tax revenue)	8.0	(5.1)

LABOUR MARKET, SKILLS AND INNOVATION

Unemployment rate (% of civilian labour force)	6.2	(7.9)	Patent applications in environment-related technologies (% of all technologies)[b]	21.2	(12)
Tertiary educational attainment of 25-to-64 years-olds (%)	37.5	(34.5)	Environmental management	11.5	(4.5)
Gross expenditure on R&D, % of GDP	1.4	(2.4)	Water-related adaptation technologies	0.6	(0.4)
			Climate change mitigation technologies	10.4	(9.8)

ENVIRONMENT

Energy intensity: TPES per capita (toe/cap.)	4.2	(4.1)	Road vehicle stock (veh./100 inhabitants)	57.3	(58.9)
TPES per GDP (toe/1 000 USD, 2010 PPPs)	0.16	(0.11)	Water stress (abstraction as % of available resources)	14.0	(9.7)
Renewables (% of TPES)	17.4	(9.6)	Water abstraction per capita (m³/cap./year)	1 311	(819)
Carbon intensity (energy-related CO_2):			Municipal waste per capita, (kg/capita)	357	(516)
per capita (t/cap.)	14.3	(9.4)	Material productivity (USD, 2010 PPPs/DMC, kg)	0.9	(1.7)
per GDP (t/1 000 USD, 2010 PPPs)	0.53	(0.26)	Land area (1 000 km²)	42.4	(34 341)
GHG intensity[c]			% of arable land and permanent crops	15.1	(12.1)
per capita (t/cap.)	16.0	(12.4)	% of permanent meadows and pastures	7.7	(23.2)
per GDP (t/1 000 USD, 2010 PPPs)	0.63	(0.34)	% of forest area	52.7	(31.2)
Mean population exposure to air pollution ($PM_{2.5}$), µg/m³	9.1	(14)	% of other land (built-up and other land)	24.5	(33.5)

* Values earlier than 2010 are not taken into consideration.

a) Where the OECD aggregate is not provided in the source database, a simple OECD average of the latest available data is calculated where data exist for a significant number of countries.

b) Higher-value inventions that have sought patent protection in at least two jurisdictions. Average of latest three years.

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

Source: Calculations based on data extracted from databases of the OECD, IEA, Eurostat.

Executive summary

Estonia needs to accelerate transition to a low-carbon economy

Estonia has made significant progress in decoupling economic growth from air pollution and energy consumption. However, its economy is the most carbon intensive and the third most energy intensive in the OECD, largely due to its heavy reliance on oil shale. In 2014, oil shale accounted for nearly three-quarters of the total primary energy supply and almost 90% of electricity generation. Use of renewable sources of energy has increased by more than 80% since 2000 due to extensive use of biomass in the heating sector and has almost reached the OECD average. However, the country's overall greenhouse gas (GHG) emissions increased by 23% between 2000 and 2014, with the energy sector remaining the largest GHG emitter.

Estonia's strategic environmental and energy policy framework stops short of a comprehensive climate change mitigation strategy. The projected low-carbon pathways are consistent with the 2015 Paris Agreement and the European Union (EU) targets for 2030 and 2050. However, specific policy measures for achieving them are yet to be elaborated. Estonia needs to develop and implement specific climate change mitigation measures to support its long-term GHG reduction goals. Developing renewable energy and taking advantage of integration into European electricity markets will allow Estonia to reduce the share of oil shale in the energy mix and the GHG emission intensity of the economy.

The country needs to further streamline regulatory requirements and improve compliance

EU directives govern much of Estonia's environmental legislation. While formally satisfying EU requirements, the transposition of directives into the national law has been largely unsystematic. This has created a considerable degree of regulatory inconsistency, where new provisions coexist with remaining elements of Soviet-era regulation. Notably, the environmental liability system includes multiple contradictory regimes and does not serve as an effective tool for environmental remediation. The codification of environmental law, underway since 2007, needs to be completed to improve the coherence of requirements and reduce the administrative burden on businesses.

The detection of non-compliance with environmental requirements has improved, primarily as a result of recently introduced risk-based planning of inspections. However, compliance monitoring remains largely reactive to complaints and incidents. Sector-oriented compliance promotion among small and medium-sized enterprises has not yet received the attention it deserves from the environmental authorities. Estonia would benefit from more extensive use of information-based tools and regulatory incentives to promote green business practices.

Environmental democracy is flourishing, but access to justice could be expanded

The Estonian public has a clear right of access to environmental information, which is widely available. Over two-thirds of Estonians consider themselves well informed about environmental issues, even though the completeness and quality of information could be improved. Environmental non-governmental organisations receive unconditional financial support from the government. Moreover, the government is actively engaged in environmental education and awareness raising. However, citizens' access to justice could be expanded beyond contesting administrative decisions.

Green taxes are increasing, but need to provide better incentives for pollution abatement

The government has an ambitious agenda for a green tax reform, which aims to shift part of the tax burden from income to consumption, use of natural resources and pollution of the environment. Revenues from environmentally related taxes increased from 1.6% to 2.6% of gross domestic product (GDP) between 2000 and 2014, putting Estonia in the upper third of OECD member countries on this indicator. Energy taxes account for almost 90% of these revenues, but still do not fully account for environmental impacts and fail to provide a consistent carbon price signal. Pollution taxes are applied to dozens of pollutants, but their current rates are too low to encourage pollution abatement. There is significant potential for increasing taxes on CO_2 emissions for sectors not already covered by the EU Emissions Trading System.

Municipal solid waste management has improved, but recycling rates are still low

Since 2005, Estonia has moved from reliance on landfilling of municipal solid waste (MSW) to a high level of energy recovery via waste incineration, due to major private sector investments and incentives provided by the waste disposal tax. Separate collection of recyclable MSW has increased, but the country is not yet on track to achieve the EU's 2020 targets for recycling. Leaving MSW collection in the hands of private companies chosen via municipal tenders has kept fees for households low, but has not ensured continuous collection of all MSW.

Increasing the efficiency of oil shale mining and processing is key to the sector's survival

In the near term, Estonia needs to invest heavily in improving the efficiency of oil shale extraction, combustion and processing, which account for 4% of GDP. The efficiency of oil shale mining is decreasing as open quarries get depleted and extraction shifts to more expensive and less efficient underground mining. The National Development Plan for Oil Shale Use 2016-30 identifies increasing mining efficiency as one of its main goals. It also supports development of reference documents on best available techniques in oil shale processing and assigns priority to expansion of applied research and development in the oil shale sector.

Pollution and social issues in the oil shale mining region need to be addressed

Oil shale mining and most of its processing are concentrated in north-eastern Estonia. Although emissions of almost all major air pollutants generated by the mining sector have declined since 2011, actions are needed to address local environmental and health problems. In addition, measures to mitigate the potential social impacts of diversification away from oil shale (creation of alternative jobs, retraining, etc.) are required. These should be taken through active collaboration between the central government, municipalities, employers and trade unions.

Reuse of oil shale mining and processing waste needs to be expanded

Waste rock from oil shale mining constitutes 70% of Estonia's non-hazardous waste, while oil shale combustion and processing account for over 90% of the country's hazardous waste generation. Estonia's hazardous waste generation per capita is the highest in the EU, 35 times the average. The recovery and reuse of waste rock and oil shale ash have increased significantly in the last decade. Still, most oil shale-related waste goes into landfills. Increasing landfill disposal taxes for oil shale mining and processing waste would create a much-needed incentive for its reuse.

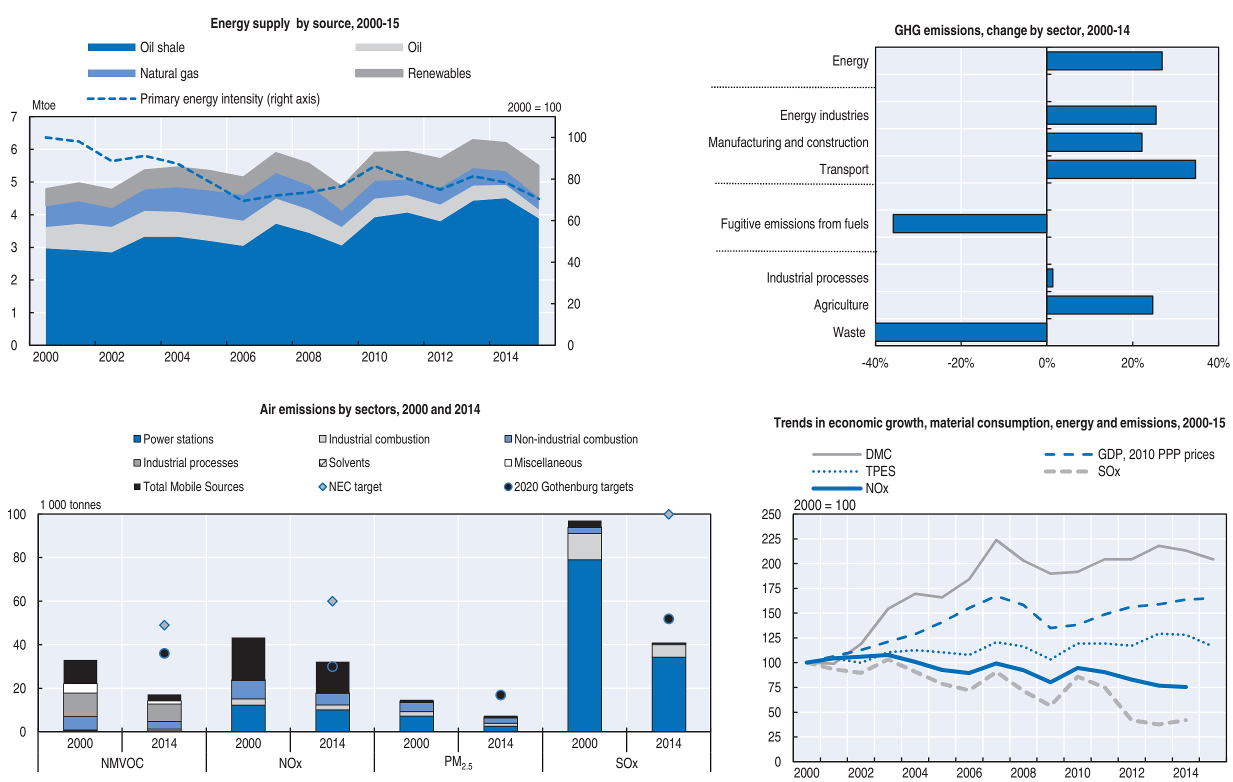
Assessment and recommendations

The Assessment and recommendations present the main findings of the Environmental Performance Review of Estonia *and identify 30 recommendations to help Estonia make further progress towards its environmental policy objectives and international commitments. The OECD Working Party on Environmental Performance reviewed and approved the Assessment and recommendations at its meeting on 7 November 2016.*

1. Environmental performance: Trends and recent developments

Estonia is a small, open economy with large oil shale reserves and abundant forestry and water resources. Between 2000 and 2007, Estonia experienced strong economic growth, in part driven by a credit-based boom in the construction sector. During the 2008-09 crisis, gross domestic product (GDP) dropped by more than 15%. However, it recovered quickly in the following years, rising above pre-crisis levels in real per capita terms in 2015. The country has made significant progress in improving its environmental performance by decoupling economic growth from the main environmental pressures (Figure 1). This objective was achieved primarily through the transposition and implementation of environmental legislation of the European Union (EU). However, Estonia still faces some challenges linked to the extensive use of oil shale, which continues to have environmentally harmful effects. In addition, regional disparities persist in population exposure to environmental health risks: residents of Ida-Viru county, where oil shale industry is located, register worse health indicators than residents of other regions (Statistics Estonia, 2016).

Figure 1. **Selected environmental performance indicators**



Note: Total primary energy supply. Breakdown excludes electricity trade and non-renewable municipal waste. SOx and NOx: total man-made emissions.
Source: IEA (2016), IEA *World Energy Statistics and Balances* (database); OECD (2016), *National Accounts* (database).

StatLink http://dx.doi.org/10.1787/888933448276

Transition to a low-carbon and energy-efficient economy

Estonia's economy is the most carbon-intensive economy in the OECD and the third most energy-intensive one, partly due to its heavy reliance on oil shale (Figure 1). Although reducing the carbon intensity of the energy sector is a policy priority, progress has been limited. In 2015, oil shale dominated the energy mix, accounting for nearly three-quarters of the total primary energy supply (TPES) and almost 80% of electricity generation. Estonia has already achieved its Renewable Energy Directive's 2020 target of 25% of renewable energy in the gross final energy consumption. The use of renewable sources of energy has increased by more than 80% since 2000 due to extensive use of biomass in the heating sector and has almost reached the OECD average. Electricity generation from renewables, which comes almost equally from wind power and biomass, is one of the lowest in the OECD. Estonia is unlikely to meet its energy efficiency target for 2020 if additional measures are not put in place, including in the building and transport sectors (EC, 2014b). The government is planning to take such measures in accordance with the 2016 Energy Sector Organisation Act. In the transport sector, Estonia achieved only 0.2% use of renewable energy sources in 2010, far below the EU-wide goal of 10% by 2020.

Estonia's greenhouse gas (GHG) emissions grew by 23% between 2000 and 2014 – the third-highest increase among OECD member countries after Turkey and Korea in contrast with the OECD-wide trend of declining GHG emissions. Nonetheless, as the GDP increased by about 64% over the same period, GHG emissions have been decoupled from economic growth. The energy sector remains the largest GHG emitter (almost 90%), showing a steep increase since 2000 (Figure 1), which was mainly driven by the boost of energy exports and the corresponding increase of oil shale's share in the energy mix. Emissions from private road vehicles, which dominate energy use in transport, have increased the most and are expected to rise further in the future. Estonia met its Kyoto Protocol target for 2008-12 (MoE, 2013). As a member of the EU, Estonia is subject to the EU Emissions Trading System (ETS) and the Effort Sharing Decision (ESD) for non-ETS sectors.[1] In 2013, Estonia was on track to comply with the ESD target.

Estonia's current policy mix for climate change mitigation does not address its long-term GHG reduction targets. The General Principles of the Climate Policy until 2050 expected to be approved in 2017 establish a policy vision aimed at setting Estonia on a pathway consistent with the 2015 United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement and the EU targets to 2050. The General Principles do not stipulate specific measures to achieve these goals, but are expected to be implemented through sector-specific development plans (for energy, transport, agriculture, etc.). The National Development Plan of the Energy Sector until 2030, adopted in 2016, charts scenarios for reducing Estonia's GHG emissions and the carbon intensity of its economy in line with the goals of the General Principles. However, specific policy measures for achieving these projected low-carbon pathways are yet to be elaborated. The country's recent integration into European electricity markets could be an important element of a transition to a low-carbon economy, whereas continued reliance on oil shale risks leading to a GHG emissions trajectory inconsistent with the long-term aims of the Paris Agreement.

Estonia is also taking steps in climate change adaptation. A draft Climate Change Adaptation Plan, scheduled to be approved by the end of 2017, is a first specific plan aiming at designing actions across several economic sectors. It will cover land use and infrastructure planning, public health and biodiversity protection, and natural resource management.

Overall, the country enjoys good air quality, with exposure to particulate matter (PM_{10}) and ozone being below the EU air quality threshold values (EEA, 2014). However, Tallinn and the county of Ida-Viru register relatively high levels of air pollution (NAO, 2014; OECD, forthcoming). The number of premature deaths caused by air pollution decreased by 30% in 2013 compared to the 2005 level (OECD, 2014) and is projected to decrease even further in 2060 (OECD, 2016c). Since 2000, emissions of all other major air pollutants have been decoupled from economic growth due to implementation of EU air quality legislation (Figure 1). In 2014, SO_x and NO_x emissions per unit of GDP were among the highest in the OECD, mainly due to emissions from oil shale-fired power stations. Overall emissions remained below the National Emission Ceiling for 2010 set in EU Directive 2001/81/EC. The two pollutants that have not already met the 2020 Gothenburg targets of the Convention on Long-range Transboundary Air Pollution are NO_x and NH_3, resulting from industrial power generation and agriculture, respectively.

Transition to efficient resource management

Estonia has one of the OECD's highest levels of material consumption per capita and per unit of GDP, due in large part to the mining of oil shale for energy. Between 2000 and 2014, the material productivity (economic wealth generated per unit of material used) decreased by 26% (Eurostat, 2015). This was due to both rising oil shale consumption, as well as rapid growth in the consumption of construction materials over 2005-07 (Figure 1).

The large majority of Estonia's primary waste is produced by oil shale mining and related energy production, which also generates almost all hazardous waste. Since 2005, municipal solid waste generation has decoupled from GDP and its treatment has changed quite significantly, moving almost all municipal waste away from landfilling. In 2014, incineration with energy recovery was the main treatment method, followed by recycling and composting.

Agricultural inputs did not show significant decoupling from agricultural production. Since 2002, both phosphorus and nitrogen balances have increased. As a consequence of this extensive use of nutrients, agriculture was the third-most significant source of GHG emissions in 2012, and one of the few sectors that has increased its emissions since 2000 (Figure 1). Organic farming accounted for 17.5% of total agricultural land in 2015, which is significantly higher than the OECD average of just over 2% (OECD, 2015b).

Management of natural assets

Estonia has an abundance of natural assets, and forests cover half of the territory. Both the total forest area and the types of tree species have remained stable over the review period. The intensity of forest resource use is one of the highest in the OECD (Statistics Estonia, 2015). In 2010, 10% of the forest area was under strict natural protection.

The gross freshwater abstraction per capita, mainly for electricity production, increased by about one-fifth since 2000; it was one of the highest in the OECD in 2014. Water pollution has significantly decreased, and most surface water and groundwater bodies registered good ecological and chemical status in accordance with EU guidelines (EC, 2012a). However, challenges with surface water and groundwater quality persist in some areas. These are mainly due to water discharges from oil shale mines that affect the chemical composition of water bodies in Ida-Viru county and diffuse pollution from agriculture.

Protected areas have progressively expanded in Estonia, achieving ahead of time the 2020 Aichi targets of the United Nations Convention on Biological Diversity, which call for protecting at least 17% of the terrestrial area and inland waters, and 10% of the coastal and marine areas. Natura 2000 sites cover about 17% of the territory, which is almost in line with the EU average. More than half of the Estonian habitats and species of EU importance are in a favourable condition (compared to the EU average of 16% of habitats and 23% of species), while the other half had an insufficient, bad or unknown status (MoE, 2015a).

Recommendations on climate change, air pollution, biodiversity and water management

Climate change

- Develop and implement specific climate change mitigation measures to achieve GHG reduction goals for 2030 and 2050, consistent with the aims of EU climate policy and the UNFCCC Paris Agreement; identify the expected contribution of each sector to these measures; set intermediate targets to track progress towards the goals and adjust measures as necessary; adopt a climate change adaptation strategy; ensure adequate implementation and monitoring of the planned actions.
- Reduce the GHG emission intensity of the economy by taking advantage of Estonia's integration into European electricity markets, reducing the share of oil shale in the energy mix and encouraging the use of renewable energy sources and energy efficiency; promote cost-effective measures to reduce emissions in the non-ETS sectors, particularly by increasing the use of low-carbon energy in transport; continue efforts to further improve public transportation networks, including rail infrastructure.

Air quality

- Strengthen measures to reduce emissions of SO_x, NO_x and NH_3 from the industrial power generation sector, transport and agriculture, respectively; consider promoting more efficient residential space heating; raise awareness about the negative environmental impacts of waste burning in households.

Biodiversity

- Promote better co-ordination in this field between the Ministries of the Environment, Rural Affairs and Finance to strengthen sustainable forest management; enhance the dissemination of knowledge on good forestry practices among private forest owners.

Water resources

- Address diffuse water pollution from agriculture and promote environmentally friendly farming practices with the use of EU funding and other sources of finance and through better inter-ministerial co-operation; develop and manage high-quality data on agricultural discharges; design and implement measures to reduce pollution of surface water and groundwater in the oil shale mining area.

2. Environmental governance and management

Institutional framework

Estonia has a centralised system of environmental governance. National authorities, led by the Ministry of the Environment (MoE), are responsible for all environmental management areas except for provision of local environmental services and spatial planning. The government's strategic planning is the principal mechanism for horizontal policy co-ordination. However, this arrangement may not be sufficient to integrate environmental considerations effectively into sector-specific policies and ensure coherent actions in several policy areas, such as water quality management and land use and transport planning.

County governments perform the role of vertical co-ordination between the national and local governments. The collaboration across local governments is expanding in several areas, including water and waste management (where their role needs to be reinforced). However, insufficiency of financial resources and technical capacity hampers their environmental performance in land-use planning and environmental infrastructure services. The government is carrying out a territorial reform aimed at significantly reducing the number of municipalities by 2018, which would help alleviate these resource and capacity constraints.

Regulatory framework

Much of Estonia's environmental legislation is governed by EU directives. While formally satisfying EU requirements, their transposition into the national law has been largely unsystematic and created a considerable degree of regulatory inconsistency. This inconsistency, together with the Soviet legacy of fragmented issue-specific environmental permitting, has been driving the process of codification of environmental law. This process, underway since 2007, is still incomplete.

Regulatory impact analysis (RIA) has been required since 2012 as part of preparation of any new legislation. However, it remains predominantly qualitative and does not include fully-fledged cost-benefit analysis. Similarly, *ex post* evaluation of all new major primary laws is required, but does not yet happen in practice.

The General Part of the Environmental Code Act, which entered into force in 2014, integrated the application and delivery process for issue-specific permits. However, these permits continue to impose a significant administrative burden on the regulated community, particularly on installations with low environmental impact (most of which are small and medium-sized enterprises, or SMEs). In addition, pre-treatment standards for industrial wastewater discharges into municipal sewerage systems are outdated and do not cover many important hazardous substances.

Environmental impact assessment (EIA) has been a key tool of environmental regulation of economic activities since the early 1990s. However, responsibilities for EIA approval related to building permits were recently transferred to municipal authorities. This is risky because these authorities have low capacity for, and objectivity in, making sound EIA decisions.

Estonia has a well-developed system of spatial planning at all administrative levels, which is designed to incorporate environmental considerations through strategic environmental assessment (SEA). At the same time, SEA is often too general to have a meaningful impact on land use and sector-specific strategic planning (Veinla and Relve, 2012). Maritime spatial planning is emerging as a practice on the basis of recently adopted methodology. There are also challenges in ensuring consistency between the national, county and local land-use planning and in making transportation policies an integral part of spatial planning.

Compliance assurance

The Environmental Inspectorate has introduced risk-based planning of its activities, which has helped improve detection of offences, even though compliance monitoring remains largely reactive to complaints and incidents. Compliance monitoring of waste management in oil shale mining and processing, including the verification of mining companies' self-reporting data, appears to be insufficient (NAO, 2015a).

The size of monetary penalties against environmental violations, including fines and penalty components of pollution taxes, has increased substantially over the last decade, but their deterrent impact is uncertain. Sanctions are not always proportionate to the seriousness of non-compliance.

The government is actively pursuing a programme of cleaning up abandoned contaminated sites, even though the lack of financial resources makes progress slow (Living Environment, 2015). With respect to current damage to soil, water resources and biodiversity, the environmental liability system combines disparate provisions in issue-specific national environmental legislation, targetting monetary compensation from the responsible party to the state, and a remediation-oriented regime resulting from the transposition of the EU Environmental Liability Directive. The system lacks coherence, does not impose strict liability on polluters and does not serve as an effective tool for environmental restoration (Veinla and Relve, 2012).

The government has engaged in efforts to promote green business practices through voluntary agreements, recognition awards, environmental management systems certifications and public procurement policies. However, these initiatives remain limited. Sector-oriented compliance promotion among SMEs has not been used sufficiently by the environmental authorities.

Environmental democracy

The public has a clear right of access to environmental information, which is widely available. Over two-thirds of Estonians consider themselves well informed about environmental issues (EC, 2014a), even though the completeness and quality of information may not always be reliable (NAO, 2013).

Environment and sustainable development is a mandatory topic in the national curriculums of primary and secondary education. The government is actively engaged in environmental education and awareness raising. The Environmental Investment Centre, local governments and universities also contribute to the financing of environmental awareness-related activities.

The legal framework provides for public participation in policy making, environmental assessment, permitting and spatial planning. Environmental non-governmental organisations (NGOs) receive unconditional financial support from the government.

Access to justice is largely limited to contesting administrative decisions of government authorities, with an explicit right of appeal provided to environmental NGOs. However, apart from going to administrative courts, citizens have little judicial recourse over environmental matters.

Recommendations on environmental governance and management

- Strengthen inter-ministerial co-ordination on environmental and sustainable development issues, including climate change, to better incorporate environmental concerns into strategic planning, sectoral policies and spatial planning; encourage collaboration between local governments in all areas of their environmental competence.

Recommendations on environmental governance and management *(cont.)*

- Complete the process of codification of environmental legislation to improve its coherence and reduce the administrative burden on the regulated community; reinforce the *ex ante* evaluation of environmental regulations and policies through rigorous regulatory impact analysis, including extensive use of economic analytical tools; encourage *ex post* evaluation of their implementation.
- Consider replacing bespoke permits with sector-specific general binding rules to simplify the regulatory regime for installations with low environmental impact; update pre-treatment standards for industrial wastewater discharges into municipal sewerage systems; ensure close MoE oversight and evaluation of EIA implementation by municipal governments.
- Improve the co-ordination and consistency between national, county and local land-use plans; increase the capacity of local governments to conduct spatial planning and related strategic environmental assessment; integrate sustainable mobility issues into spatial planning at the local level.
- Further enhance risk-based planning of environmental inspections; reform the system of penalties for environmental violations by adopting a sound methodology for the determination of fines, based on the gravity of the offence and economic benefit from non-compliance; develop an enforcement policy with clear guidance on applying administrative and criminal sanctions proportionately to the seriousness of non-compliance.
- Scale up government efforts to promote environmental compliance and green business practices through a range of information-based tools and regulatory incentives; strengthen voluntary agreements with industrial associations by setting ambitious sector-specific environmental targets and encouraging investment in eco-innovation.
- Streamline the environmental liability regime by integrating liability provisions of issue-specific environmental laws into the Environmental Liability Act, while assigning priority to remediation of damage to the environment at the expense of the responsible party over monetary compensation; accelerate the programme for the clean-up of contaminated sites by securing adequate financial resources for its implementation.
- Expand citizens' access to justice beyond the review of administrative decisions related to the environment in order to guarantee broader human rights on environmental matters in county courts of general jurisdiction; enhance the completeness and quality of environmental information available to the public.

3. Towards green growth

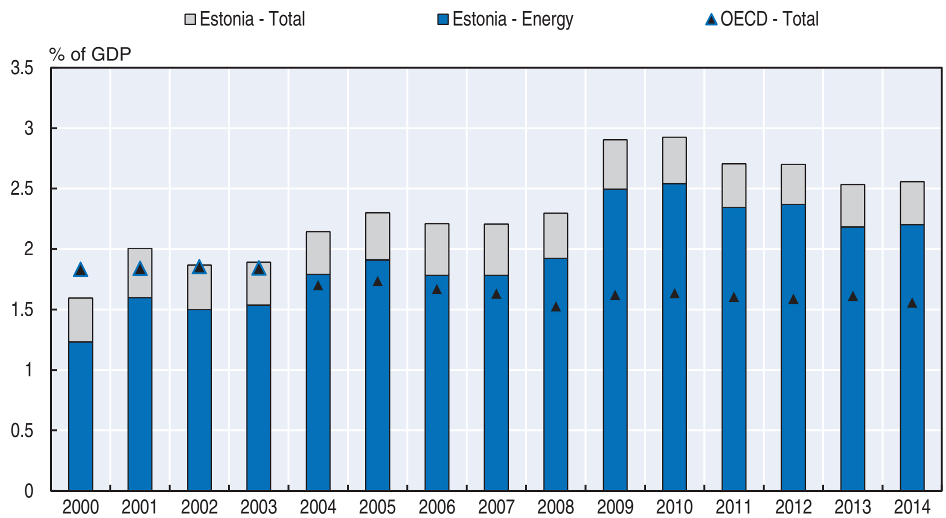
Estonia's overarching framework for sustainable development is set out in the National Strategy on Sustainable Development "Sustainable Estonia 21", adopted in 2005, with progress monitored via a set of sustainable development indicators. There is no dedicated green growth strategy, but green growth initiatives can be identified in various governmental strategies and plans.

Greening the tax system

The government has an ambitious agenda for a green tax reform, which aims to shift part of the tax burden from taxation of income to taxation of consumption, use of natural resources and pollution of the environment. The MoE is leading a multi-year process to evaluate the external costs of all main forms of pollution with the intent to adjust environmental taxes. The project is expected to finish in 2017, with changes to the tax system made by 2020.

Revenues from environmentally related taxes increased from 1.6% of GDP in 2000 to 2.9% in 2010, before declining to 2.6% in 2014. Estonia is in the upper third of OECD member countries on this indicator. The overall increase was due mainly to a significant increase in energy tax rates and the introduction of an excise tax on electricity. As in most OECD member countries, revenue from energy taxes makes up the largest share, accounting for close to 90% of revenues from environmentally related taxes, well above the OECD average of 69% (Figure 2).

Figure 2. **Environment-related tax revenue has declined since 2010**



Note: 2014 data for OECD are estimates.
Source: OECD (2016), "Instruments Used for Environmental Policies and Natural Resources Management", OECD *Environment Statistics* (database).

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Energy tax rates vary considerably across energy sources and uses. There are a number of exemptions and reduced rates for various users, which weaken incentives for energy efficiency and result in tax revenue losses. Households bear a significant share of the fuel and electricity tax burden. Current energy tax rates do not fully account for negative social and environmental effects and fail to provide a consistent carbon price signal. Estonia has a CO_2 pollution tax, which covers energy producers (except electricity generation). However, the low rate of EUR 2 per tonne of CO_2 has had a negligible impact on carbon abatement. The EU ETS covers a large share of Estonia's GHG emissions – an estimated 75% of emissions in 2013 (EEA, 2014); this makes the country's economy vulnerable to eventual increases in the ETS carbon price.

Road transport accounts for a significant and rising source of air pollution and carbon emissions. However, Estonia has few taxes on motor vehicles (apart from a heavy goods vehicle tax and a registration fee for personal cars). In 2014, revenue from these taxes amounted to 2.5% of environmentally related tax revenues, well below the OECD average. The government has analysed options for vehicle taxation, including based on environmental characteristics. It is planning to introduce road charges for heavy duty vehicles, but not taxes on passenger cars. Estonia is among the ten OECD member countries that capture the fewest taxable benefits of company cars.

Estonia has a range of environmental pollution and natural resource extraction taxes.[2] Pollution taxes, in particular, are imposed on a large number of parameters, e.g. air emissions of heavy metals or their compounds, discharges of a wide range of hazardous substances into water, most of which are not directly monitored. While rates have increased significantly since 2000, they remain too low to have an impact on the environmental performance of firms. For example, the oil shale industry accounted for 72% of the revenue collected via the environmental tax systems in 2013 (MoE, 2015b). Although significant pollution abatement investments have been made in the oil shale sector, a recent assessment concluded that environmental taxes applied to oil shale activities do not, at their current rates, motivate companies to prevent or reduce potential environmental damage (NAO, 2014). In the area of biodiversity conservation, Estonia compensates private owners of protected forests, but does not use other forms of payments for ecosystem services.

There is no comprehensive assessment of the scope or magnitude of environmentally harmful subsidies in Estonia. These subsidies include exemptions and reduced rates for certain users. Support for oil shale-based electricity and heat production has dropped drastically in recent years with the removal of several tax exemptions. However, the agricultural sector enjoys reduced fuel tax rates (which could be phased out easier in the context of low oil prices) and is exempt from the water abstraction tax (OECD, 2015a).

Green investment

General government expenditure on environmental protection rose from 0.7% to 0.9% of GDP between 2000 and 2012, just above the EU-28 average of 0.8%; waste and wastewater management accounted for 35% of the total (Eurostat, 2016b). Pollution abatement expenditure by production enterprises more than doubled over 2010-13 (with a 71% share of investments), although it focuses more on end-of-pipe than process-integrated technologies (MoE, 2015b). Waste management accounts for the largest share of business sector expenditure.

Estonia has several support schemes to stimulate green investment. The Environmental Investment Centre is channelling significant amounts of finance towards environmental projects: more than EUR 1.3 billion to over 18 000 (mostly small) projects since its establishment in 2000. Other investment schemes are targeting energy efficiency in buildings and the development of export-capable firms, with apparently positive results. However, there are concerns about the effectiveness of government investments in energy efficiency.

Estonia is actively promoting the use of renewable energy via a feed-in premium scheme introduced in 2007. In 2014, total subsidies for electricity produced from renewable sources were worth EUR 65 million: almost half of funds were allocated to wind energy generation, and over a third to electricity production from biomass at large power plants (Elering, 2015). Achieving the current level of wind power generation has required subsidies. However, the economic viability of additional wind projects is uncertain at the current carbon price in the EU ETS and low electricity price more generally, as the government plans no further subsidies in this sector. Over 95% of electricity generated from biomass comes from subsidy-eligible combined heat and power plants.

Estonia has promoted sustainable transport with a few targeted initiatives, including investments in public transport infrastructure and biomethane use in public transport and private vehicles. The Electromobility programme provided (until 2015) support for the purchase of electric cars and the establishment of a nation-wide system of electric charging stations. However, the uptake of clean passenger vehicles has been slower than planned.

Promoting eco-innovation

There is no specific eco-innovation policy in Estonia, but eco-innovation measures are incorporated into strategic development plans of various ministries. Public research and development (R&D) spending allocated for the environment has followed the upward trend of public R&D spending since 2000 with a peak in 2010 due to considerable one-off investments in the oil shale industry. In 2014, Estonia ranked second among OECD member countries in terms of environment-related R&D as a share of total public R&D budgets (about 6%) (OECD, 2016b). The share of environment-related technology in patent applications went from 0.7% in 2000-02 to 21.2% in 2010-12, exceeding the OECD average of 12% (OECD, 2016a).

While Estonia has reached EU average levels of eco-innovation inputs and activities, it is considerably behind on eco-innovation outputs, GHG emission reduction, socio-economic outcomes and resource efficiency outcomes – key components determining overall performance (Eco-Innovation Observatory, 2016). Access to finance appears to be a limiting factor. Many firms remain either unaware of R&D grants or complain that the application is long and bureaucratic (Eco-Innovation Observatory, 2016). In addition, there is poor co-ordination between different ministries responsible for innovation in their respective areas.

Expanding environmental markets

There are no official statistics on the environmental goods and services (EGS) sector. However, a pilot project recently estimated that value added in the sector could account for as much as 6% of GDP (Statistics Estonia, 2016), compared to the EU average of 2.2% (Eurostat, 2016a). Energy saving and management and renewable energy generation are the main contributors to the EGS sector, in terms of both value added and employment. In 2013, the share of direct and indirect renewable energy-related employment in Estonia's total employment was 0.71%, above the EU average of 0.53% (EC, 2015). To promote EGS, the government relies mainly on green public procurement (GPP), whose share in the total volume of public procurement (6% in 2014) remains well below the OECD average of 26% (EC, 2012b).

Recommendations on green growth

- Continue green tax reform by further shifting the tax burden from labour towards environmentally harmful activities without increasing the overall tax burden on the economy; regularly evaluate its economic impact; focus air and water pollution taxes on a limited number of priority pollutants whose emissions or discharges are monitored; increase the tax rates for these pollutants to provide a real incentive for their abatement; develop a methodology for setting resource extraction tax rates based on the value of extracted resource; expand the use of economic instruments for biodiversity protection, including payments for ecosystem services.
- Raise and adjust tax rates on negative environmental externalities of energy production and use, including the tax on CO_2 emissions for sectors not already covered by the EU ETS; set tax rates for diesel at least at the same level as for petrol; strengthen incentives

Recommendations on green growth *(cont.)*

for energy efficiency in both heating networks and buildings by broadening the use of metering and introducing penalties for heating network operators when they fail to meet heat loss targets.

- Consider introducing policy measures to address the environmental damage from road transport via a road pricing system or taxes on motor vehicles adjusted to reflect the environmental characteristics of the vehicle; continue investments in the use of biofuels in motor vehicles; eliminate fiscal incentives for the use of company cars.
- Develop a comprehensive assessment of the extent and magnitude of environmentally harmful subsidies and set priorities for phasing them out; continue to phase out exemptions and preferential rates (of energy excise taxes, water abstraction taxes, resource extraction taxes, etc.) for certain economic sectors, such as agriculture.
- Monitor the effectiveness of the Environmental Investment Centre and other investment support schemes to ensure they support government priorities, add value in addressing environmental problems and reflect the principles of sound public finance.
- Strengthen eco-innovation by improving access to finance by raising firms' (in particular SMEs') awareness about existing support mechanisms and reducing their administrative complexity; improve co-ordination between government institutions, enterprises and academia on research and development; enhance green public procurement by expanding the range of procurement categories with green purchasing criteria and designating and training procurement officials in public institutions on effective use of such criteria.

4. Waste and materials management

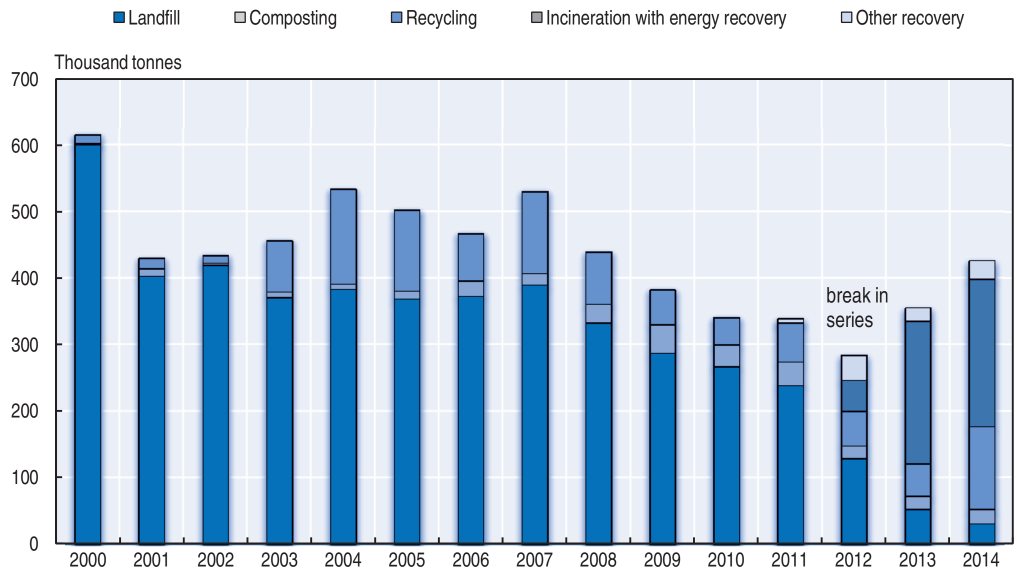
The EU membership has brought significant changes to Estonia's legal and policy framework for waste management. These comprise new standards for waste facilities, including landfills, as well as ambitious targets for recycling. National waste policies make it a priority to achieve the EU objectives of reducing landfilling of municipal solid waste (MSW) and to increase the country's recycling and composting.

Municipal solid waste management

Since 2005, Estonia has undertaken a major transformation in the treatment of MSW: the country has moved from reliance on landfilling to a high level of energy recovery via waste incineration. Recycling and composting have increased, though less dramatically (Figure 3). Private sector investments have played a major role in financing new waste treatment facilities: the national waste disposal tax provided incentives for these investments. In parallel, Estonia has used public resources, including EU funds, to close 150 old, substandard landfills and to build 5 landfills that meet standards. By 2015, however, Estonia had overcapacity of waste treatment facilities. Nonetheless, the country is not on track to achieve the EU's 2020 targets for recycling: while separate collection of recyclable MSW has increased, further progress is needed as a high share of MSW now goes to incineration.

In Estonia, private companies collect MSW. Although they are chosen via municipally organised tenders, they collect fees directly from households. The system has kept fees for households low. However, many municipalities lack capacity and resources to manage tenders effectively and more generally to ensure proper waste management. Although

Figure 3. **Transformation of municipal waste management**



Note: As of 2012, amounts treated refer to waste actually treated during the reference year, and do not necessarily refer to amounts generated during the same year (due to amounts stored temporarily for treatment in the following year).
Recycling may include some waste undergoing a pre-treatment before being recycled (e.g. metal waste); it excludes paper and cardboard waste, and bulky waste recovered.
Other recovery includes pre-treatment of some waste (repacking of hazardous municipal waste) and the recovery of mineral parts (for example sand, stones) from MBT treatment process for closure of landfills or backfilling.
Source: OECD (2016), "Municipal Waste – Generation and Treatment", OECD *Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448290

municipalities can join their efforts, this is voluntary, and few inter-municipal collection areas have been set up. If a legal challenge overturns a tender decision, each household can choose its waste collection company until a new tender is organised. This provision does not assure continuous collection of all MSW. The role of local government in overseeing MSW management has been the topic of ongoing debate. The resulting uncertainty hinders the development of a stable policy and management framework that can support the attainment of higher levels of separate collection and recycling and ensure that all MSW is collected.

These issues reflect the weak role of government planning for MSW management: national waste management plans have set out broad goals, but have not specified all the instruments and actions for their implementation. As a result, key decisions left to waste management companies and to the local level have not sufficiently supported national objectives, such as the 2020 recycling targets.

Estonia has set up extended producer responsibility (EPR) for six waste streams, including packaging waste, electronic and electrical waste, and end-of-life vehicles. Multiple producer responsibility organisations (PROs) operate for four waste streams, including waste from packaging and batteries. The EPR schemes face several issues, including "free riders" that put products on the market outside EPR requirements and scrap dealers that collect waste with resale value (e.g. metal from home appliances), separately from the PROs. Insufficient government oversight of PROs and the lack of a clearinghouse mechanism among competing organisations create further problems, including questions about the accuracy of data and the actual achievement of targets. Moreover, PROs could play a stronger role in supporting local government on awareness raising and actions to achieve recycling targets.

The overall accuracy of waste data needs to be further improved and information systems better integrated and tied to stronger enforcement. This is the case for many waste streams, including those under EPR schemes, as well as hazardous waste. For example, information systems for hazardous waste permits and reporting are not integrated, hindering checks of data accuracy (NAO, 2015b). Further work is also needed to identify the amount of MSW not collected.

Hazardous waste management

Estonia's hazardous waste generation per capita is the highest in the EU, 35 times the EU average (Eurostat, 2016c). The combustion and processing of oil shale generates high volumes of material classified as hazardous waste, nearly all of which is deposited in landfills. After many decades, these activities have also left a legacy of contaminated sites. Estonia has spent significant domestic resources, bilateral support and EU funds to ensure that landfill disposal sites now meet standards and to promote reuse of mining waste.

Estonia has several treatment facilities for hazardous waste from activities outside the oil shale sector. A cement plant plays a key role in the incineration of other hazardous waste and refuse-derived fuel (RDF). The cement industry in the Baltic Sea region has overcapacity, however, creating uncertainty about whether this waste treatment option will continue. A state-owned hazardous waste landfill reopened in 2016 with a new leachate treatment plant.

Materials management and circular economy

Estonia has established policy objectives to improve material productivity, both overall and for key sectors such as biomass, construction materials and oil shale: the objectives include an overall national target for material productivity. From 2014 to 2020, Estonia plans to invest EU funds in resource efficiency and materials productivity to support these policy objectives. However, the continued combustion of oil shale – the single largest type of material consumed – does not allow significant productivity improvement or recovery of waste materials. The lack of a comprehensive policy framework for a circular economy is a barrier to achieving sustainable use of resources throughout the entire product value chain.

Recommendations on waste and materials management

- Establish a stable, long-term institutional framework that can ensure the achievement of European requirements and targets for MSW management, including by strengthening the institutional role and financial and technical capacities of local authorities to oversee MSW management more effectively; consider establishing inter-municipal entities for this purpose.
- Consider the introduction of economic instruments such as a tax on domestic mixed waste and possibly an incineration tax to better support recycling targets, which would create incentives for separate collection at source, for mechanical-biological treatment facilities to separate materials for recycling, and for waste companies to send all recyclable waste to recycling facilities.
- Strengthen the role of PROs in supporting the achievement of waste management goals, including those for recycling, by establishing a stronger framework for co-operation between PROs and government bodies responsible for MSW management; encourage PROs to raise public awareness of benefits of separate collection and recycling, and ensure sufficient infrastructure for the separate collection of recyclable waste at the local level.

Recommendations on waste and materials management *(cont.)*

- Take steps to implement an independent clearinghouse mechanism to oversee the multiple PROs to help ensure their long-term viability, as well as the accuracy and transparency of their reporting; extend government accreditation and auditing requirements, now in place for packaging waste PROs, to the other EPR schemes.
- Further strengthen data gathering and information systems for waste management in such key areas as packaging waste, hazardous waste and the monitoring of potential impacts of existing and former waste sites.
- Continue to explore options to improve material productivity, including by enhanced research and development on oil shale use and its waste products, drawing on EU initiatives for a circular economy; ensure the effective use and monitoring of planned investments of EU funds in resource efficiency.

5. Mining and the environment

The energy sector is dominated by one indigenous primary energy source: oil shale. The oil shale sector accounts for 4% of GDP (IEA, 2013) and 1.5% of employment (Praxis, 2014). It is heavily concentrated in one county in north-eastern Estonia; four companies hold mining permits, among which state-owned Eesti Energia accounts for 75-80% of total oil shale extracted. Estonia is one of the most energy-independent countries in Europe. However, with Estonia's recent integration into the Nord Pool energy market and continuing integration into the Continental European Market, energy security can be guaranteed through increased diversity of energy suppliers without heavy reliance on domestic fossil fuels.

The policy framework for the management of mineral resources in Estonia is extensive. It includes sectoral and environmental strategies and legal acts, which generally address environmental issues of the mining sector. The newly adopted National Development Plan (NDP) for Oil Shale Use for 2016-30 (MoE, 2015c) identifies increasing mining efficiency, while minimising the sector's negative environmental impact, as its main goal. The new NDP defines a number of indicators and respective 2020 targets with respect to efficiency and environmental impact of oil shale mining and use. However, these targets are not ambitious and commonly call for maintaining the 2013 performance levels. In addition, the NDP and other relevant strategies are not always coherent in their measures, particularly in addressing the growing challenge of oil shale waste management.

Extraction and use of mineral resources

The oil shale sector is ageing and facing economic challenges. The efficiency of oil shale mining is decreasing as open quarries get depleted, and extraction shifts to more expensive and less efficient underground mining, where more rock needs to be extracted per unit of produced energy. The NDP 2016-30 sets a target of keeping losses of oil shale in underground mines below the 2013 base of 29% (MoE, 2015a). Low global energy prices since 2015 make the sector's financial sustainability especially vulnerable: Eesti Energia's net profit fell by 66% over 2014-15 (Eesti Energia, 2016). The low mining efficiency leads to increased environmental impacts, and the unfavourable economic situation impairs the sector's ability to mitigate them.

To keep the oil shale sector profitable and mitigate negative environmental impacts, the Estonian government is examining measures aimed at reducing the use of oil shale for electricity production (given its low efficiency) and increasing oil shale processing into shale oil and chemical products valued in the international market. Yet approximately 75% of the oil shale processing capacity will reach the end of its economic lifetime in the coming years (Ernst and Young, 2014). Some investments into replacing it with more efficient and environmentally friendly processing technologies have been made, others are under consideration. The NDP 2016-30 assigns priority to increasing applied R&D in the oil shale sector and the development of reference documents on best available techniques in oil shale processing (MoE, 2015c).

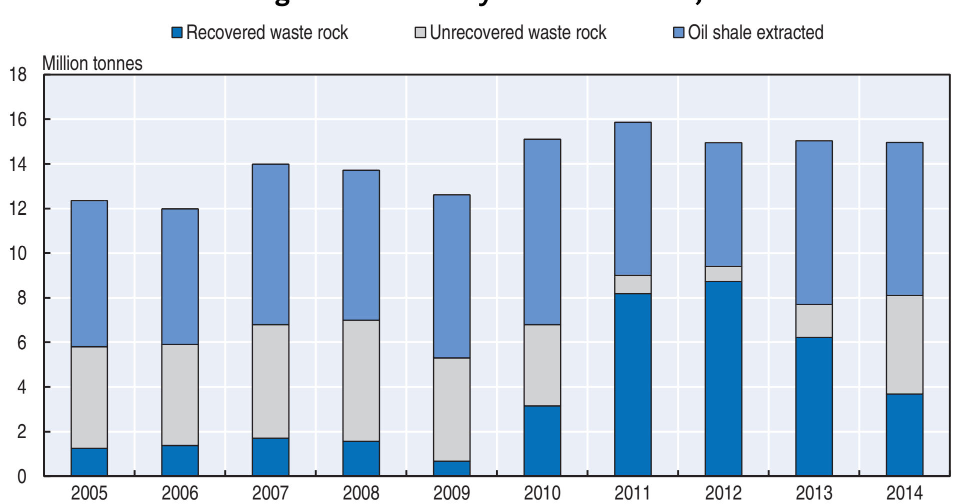
Sand, gravel and limestone are the most widely used construction minerals in Estonia. The economic crisis in 2008 resulted in a decrease of mining volumes of all minerals. Since 2011, they have started to gradually increase, largely driven by investment of EU structural funds into transport infrastructure. However, volumes have not reached pre-crisis levels.

Environmental impacts of mineral resources extraction and use

Oil shale mining and use are the dominant source of environmental impacts in the country. The industry (including state-owned Eesti Energia) spent EUR 366 million in 2011-14 alone to reduce pollution caused by oil shale mining and processing (Statistics Estonia, 2015), and the environmental situation related to oil shale mining and use has been improving over the last decade. However, major challenges remain with respect to waste management, air and water quality. Furthermore, the government does not seem to have full information about the environmental impact of the oil shale industry, as mining companies' self-reporting data are poorly verified (NAO, 2015a).

Waste rock from oil shale mining constitutes 70% of Estonia's non-hazardous waste. Due to the increased extraction of oil shale from underground mines, which generates more waste, the amount of waste rock is increasing despite the stable extraction rates. The reuse of waste rock is encouraged, but the actual reuse has been less than 50% (except during the years of high construction activity) due to the low quality of the gravel produced from it, as well as the high costs of its transportation (Figure 4). The NDP 2016-30 sets the waste rock reuse target for 2020 at just 40% (MoE, 2015c).

Figure 4. **Oil shale mining waste recovery rose until 2012, but has since declined**



Source: Statistics Estonia (2015).

StatLink http://dx.doi.org/10.1787/888933448305

The NDP for mineral resources used in the construction industry for 2010-20 encourages expanded use of waste rock from oil shale mining as an important resource for construction. Government policies identified the mining sector's efficiency gains as the key means for improving environmental performance and the key challenge for the industry. However, the efficiency goals have not been achieved.

Oil shale combustion and processing account for over 95% of hazardous waste generation in the country. This includes ash from oil shale combustion and semi-coke and retorting waste from its conversion to shale oil. While the oil shale ash recovery has more than doubled since 2005, it remains at a low level; most hazardous waste goes into landfills, which leads to air pollution with toxic organic substances. The government is setting only a modest target of 4.5% ash recovery for 2020 in its oil shale NDP (MoE, 2015c).

The impact of the mining industry on water resources manifests in acid discharges with mine water. In addition, river water temperature increases from discharges of mine water and cooling water discharges from power plants. The mining sector is the largest water consumer in the country. Mining operations have considerable impact on the hydrological regime in the region. They influence groundwater infiltration and affect river run-off and flow feed, causing land subsidence in north-eastern Estonia. The contamination of groundwater in the oil-shale mining area has a direct impact on public water supply.

Air quality issues associated with oil shale are mainly related to emissions of SO_2, NO_x, particulate matter and CO_2 from oil shale-based electricity and heat production. While the impact of mining itself is relatively small, oil shale processing is carbon-intensive and causes local air pollution. Estonia has taken measures (such as installation of desulphurisation equipment at the Narva power plant) to comply with the EU air quality standards, and SO_2 emissions have fallen sharply since 2010. However, the situation in Ida-Viru county – the main area for oil shale mining and use in eastern Estonia – remains worrisome. While emissions of almost all major pollutants have declined since 2011 (ESTEA, 2016), the incidence of respiratory and heart diseases is significantly higher in Ida-Viru than in any other region of the country (Orru et al., 2015).

Policy instruments and their effectiveness

Extraction permits, issued by the MoE or the Environmental Board, and issue-specific environmental permits issued by the Environmental Board, are the main instruments for regulating environmental impacts of mining activities. An annual oil shale extraction limit of 20 million tonnes per year as of 2008 was established in the Earth's Crust Act. However, the utility of the extraction limit for limiting waste generation is questionable: oil shale companies operate well below the limit, while the amount of waste is increasing due to the shift to underground mining. Moreover, mining companies have been allowed to extract additional amounts of oil shale as compensation for the years 2009-14 when they did not reach the established extraction limits. This may lead to a further increase of the sector's environmental impacts.

There is also evidence (NAO, 2015a) that extraction permits do not include financial requirements and guarantees to conduct remediation. According to the Earth's Crust Act and an MoE regulation, the extraction permit holder is required to restore the land disturbed by the mining of mineral resources on the basis of a restoration project. There are excellent examples of effective land restoration when open-cast waste deposits have been redesigned into multipurpose recreational areas. However, there are also persistent problems with land subsidence around Soviet-era underground oil shale mines that have been abandoned.

Environmental taxes are the main instrument of environmental policy affecting the mining sector, in addition to the required participation of power sector enterprises using oil shale in the EU ETS. They include a mineral resource extraction tax and taxes on air and water pollution, as well as on waste disposal. The largest share (almost 80%) of environmental taxes is paid by enterprises active in mining, production of shale oil, electricity and heat supply (Statistics Estonia, 2015).

Rates of all environmental taxes increased significantly between 2005 and 2015. For example, disposal taxes rose seven-fold for non-hazardous mining waste and more than eight-fold for oil shale ash and semi-coke. However, they have had no impact on the level of mineral extraction volumes and limited impact on the environmental effects of the mineral mining and processing industry. Air emissions and wastewater discharges have been reduced, but mainly due to investments made to comply with stricter EU environmental standards. The low water abstraction tax rates create a perverse incentive for extensive water consumption by the mining industry and hamper the necessary efficiency improvements.

In general, businesses perceive environmental taxes as generating revenues for the government rather than as serving their principal purpose of stimulating the reduction of environmental impacts. Amendments to the Environmental Charges Act (approved by Parliament in June 2016) tie extraction taxes for oil shale to the oil price retroactively from July 2015, effectively reducing their rate by more than five-fold until the end of 2017. This reform, aimed at alleviating the tax burden on the oil shale mining and processing industry, will deprive the government of significant environmental tax revenues and runs contrary to the green tax reform pursued by the Estonian government.

Recommendations on mining and the environment

- Align the policy of oil shale extraction limits with the sector's overall efficiency and environmental goals stated in relevant strategic documents; make the NDP's efficiency and environmental targets for 2025 and 2030 more ambitious in view of reducing the share of oil shale in the energy mix, and plan measures for achieving them; strengthen the information base on the sector's environmental and health impacts, including through establishing standard monitoring and reporting procedures and more diligent verification of companies' self-reporting data by the Environmental Inspectorate.
- Encourage deployment of more efficient oil shale mining and processing technologies; develop partnerships between government and industry to facilitate cost-effective transition to cleaner and more efficient oil shale extraction and use; develop a reference document on best available techniques in energy generation and oil production and rational use of extracted resources.
- Consider additional actions towards the diversification of the Ida-Viru region's economy away from oil shale mining and use, envisaging measures to mitigate the potential social impacts (e.g. improving labour mobility and training) through active collaboration between the central government, municipalities, employers and trade unions.
- Reinforce efforts to increase the recovery of mining waste, including ash and semi-coke from oil shale processing, by investing in research and development in collaboration between the government, research institutions and enterprises; consider increasing landfill

Recommendations on mining and the environment *(cont.)*

disposal taxes for oil shale mining and processing waste; improve the monitoring of air and water pollution in mining areas.

- Strengthen the permitting regime for the mining industry by ensuring that extraction and environmental permits contain clear conditions for waste minimisation and post-operation land remediation; better enforce land restoration requirements, particularly for construction minerals mining sites; provide financial support for innovative land restoration projects.

Notes

1. The EU ETS target is a 21% reduction in greenhouse gas emissions by 2020 compared to the 2005 level; Estonia's ESD target is an 11% increase by 2020 compared to the 2005 level.
2. While defined as charges by Estonian law, these instruments are referred to as taxes in accordance with the OECD definition.

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PART I

Progress towards sustainable development

PART I

Chapter 1

Key environmental trends

Estonia has made significant progress in improving its environmental performance by decoupling economic growth from the primary environmental pressures. However, it still faces some challenges linked to the extensive use of natural resources, which results in high emissions intensities and low material productivity of the economy. This chapter presents the key socio-economic developments and considers Estonia's progress in moving towards a low-carbon and energy-efficient economy, resource efficiency and sustainable management of natural assets, including biodiversity and water resources.

1. Introduction

Estonia is a small, sparsely populated country with large oil shale reserves and abundant forestry and water resources. Since 2000, Estonia has experienced strong economic growth, significantly higher than the OECD average. Still, gross domestic product (GDP) per capita remains lower than the OECD average.

Drawing on indicators from national and international sources, this chapter reviews progress towards the country's national and international targets. It focuses on the period since 2000. To the extent possible, it compares the state of the environment with that of other OECD member countries. It highlights some of the main environmental achievements and remaining challenges on the path towards green growth and sustainable development.

2. Key economic and social developments

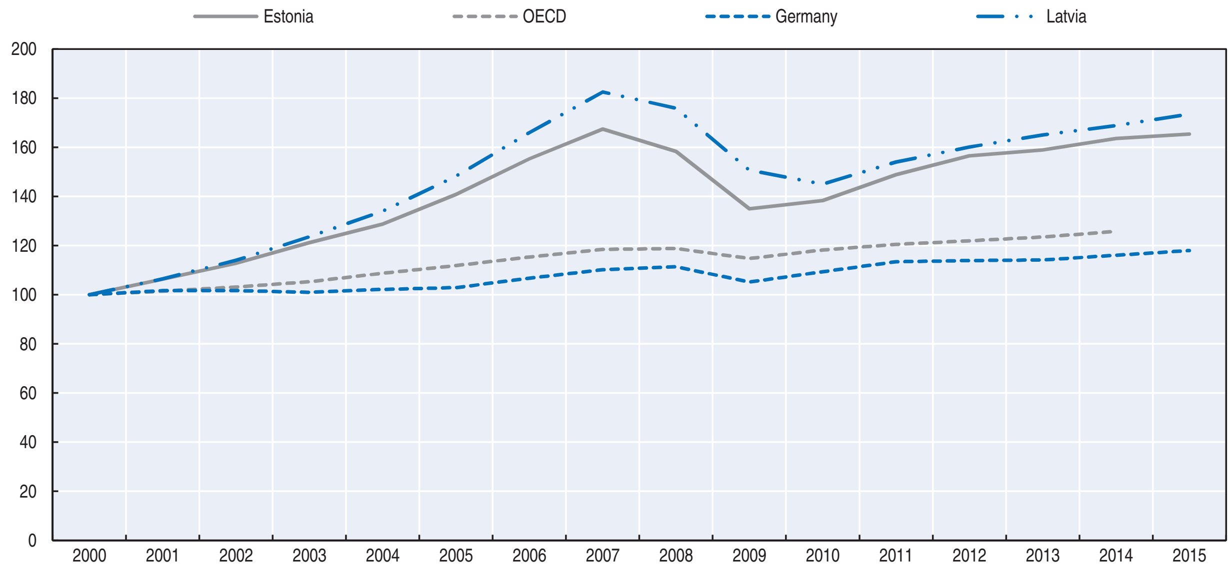
2.1. Economic performance

Over 2000-15, GDP in Estonia increased by about 65%, with an average annual growth of 3.6% per year in the last five years (Basic Statistics). The country enjoyed record-breaking growth between 2000 and 2007, in part driven by a credit-based boom in the construction sector. In this period, the economy grew at a rate much higher than the OECD average, although lower than the two other Baltic states of Latvia and Lithuania (Figure 1.1). In 2009, due to the global financial crisis, GDP decreased by more than 15% in just one year. A solid banking sector and a strong fiscal position contributed to economic recovery, and GDP is projected to reach 2.6% annual growth in 2017 and 3% in 2018 (OECD, 2015a; OECD, 2016a).

Economic activity is projected to accelerate gradually. This is largely due to the recovery of foreign demand and investment. However, the government's strong financial position and planned structural reforms also play a role. Estonia's fiscal balance improved in recent years – from a small deficit in 2013 to a narrow balance in 2014/15. The improvement was due to a broadened value added tax (VAT) base and higher taxes on alcohol and tobacco, even as the government raised spending on education and cut income tax. Public debt is the lowest in the OECD. It amounts to almost 14% of GDP, compared to the OECD average of almost 90% (Basic Statistics). Significant structural reforms are underway in the labour market, research and development (R&D), education and other areas to promote innovation, remove remaining barriers to entrepreneurship and competition, ensure access to finance for small and medium-sized enterprises (SMEs), upgrade infrastructure and raise energy efficiency. Despite the increase of R&D spending in recent years, its economic impact has been limited. Therefore, additional efforts would be needed to help revitalise productivity growth, especially with regard to innovation policy and knowledge transfer to firms. Further reforms of vocational education and lifelong learning programmes would help improve the skills level of the labour force (OECD, 2015a).

Estonian taxation levels are lower than the OECD average, but higher than in the other Baltic states. The labour tax wedge (the tax burden as a percentage of labour cost) remains

Figure 1.1. **Estonia is a top-performing economy among OECD member countries**



Note: GDP expressed at 2010 prices and purchasing power parities. 2000 = 1000
Source: OECD (2016), *National Accounts* (database).

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higher than the OECD average, especially for low-earning workers. An effective way to reduce it would be to continue the green tax reform (Chapter 3). The share of environmental taxes has steadily increased over the last 20 years; in 2014, they accounted for 2.6% of GDP (Basic Statistics). Estonia is the least decentralised country in the OECD with regard to taxation, as sub-national tax revenue is only 1.6% of the total tax revenue (OECD, 2016b). Government spending accounted for 39.5% of GDP in 2015, lower than the OECD average (Basic Statistics). Sub-national governments were responsible for 24% of the total government expenditure (OECD, 2016b).

2.2. Structure of the economy, employment and trade

In Estonia, as in most OECD member countries, the services sector accounts for the largest share of GDP in terms of value added, followed by industry, construction and agriculture (Basic Statistics). In 2015, 72% of the population aged 15-64 was employed, a higher level than the OECD average; the rate was seven percentage points higher for men. Despite the labour tax wedge and skill mismatches between workers and jobs, unemployment has decreased in recent years. It stands at around 6% – below the OECD average (OECD, 2015a). Unemployment levels are similar for working-age women and men (25-64 years-old). Unemployment of young people (15-24 years-old) is higher compared to the rest of the active population. Significant differences exist in unemployment levels across the country. The two counties with the highest unemployment rate are Ida-Viru – one of the largest and most industrialised counties that is home to all oil shale mining fields – and neighbouring Lääne-Viru; both have large shares of Russian-speaking people (Statistics Estonia, 2016).

International trade plays a significant role in the economy. Estonia has a very open economy with a ratio of exports to GDP amounting to 80%, while the imports to GDP ratio is 76%. The country's major trading partners are Sweden, Finland, Latvia and Germany. Weak growth in the euro area, as well as sanctions against the Russian Federation (hereafter

Russia), have stalled Estonian exports and negatively affected the economy (OECD, 2015a). Core exports and imports are electrical machinery and equipment, and mineral fuels (Basic Statistics).

2.3. Quality of life and regional disparities

With 1.3 million inhabitants in 2015, and a surface area of more than 42 000 km^2, Estonia has a lower population density than the OECD average. Compared to most OECD member countries, where the largest share of the population lives in urban areas, the majority of Estonia's population (almost 80%) lives in intermediate regions,[1] where rural communities account for 15-50% of the population (Basic Statistics). More than 70% of the population lives in Harju county where Tallinn is located (ESTEA, 2014b).

In general, Estonians are less satisfied with their lives than the OECD average. Despite steady economic growth, Estonia scores well in only a few measures of well-being, according to OECD indicators. It ranks above most other countries on environmental quality, education and skills, and work-life balance. However, it is below average on housing, jobs and earnings, subjective well-being, personal security, income and wealth, health status and civic engagement (OECD, 2012).

Estonia is a top-performing country in terms of the quality of its educational system: 90% of the working-age population has at least upper secondary education, among the highest rates in the OECD (OECD, 2012). The share of tertiary graduates is also higher than the OECD average (Basic Statistics). The average student scored very well in the OECD's Programme for International Student Assessment (PISA), making Estonia one of the strongest OECD member countries in student skills (OECD, 2012).

Since 2000, real GDP per capita has almost doubled and reached USD 24 200 (in current prices and purchasing power parity) in 2015, still lower than the OECD value (USD 36 900). The country also lags behind with respect to household disposable income. Ida-Viru county has the greatest share of residents with yearly disposable income below the at-risk-of-poverty threshold, compared to other counties (Statistics Estonia, 2016). In addition, Estonia is in the top quarter of OECD member countries in terms of inequality (as measured by the Gini coefficient) and relative poverty (Basic Statistics).

Life expectancy at birth is lower than in most OECD member countries. This is generally associated with modest health care public spending, although other factors may have an impact on life expectancy (OECD, 2015a). Similarly to other socio-economic indicators, there are regional differences in life expectancy: in the north-eastern region, life expectancy is nearly five years shorter than in other parts of the country (see Chapter 5, Box 5.4). The latest assessment of the World Health Organization (WHO) indicates that environmental factors represent 18% of the total burden of disease in Estonia, higher than the average level in the assessed countries (WHO, 2009).

A study by the University of Tartu indicates regional disparities in exposure to environmental health risk. Residents of Ida-Viru county had worse health indicators than residents of other regions (Chapter 5). In 2015, the share of population in Ida-Viru that registered good health status was the lowest compared to other counties and significantly below the country average. Consequently, Ida-Viru has the highest occurrence of long-term illness in Estonia (Statistics Estonia, 2016). The negative health status of residents in this area is due to emissions from oil shale production, but also to other sources of industrial pollution, as well as modest living standards.

3. Transition to an energy-efficient and low-carbon economy

3.1. *Energy intensity and use*

Carbon-intensive energy mix

Estonia has one of the largest shares of fossil fuels in the energy mix among OECD member countries – more than 80% of total primary energy supply (TPES). Estonia is one of the world's largest producers of oil shale, a sedimentary rock rich in organic matter that, once extracted from the ground, can be either used directly as a fuel for power plants, or processed to produce shale oil or other outputs. Oil shale accounts for around 70% of TPES.

Since 2004, Estonia has been making reforms to integrate more effectively into regional electricity and gas markets. Its recent integration into the Nord Pool energy market guarantees energy security through greater diversity of energy suppliers without reliance on domestic fossil fuels (Box 1.1).

Box 1.1. **Estonia's energy security**

Since joining the European Union (EU) in 2004, Estonia has significantly reformed its electricity and natural gas markets. It has fully transposed the EU Third Energy Package Directives and has a strong and independent regulator in place – the Competition Authority. The electricity sector has been liberalised. Estonia is now part of the Nord Pool wholesale electricity market, primarily due to Estlink 2 interconnection with Finland launched in 2014.

With funding from the EU, Estonia has made infrastructure investments to strengthen connections to regional electricity supply. The three Baltic states agreed in 2015 on a common strategic goal of de-synchronisation from the Russian power system and synchronisation with the Continental European Network, as a key priority of the Baltic Energy Market Interconnection Plan.

As a member of the Nord Pool, Estonia no longer bases its domestic electricity production solely on oil shale. However, with the same prices within Estonia and the Nord Pool countries, there is no market incentive for increased imports of electricity from cleaner sources. This may change with the eventual completion of additional nuclear capacity in Finland.

To address its isolation from the EU natural gas market and total dependence on imported gas from Russia, Estonia plans to build a regional Baltic liquid natural gas terminal and a pipeline connector between Finland and Estonia at an estimated cost of EUR 300-500 million.

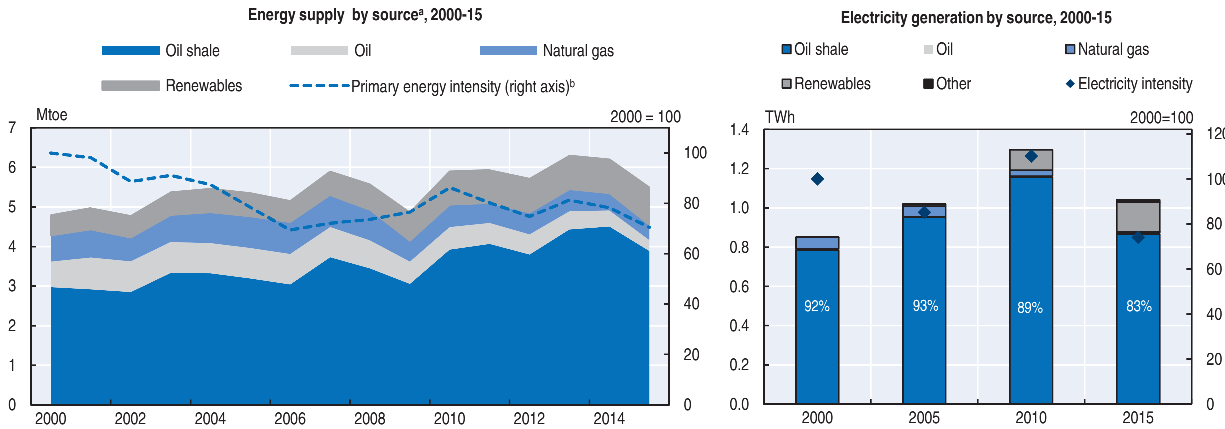
Source: EC, 2015a; Kearns, 2015.

The total energy supply has increased since 2000, with shares of oil shale and renewables rising at the expense of natural gas and oil (Figure 1.2). Oil shale is the main source of electricity generation. Since 2000, however, the electricity mix has moved towards higher use of renewables (Figure 1.2).

Rapid development of renewable energy supply

Renewable energy supply (RES) has increased by more than 80% since 2000 and accounted for 17% of TPES and 14% of electricity generation in 2015. This was above the OECD average of 9.6% of RES over TPES, but below the OECD average of 34% of RES over electricity generation. The relatively high share of renewables in the total energy supply is

Figure 1.2. **Fossil fuels dominate the energy mix**



a) Total primary energy supply. Breakdown excludes electricity trade and non-renewable municipal waste. Oil shale includes a small percentage of coal and peat.
b) Index of relative change since 2000 of total primary energy supply per unit of GDP (at 2010 prices and purchasing power parities).
Source: IEA (2016), IEA *World Energy Statistics and Balances* (database); OECD (2016), *National Accounts* (database).

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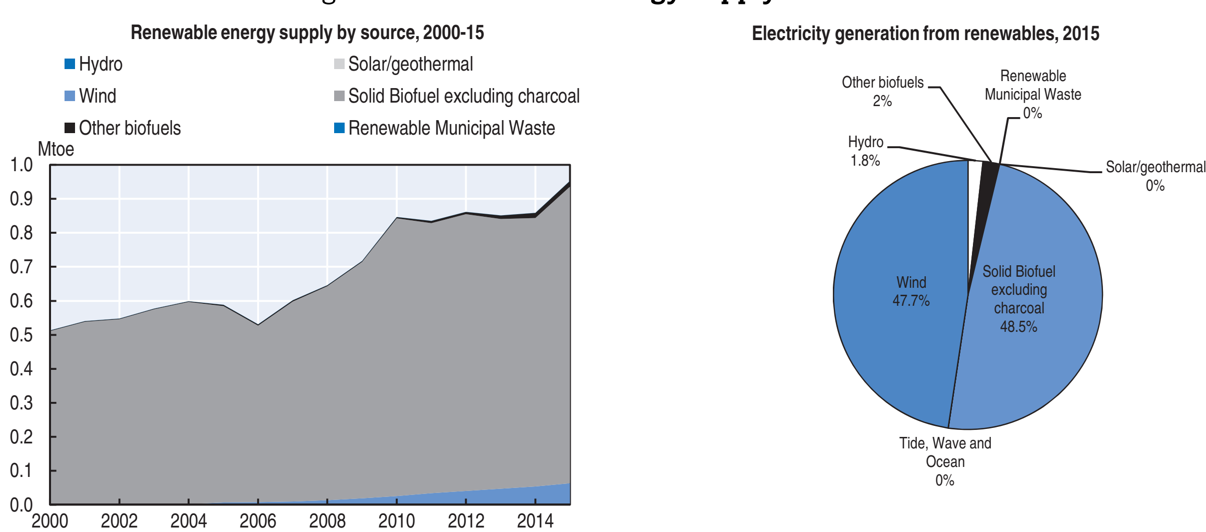
due to extensive use of biomass in the heating sector. Estonia has increased wind power generation significantly since first tapping wind power in the early 2000s. However, wind still accounts for a smaller portion of renewable energy than biomass. Negligible shares of biofuels and hydropower (due to its limited potential in the country) account for the remaining renewable sources (Figure 1.3).

Under the European Union Renewable Energy Directive (2009/28/EC), Estonia has a target to increase the share of renewable energy in gross final energy consumption[2] from 18% to 25% between 2005 and 2020. The country has largely surpassed the 2011/12 interim target reaching its 2020 target in 2011. With 24.8% of RES in 2012, Estonia has also exceeded the 2012 interim target under its National Renewable Energy Action Plan (NREAP) up to

Figure 1.3. **Renewable energy supply increased**



Note: Solar/geothermal = Geothermal + Solar Photovoltaics + Solar Thermal. Other biofuels = Charcoal + Biogases + Biogasoline + Biodiesel + Other Liquid Biofuels.
Source: IEA (2016), IEA *World Energy Statistics and Balances* (database).

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2020. The electricity sector contributed the most to the early achievement of these targets. It is expected that Estonia will meet its 2020 overall target by implementing its current renewable energy policies (MEAC, 2013; EC, 2015b, 2013).

In the transport sector, Estonia achieved only 0.2% use of renewable energy sources in 2010, far below the EU-wide goal of 10% by 2020. The exemption of certain biofuels[3] from excise duty, aimed at promoting their use in transport, had no positive effect and was removed in 2011. Significant expansion of RES will be needed to achieve the EU target. To this end, under its NREAP, Estonia has planned a number of policy measures. These include mandating a 5-7% biofuel requirement for motor fuels, a shift to renewable energy in public transportation and an increase in the share of vehicles using alternative biofuels (other than biodiesel and bioethanol) (MoE, 2013).

High energy intensity

The energy intensity (TPES per unit of GDP) of the Estonian economy is the third highest in the OECD (Annex 1.A). Since 2000, the TPES has grown far slower than economic activity, showing relative decoupling from economic growth. The final energy intensity decreased, due in part to energy efficiency measures put in place pursuant to the EU Directive on Energy End-Use Efficiency and Energy Services. Estonia declared in its second Energy Efficiency Action Plan (EEAP2) to have reached its 2010 intermediate target of 2.3%. However, according to the European Commission's progress report, it is not clear how the savings have been calculated and how they relate to the measures presented. The EEAP2 indicates that the 2016 forecast final energy savings are unlikely to be met, requiring a greater level of ambition to achieve the country's energy efficiency targets (EC, 2014b). In 2016, Parliament approved the Energy Sector Management Act, which requires energy efficiency measures in public buildings, energy production and supply, as well as energy efficiency criteria for public procurement, among other provisions.

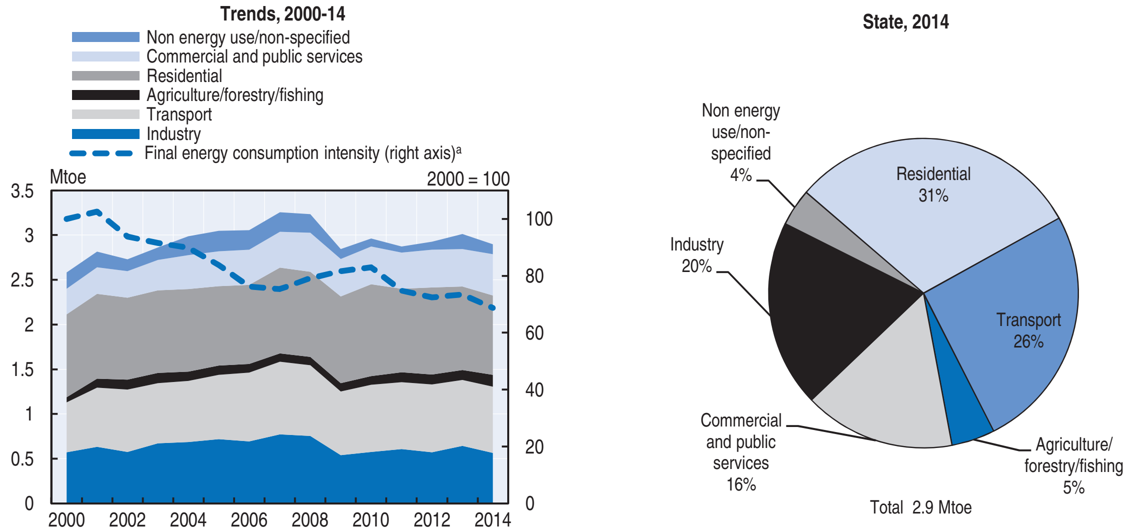
A similar trend can be observed for total final consumption (TFC), which increased between 2000 and 2013, but at a slower pace than economic activity. The residential sector accounted for the largest share of energy consumption in 2014 (31%), followed by transport and industry (Figure 1.4).

3.2. Greenhouse gas emissions

Estonia's GHG emissions, excluding emissions/removals from land use, land-use change and forestry, have increased by 23% since 2000 – the third-highest increase among OECD member countries after Turkey and Korea, in contrast with the OECD-wide trend of declining GHG emissions. Nonetheless, as the GDP increased by about 64% over the same period, GHG emissions have been decoupled from economic growth (Figure 1.5). GHG emission intensity per capita and per unit of GDP was above the OECD average, reflecting the dominance of oil shale in the energy mix (Annex 1.B). Emissions per unit of GDP fell by about 25%, in line with the OECD average.

Estonia met its 2008-12 Kyoto Protocol target of reducing GHG emissions by 8% compared to the 1990 level. The Kyoto target was achieved through a structural reorganisation of key economic sectors (energy production, industry and agriculture), which occurred after the fall of the Soviet Union in the early 1990s. Estonia also relies on the Kyoto Protocol's Joint Implementation mechanism, through which it has earned emission reduction units with a number of renewable energy projects, mostly on biomass and wind power (IEA, 2013).

Figure 1.4. **Energy consumption grew, while its intensity decreased**



a. GDP in 2010 PPP prices

Source: IEA (2016), IEA *World Energy Statistics and Balances* (database); OECD (2016), *National Accounts* (database).

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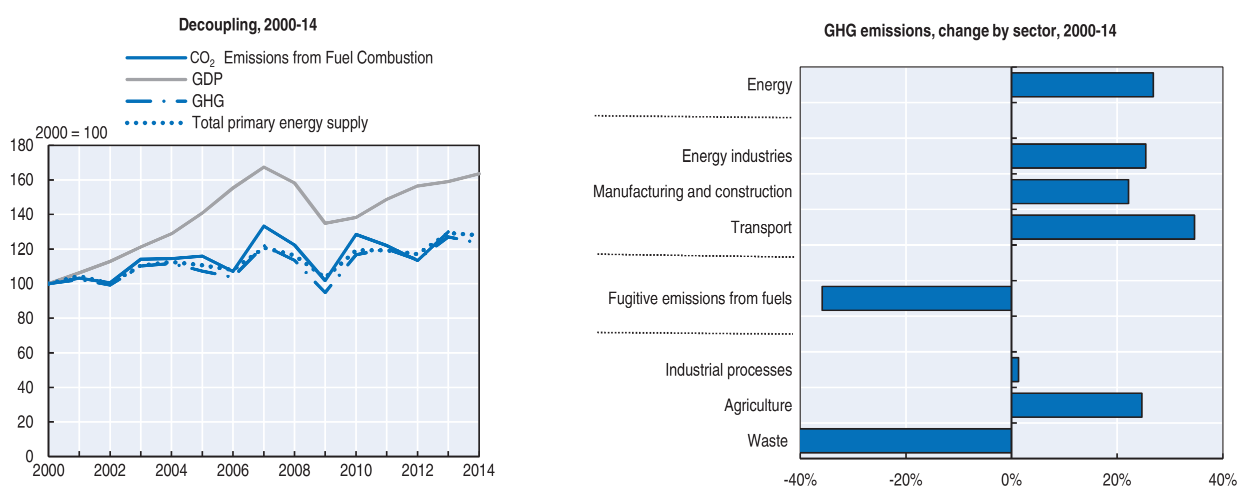
Figure 1.5. **GHG emissions are decoupled from economic growth, but continue to increase**



Note: GDP is expressed in 2010 PPP prices

Source: IEA (2016), IEA CO_2 *Emissions from Fuel Combustion Statistics* (database); IEA (2016), IEA *World Energy Statistics and Balances* (database); OECD (2016), *National Accounts* (database).

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The energy sector is by far the largest producer of GHG emissions (almost 90%). It is also the sector that has shown the largest increase in emissions since 2000 (27%), mainly driven by the boost of energy consumption and the increased share of oil shale in the energy mix. The agricultural sector also increased its emissions (by 25%), while emissions related to waste dropped by 40% (Figure 1.5). Agriculture-related emissions comprise methane from livestock and nitrogen compounds from fertilisers (MoE, 2013).

Emissions from transport, which accounted for 11% of total GHG emissions in 2014, have increased by 35% since 2000. Transport is the main source of CO_2 emissions in the non-Emissions Trading System (ETS) sector (Figure 1.5). As in many other OECD member countries, road transport dominates the sector's energy use. Public transportation is used less than in other European countries; between 2006 and 2012, the number of passengers travelling by train dropped as a result of obsolete rail infrastructure (MoE, 2013). Estonia has relatively low taxes on transport fuels, which means that it has significant potential to stimulate reduced energy consumption and related emissions in the transport sector (Chapter 3).

As in most OECD member countries, carbon dioxide (CO_2) was the main source of GHG emissions, accounting for about 90% of the total in 2014, followed by methane (5%), nitrous oxide (4%) and fluorinated gases (1%). Consumption-based CO_2 emissions (i.e. excluding emissions embodied in Estonia's exports) increased less rapidly than production-based emissions and represented 10.5 tonnes per capita in 2011, slightly below the OECD average of 11 tonnes. Estonia is among the few net exporters of CO_2 emissions in the OECD, reflecting its carbon-intensive export-oriented economy (Annex 1.B; Wiebe and Yamano, 2016). The electricity and heat generation sectors are responsible for the largest share of CO_2 emissions, followed by transport, industry and construction. Emissions from the residential sector accounted for a very low share of the total (IEA, 2013). The use of F-gases has been growing in recent years due to their increased use in refrigeration and air conditioning as substitutes of ozone-depleting substances, such as chlorofluorocarbons (CFCs) (MoE, 2013).

The high emission intensity makes economic activities vulnerable to rising carbon prices in the framework of the EU ETS. Energy efficiency measures in the electricity and heating sectors, as well as processing of oil shale into lighter oil products instead of burning it, could help lower the emission intensity of the economy. Finally, taxing energy sources according to their carbon content could help decrease the emission intensity of the economy (Chapter 3) (IEA, 2013; OECD, 2015c).

Projections of the United Nations Framework Convention on Climate Change (UNFCCC) indicate that total GHG emissions, with currently implemented and adopted measures, are expected to decrease by 7% by 2020 compared to 2005, and by another 5% by 2030. An additional decrease of a few percentage points in both timeframes could be achieved in a scenario that includes policies and measures that are still in the planning stage (MoE, 2013).

As a member of the EU, Estonia is subject to the EU ETS and the Effort Sharing Decision (ESD). The EU ETS sets an EU-wide target to reduce 21% of emissions by 2020 compared to the 2005 levels. The ETS covers 71% of Estonia's GHG emissions. The ESD allows Estonia to increase its emissions from non-ETS sectors[4] by 11% by 2020, compared to the 2005 level. In 2013, EU ETS-verified emissions had increased by more than 20% compared to 2005. Emissions from non-ETS sectors, on the other hand, had decreased by more than 7% compared to the base year. As Estonia is part of the EU framework for post-2020 commitments, it is bound to a 40% decrease in GHGs by 2030; it seeks an 80-95% reduction by 2050 from the 1990 level. In addition, to implement the UNFCCC Paris Agreement, Estonia needs to pursue ambitious domestic mitigation measures (MoE, 2013; EEA, 2014a; OECD, 2015d).

Estonia's current policy mix for climate change mitigation does not address its long-term GHG reduction targets. In 2017, the Ministry of the Environment (MoE) is expected to adopt the General Principles of the Climate Policy until 2050. The General Principles were drawn on the basis of the 2005 National Strategy on Sustainable Development "Sustainable Estonia 21" and the 2007 Estonian Environmental Strategy to 2030. The draft General Principles establish a vision for all sectors aimed at setting Estonia on a pathway consistent with the 2015 Paris Agreement and the EU targets to 2050. The document declares policy goals of reducing GHG emissions by 70% by 2030, by 72% by 2040 and by 80% by 2050, compared to the 1990 level. The General Principles do not stipulate specific measures to achieve these goals, but are expected to be implemented through sector-specific development plans (energy, transport, agriculture, etc.).

One key sectoral strategic document is the National Development Plan of the Energy Sector (NDPES) until 2030, which was developed with wide stakeholder participation and adopted in 2016. It superseded the earlier plan (2009-20). The draft NDPES-2030 describes the goals for the Estonian energy policy until 2030 and presents a vision up to 2050. It focuses on the three main objectives of security of supply, increased energy efficiency and improved competitiveness. It also states that in 2030 renewable energy sources are to contribute 50% of electricity production and 80% of heat generation, as well as make all new buildings energy neutral.

The draft NDPES presents optimistic scenarios for reducing Estonia's GHG emissions and the carbon intensity of its economy in line with the goals of the General Principles of the Climate Policy. These scenarios, based on modelling work in 2012-15, indicate that emissions would peak before 2015 and then begin to decline. However, the plan does not specify measures to achieve the low-carbon pathways. It states that the public sector's intervention will be reduced to a minimum and that development of the oil shale sector will largely depend on investments of oil shale companies.

The 2011 National Reform Programme "Estonia 2020" established two key priorities for the country: restructuring the energy sector in line with Estonia's energy security and energy efficiency goals, and reducing the country's resource intensity, with a particular focus on energy. The related Action Plan for 2014-18 listed a number of measures without assessing their mitigation capacity.

To address Estonia's growing climate change-related challenges (Box 1.2), the MoE has prepared a Climate Change Adaptation Plan that is expected to be adopted in 2016. The plan focuses on eight priority sectors, including energy, industry and biodiversity. However, the cross-sectoral goals and measures set out in the draft plan are not sufficiently specific and the funding needs are not broken down by task. In addition, a number of sector-specific plans already deal with adaptation issues. Estonia also participates in several Baltic Sea Region adaptation projects.

Box 1.2. **Climate change adaptation challenges in Estonia**

Climate change is not expected to result in extreme environmental consequences in Estonia, compared to many other countries. Indeed, some of its effects can be considered positive. Some of the key projected climate change consequences for Estonia are temperature rise, increase in precipitation (especially in winter) and sea-level rise. Among the most affected sectors are water management, energy and coastal infrastructure.

Water management

Climate change is projected to affect water management both positively and negatively. On the one hand, increased precipitation and the corresponding rise of groundwater supply will augment the safe yield of wells in Upper Estonia (i.e. the level at which groundwater can be withdrawn without causing depletion of the aquifer); this will make public water supply cheaper and more reliable (OECD, 2013a). On the other hand, increased groundwater levels may hamper agricultural production, due to excessively moist land, and make it easier to transport pollutants and contaminate wells. Addressing these challenges would require the development and improvement of drainage systems (Baltadapt, 2013; MoE, 2013).

Box 1.2. **Climate change adaptation challenges in Estonia** *(cont.)*

With regard to surface water, increased flow in winter would improve water quality of rivers and benefit fish farming. Yet reduced flows in the spring may deteriorate water quality and have a negative impact on aquatic habitats (OECD, 2013a).

The major risks related to a sea-level rise and increased precipitation are seasonal flooding and inundation of mines, as well as riverbank and seashore erosion. Addressing these impacts requires coastal and inland infrastructure development (MoE, 2013).

Energy sector

Climate change is also expected to have a mixed impact on the energy sector. The rise in winter temperatures is projected to reduce the heating needs in the cold season. Conversely, warmer summers and more frequent heat waves would increase electricity production for cooling (MoE, 2013).

With regard to oil shale production, the primary concern is an increased risk of mine flooding (SEI, 2015). At the same time, warmer temperatures may create favourable conditions for increased growth of herbaceous biomass and their use as biofuel (MoE, 2013).

Wind power will benefit significantly from climate change, as wind speeds are expected to increase in the cold half-year – when demand for energy is high. However, fast changes in wind direction might result in energy losses, if wind turbines are incorrectly designed (SEI, 2015).

Source: Baltadapt (2013); MoE (2013); OECD (2013a); SEI (2015).

3.3. *Air emissions and air quality*

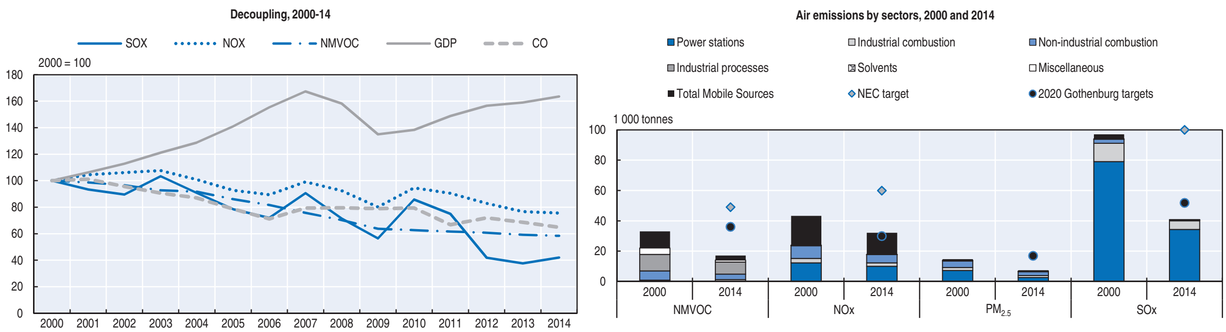
The country enjoys relatively good air quality except in Ida-Viru county, where emissions from oil shale combustion and processing represent a health hazard to residents (Section 2.3). In Tallinn, a relatively large share of the population (47%) is exposed to high levels of $PM_{2.5}$,[5] while in Narva and Tartu, the level is much lower, at 23% and 4%, respectively (OECD, forthcoming). In 2013, 502 people were estimated to have died prematurely from $PM_{2.5}$, a 30% decrease compared to the 2005 level. Projections for 2060 indicate a further decrease, with the number of premature deaths dropping to 445 per year (OECD, 2016c). The cost of such deaths[6] increased slightly (by 2%) over 2005-13, reaching more than USD 1.3 billion[7] (OECD, 2014).

Emissions profile

Since 2000, emissions of major air pollutants have been decoupled from economic growth. Emissions of sulphur oxides (SO_x) decreased by the largest share (almost 60%), followed by non-methane volatile organic compounds (NMVOC) (-42%), carbon monoxide (CO) (-35%) and nitrogen oxides (NO_x) (-24%) (Figure 1.6). In 2014, SO_x and NO_x emissions per unit of GDP were among the highest in the OECD (Annex 1.B). Ammonia (NH_3) emissions, which increased by around 17%, are mainly caused by livestock manure management and use of fertilisers (ESTEA, 2014a).

Stationary sources account for the majority of SO_x and NO_x emissions, with power stations contributing the largest share. Non-industrial combustion, mainly burning both wood in the residential sector and municipal solid waste in domestic heaters, represents one-third of small particulate emissions and around one-fifth of NMVOC and NO_x emissions (Figure 1.6).

Figure 1.6. **Air emissions have decreased**



Note: Data refer to 2003 for $PM_{2.5}$ of the Miscellaneous source.
Source: OECD (2016), "Air Emissions", *OECD Environment Statistics* (database); OECD (2016), *National Accounts* (database).

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Emissions of particulate matter declined over the review period. $PM_{2.5}$ emissions decreased by around 50% over 2000-14 (Figure 1.6), while PM_{10} emissions decreased by around 60% over 2000-14. PM and ozone (O_3) are Europe's most dangerous pollutants in terms of harm to human health and are mainly caused by anthropogenic emissions (EEA, 2014c).

Average PM_{10} concentrations[8] dropped, achieving the 2012 target set by the EU legislation two years early (EEA, 2014b). Reduced road traffic, caused by the economic recession, could have contributed to this outcome; emissions are likely to rebound as economic growth picks up. Since the formation of ozone requires sunlight, O_3 concentrations are generally lower in northern countries. In Estonia, exposure to urban air pollution from ozone was below the EU threshold value in 2011 (EEA, 2014c).

Main policies and measures

The main factor influencing overall trends in air quality has been implementation of the EU Air Quality Directives 2008/50/EC and 2004/107/EC, which set legally binding limits for concentrations of outdoor air pollutants. Estonia's Ambient Air Protection Act regulates polluting activities, as well as data reporting and collection. It entered into force in 1999, was amended numerous times and is supported by a large number of implementing regulations. The Air Protection Act set emission standards and pollution control requirements, including, in its latest amendment of 2012, those related to F-gases. The Environmental Charges Act, in force since 2006, establishes emission taxes[9] for several pollutants released into the air from stationary sources, for all installations required to have an air pollution permit (Chapter 2). Most pollutants, except methane and F-gases, are subject to emission taxes (MoE, 2013).

Estonia has met the 2010 target under the National Emission Ceiling Directive (NEC) for all pollutants. Estonia is on track to comply with the Gothenburg Protocol of the Convention on Long-range Transboundary Air Pollution (LRTAP), which sets reduction targets for 2020, compared to 2005 levels. By 2013, all pollutants except for $PM_{2.5}$, NO_x and NH_3 had already met the Gothenburg targets. In addition, among the requirements of Estonia's 2004 accession to the EU, it was agreed that sulphur dioxide (SO_2) emissions from oil shale combustion plants would not exceed 25 kilotonnes after 2012. The main reason for the significant decrease in SO_x emissions since 2000 has been technology improvements in the oil shale-fired Narva power plant, the largest power generator in the country. However, a number of energy-intensive industries (shale oil and cement production) are expected to expand their operations in the near future, which may increase air emissions in those sectors.

European standards on sulphur emissions have drastically reduced the sulphur content in motor fuels, which is currently very low in Estonia. This contributes to a decrease in particulate, carbon monoxide and NMVOC emissions. Other measures in the transport sector include an increased use of catalytic filters on motor vehicles. As a result, there has been a reduction of NO_x emissions, mostly from power generation and road transport. Moreover, the expansion of diesel fuel at the expense of petrol caused a decline in CO and NMVOC emissions. European directives on limitations on NMVOC from solvent use have been responsible for reduction of those emissions.

4. Transition to a resource-efficient economy

4.1. Material consumption

Between 2008 and 2015, the material productivity of Estonia (the amount of economic wealth generated per unit of material used) increased by 4%. Nevertheless, it is the fourth lowest level in the OECD (Annex 1.C). The National Reform Programme "Estonia 2020" (discussed above) focuses, among other things, on seeking to increase material productivity by 10% by 2019. Other measures are foreseen in the Multiannual Financial Framework 2014-20, including financial support schemes for more than EUR 100 million to support investment in resource-efficient initiatives. Trends in material consumption are further discussed in Chapter 4.

4.2. Waste management

Estonia generated almost 22 million tonnes of primary waste in 2014, corresponding to more than 16 000 kg per capita – more than double the average of other OECD member countries. Mining and quarrying are responsible for the largest shares (36% of total waste), followed by energy production (33%) and manufacturing (20%). Water treatment and construction waste account for small shares of primary waste. Hazardous waste represents a large share of primary waste (42%). Almost all hazardous waste is produced by oil shale processing (Chapter 4).

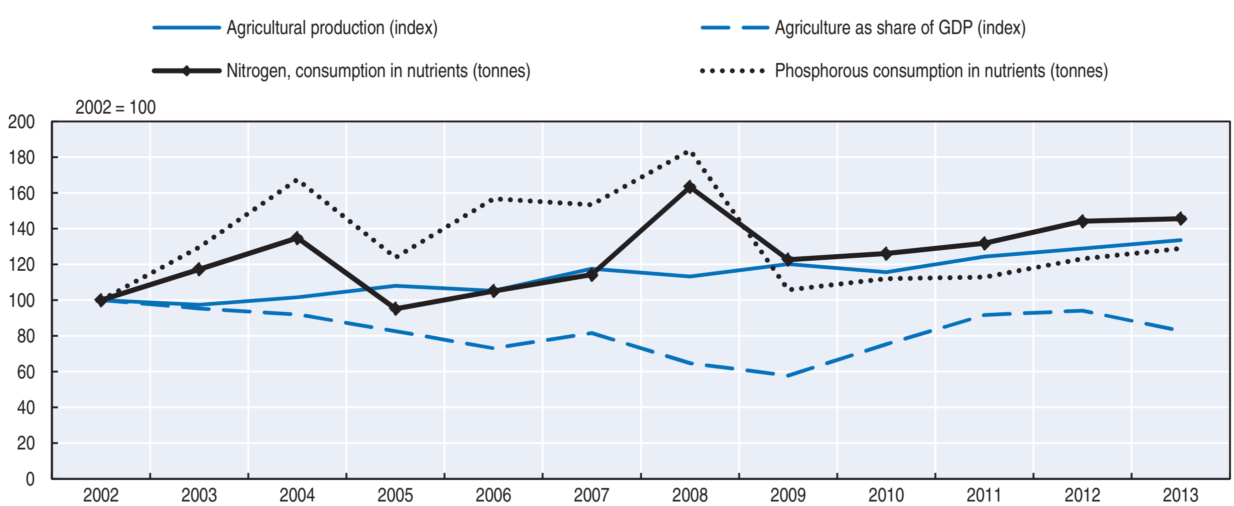
Municipal waste per capita was 357 kg in 2014, among the lowest levels in the OECD (Annex 1.C). Since 2000, the treatment of municipal waste has changed significantly from landfilling. In 2014, incineration with energy recovery was the main treatment method (52%),[10] followed by recycling (29%) and composting (5%). Landfilling represented only 7% of the total volume. The remainder was used for backfilling (filling excavated areas with mineral waste, such as sand and stones).

Estonia's waste management strategy is built on EU directives, which have been transposed into national legislation. With about 30% of municipal waste recycled,[11] the country is facing a significant challenge to meet the 50% recycling target for 2020 set in the EU Waste Framework Directive. The National Waste Management Plan 2014-20 aims at harmonising the different waste targets and introducing new ones for local administrations. The main focus has been on reducing landfilling and increasing waste prevention and recycling. Most recovered materials come from oil shale mining waste, oil shale ash from power generation, wood production, and construction and demolition industries. Waste management policies are discussed in detail in Chapter 4.

4.3. *Agricultural inputs*

Agricultural inputs did not show significant decoupling from agricultural production. While the latter increased by 34% over 2002-13, spurred by EU support, phosphorus consumption (measured as the amount of nutrients per hectare of agricultural land) increased by almost 30% and nitrogen use was up by 46% (Figure 1.7). However, the gross nutrient balance (the difference between nitrogen and phosphorus inputs and their uptake by crops and pasture), was lower than the OECD average, showing a moderately negative impact of fertiliser consumption on the environment. As in most OECD member countries, the amount of phosphate fertilisers used per hectare of agricultural land is much lower than that of nitrogen fertilisers, the latter being higher than the OECD average (OECD, 2015b). Over the past decade, growth in agricultural production has not been completely decoupled from the sale of pesticides, which grew by a yearly average of 8%, compared to an overall average decrease in OECD member countries (OECD, 2013b). However, the quantity of pesticides sold per square kilometre of agricultural land is one of the lowest in the OECD (Annex 1.C).

Figure 1.7. **Nitrogen inputs did not decouple from agricultural production**



Note: Consumption in nutrients, kg per ha of agricultural land.
Source: FAO (2016), *FAOSTAT* (database); World Bank (2016), *World Development Indicators* (database).

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Agriculture was the third most significant source of GHG emissions in 2012. Opening the market to cheaper imported products had caused an overall decline in the sector after 1991, but agricultural production picked up in 2005 (Figure 1.7). Since then, the cropland area has been growing as a result of EU subsidies, increased exports in the sector and expansion of organic farming. Organic farming accounted for 17.5% of total agricultural land in 2015, which is significantly higher than the OECD average of just over 2% (OECD, 2015b).

5. Managing the natural asset base

5.1. *Fossil fuels*

Estonia has considerable reserves of oil shale, which it has been mining for almost a century. These reserves are estimated at more than 4 billion tonnes, which represent 1% of the global and 17% of European deposits (IEA, 2014). Oil shale mining, which is extracted either through open-cast mining or underground mining, has a negative impact on the environment. Following extraction, oil shale is transported to a processing plant, where it is crushed and heated to produce shale oil or used directly as feedstock for heat or power generation. There are two oil shale types in Estonia – dictyonema argillite and kukersite. Dictyonema argillite is more abundant, but is a poorer source of energy, yielding 3-5% of oil. Kukersite, on the other hand, can yield 30-47% of oil (IEA, 2013). The environmental aspects of mining are discussed in depth in Chapter 5.

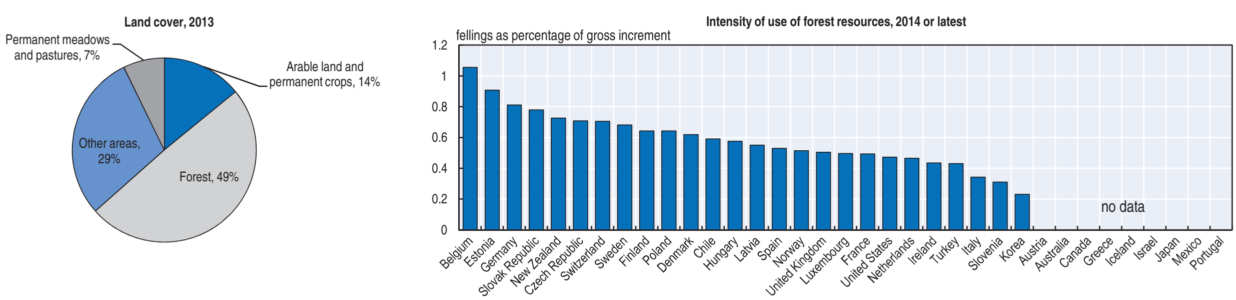
5.2. *Biodiversity and ecosystems*

Land cover and forests

Estonia's average annual urban land expansion over 2000-06 was higher than the EU average. Housing, services and recreational activities took up most of the new urban land. Mining, landfills, industrial sites and transport infrastructure accounted for the remainder (EEA, 2015).

Forests cover almost half of Estonia's territory. Both the total forest area and the types of tree species have remained stable over the review period. Pine and birch are the most common species, followed by spruce and grey alder (Statistics Estonia, 2015). Arable land and croplands account for 14% of the territory, and meadows and pastures for 7% (twice as much as in 2000) (Figure 1.8).

Figure 1.8. **Forests are intensively used**



Note: Land cover country area, and not land area, is used for computing the shares.
Source: FAO (2016), *FAOSTAT* (database); OECD (2016), "Depletion and growth of forest resources in terms of volume", OECD *Environment Statistics* (database).

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The intensity of forest resource use is one of the highest in the OECD (Figure 1.8).[12] The share of exports of forestry products in total national exports is also significantly higher than in most OECD member countries (OECD, 2015b). In 2010, 10% of the forest area was under strict natural protection. One-third of the protected forest area is privately owned, with compensation mechanisms in place only for Natura 2000 areas. Further efforts are needed to ensure a greater variety of forests covered by protected areas (Statistics Estonia, 2015). This would also contribute to the implementation of Sustainable Development Goal 15 "Life on Land".

Protected areas

In 2014, 18% of Estonia's terrestrial area and 27% of the territorial sea were under protection (MoE, 2015a). The highest level of nature protection is provided in nature reserves and wilderness areas (World Conservation Union [IUCN] category I), which cover some 4% of the territory, more than in most OECD member countries. Other IUCN categories of protected areas (habitat or species management areas, protected landscapes and managed resource protected areas) cover around 15% of the country's territory. However, due to different national and international definitions of protected areas and sometimes overlapping categories, the actual share of protected land is difficult to establish (OECD, 2015b).

Natura 2000 sites represent around 17% of the territory, almost equal to the EU average of 19%. Terrestrial and marine areas each make up approximately half of Estonia's Natura 2000 network (MoE, 2015b). Estonia has already reached the 2020 Aichi targets of the United Nations Convention on Biological Diversity (CBD), which call for protecting at least 17% of the terrestrial area and inland waters, and 10% of the coastal and marine areas.

As in many other OECD member countries, protected areas have grown in Estonia, contributing to increased connectivity between habitats, which has helped animals move from one area to another. Estonia's policy on protected areas seeks to avoid fragmentation of ecosystems through sustainable management of forests and grasslands and the creation of corridors between these areas.

Threatened habitats and species

The 2013 monitoring report under EU Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) revealed a small improvement in the status of habitats since the first assessment in 2007. More than half of habitat types are in a favourable condition – much higher than the EU average of 16%; the remaining habitat types in Estonia registered an insufficient or bad status (MoE, 2015a). In Estonia, the main pressures on natural habitats come from changes in land use and the presence of alien species.

The 2013 Habitats Directive monitoring report registered an improvement in the status of species since 2007, with the majority recording favourable status, compared to an EU average of only 23% (MoE, 2015a). The main pressures on species come from human activity that made their habitats unsuitable and forced them to retreat to certain areas. According to the 2013 report under the Birds Directive (2009/147/EC), the short-term population trend of breeding birds is either stable or improving for most assessed species (MoE, 2015a).

Most freshwater and marine fish species are not threatened. Compared to other countries, aquaculture is a small-scale activity, with the rainbow trout and carp being the main species bred. Fish farms are also used to replenish the fish stock of endangered species (Statistics Estonia, 2015).

Biodiversity policies

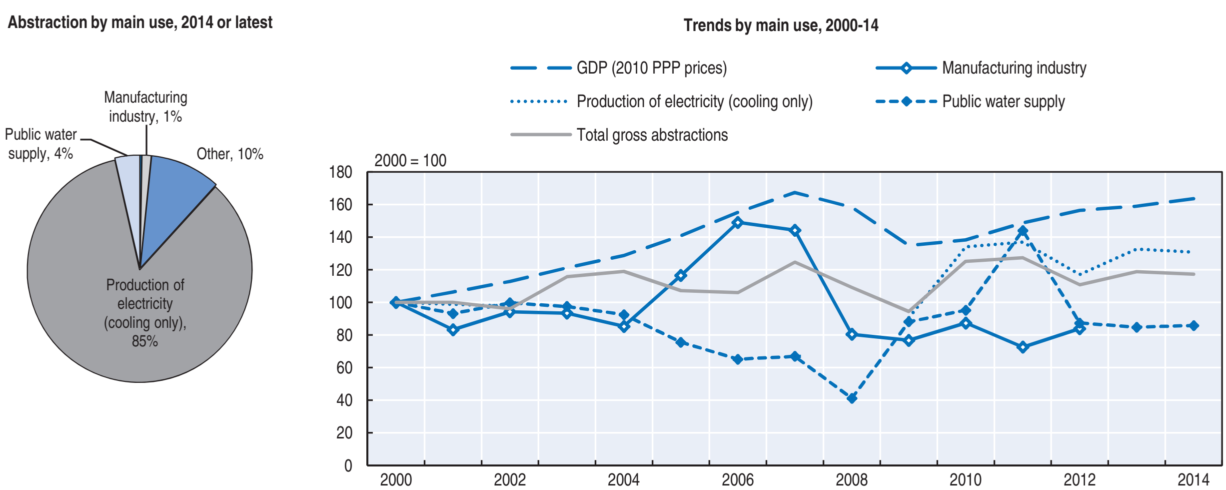
The Estonian Nature Conservation Act (2004) promotes the preservation of biodiversity by defining natural objects under protection and the main provisions for their management. In 2012, to implement the nature protection objectives of the Environmental Strategy to 2030, the government approved the Nature Conservation Development Plan to 2020. This plan draws from international and European objectives and establishes specific and often quantitative targets to achieve favourable conservation status of species and habitats (MoE, 2015a). Strategies and plans guide biodiversity conservation in specific sectors. The Estonian Forestry Development Programme until 2020, for example, promotes forest productivity, reforestation, protection and diversity of forest species (Statistics Estonia, 2015). These documents also make biodiversity protection an important factor in strategic and environmental impact assessment (Chapter 2).

5.3. Water resources

Water use

Estonia is a country with a medium level of water stress, abstracting around 14% of the total available renewable freshwater in 2014. Gross freshwater abstraction has increased by 17% since 2000 and was around 1 310 m^3 per capita in 2014, one of the highest levels in the OECD (Annex 1.D). Overall, freshwater abstraction has shown relative decoupling from economic growth over 2000-14, increasing slower than GDP. As in other OECD member countries, cooling in electricity production represents the largest share of freshwater abstraction (85%), which in Estonia is favoured by low rates of abstraction taxes. Other sectors that abstract freshwater are public water supply (4%) and manufacturing industry (1%) (Figure 1.9).

Figure 1.9. **A medium-stressed water country, with most freshwater abstracted for power plant cooling**



Note: Production of electricity: up to 2001 data refer to total abstractions for electricity production (ISIC 35.1 Rev.4). Since 2001, data refer to the NACE activity 40.1, which means that part of the cooling water is allocated to the "other" category. The category "other" may include aquaculture, mining and quarrying, construction, services and private households.
Source: OECD (2016), "Freshwater Abstractions", OECD *Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448390

Water management

Estonia's water policies and legislation stem from EU requirements,[13] which are transposed into national legislation through the Water Act and implementing regulations. The main strategic document on water management is the Estonian Environmental Strategy to 2030, which aims at improving the status of surface and groundwater bodies. Following the requirements of the Water Framework Directive, Estonia has put in place River Basin Management Plans (RBMPs) for the three river basin districts, two of which are international. The RBMPs of the first cycle were adopted in 2010, with revisions planned every six years. They contain provisions for regulating agricultural production, wastewater collection and treatment, and water use. Moreover, the plans envisage infrastructure development such as the construction of wastewater treatment plans, sewerage systems and water distribution networks. RBMPs of the second cycle were adopted in January 2016.

In addition to water management plans, local authorities establish public water supply and sewerage management plans at the municipal level. These plans must be consistent with RBMPs and revised every four years. In areas vulnerable to diffuse pollution from agriculture, a nitrate pollution reduction action plan foresees specific measures to limit nitrate pollution of groundwater.

Two of the three river basin districts, East Estonia and Koiva, are international, but no comprehensive transboundary water management plans are in place. Concerning surface waters, a joint transboundary monitoring programme between Estonia and Russia was established in 2011 for the East Estonia river basin and regularly reviewed ever since. The current programme, which runs until 2018, will be used to evaluate the status of surface waters. Co-ordinated monitoring activities for transboundary groundwater aquifers are lacking (EC, 2012).

Estonia is party to the Helsinki Commission (HELCOM) for the protection of the marine environment in the Baltic Sea area. The government approved a 2008-11 implementation programme of the Baltic Sea Action Plan, which was renewed until 2015. Since 2016, the action plan is implemented within the framework of Estonia's Marine Strategy to 2020. The government is engaged in international co-operation with other Baltic countries in the areas of eutrophication, hazardous substances and marine biodiversity.

Water quality

Since 2000, water pollution has decreased significantly; in 2009, the majority of freshwater bodies registered good status. According to Estonia's first cycle of RBMPs, around 70% of surface water bodies had good ecological and chemical status. Groundwater quality is also good, with more than 90% of bodies having good chemical and quantitative status (EC, 2012). The only groundwater body in poor status is the aquifer in the East-Viru oil shale basin in eastern Estonia: oil shale mining causes water drainage (due to pumping water from the ground to prevent mine flooding) and pollution (due to infiltration from ash fields and contaminated semi-coke landfills). According to the second cycle of RBMPs, 62% of surface water bodies and 79% of groundwater bodies had good status. The deterioration of the status of water bodies was a result of improved assessment methodologies and additional monitoring data. The relatively good status of water quality in Estonia shows the country's commitment to Sustainable Development Goal 6 "Clean Water and Sanitation".

The most significant pressures in all river basin districts come from non-point source pollution from agriculture. The European Commission conducted an inquiry on water pollution from nitrates in Estonia and urged the country to enforce tighter rules on fertilisers to comply with EU law in this area (EC, 2016). As a result, Estonia introduced more stringent conditions for fertilisers in its regulation on water protection requirements.

Point sources such as industrial plants, wastewater treatment facilities and landfills also discharge pollutants into the water (ESTEA, 2014b). However, according to the 2012 Estonian report under the Water Framework Directive, it is not clear from the first RBMPs how pressures on water bodies were identified and measured (EC, 2012). The fourth implementation report of the Water Framework Directive shows that measures applied since 2012 have not been effective in tackling pressures from point and diffuse sources or from water abstraction and morphological alterations in surface and groundwater bodies (WRc, 2015). Revised RBMPs were approved in January 2016. Many planned measures are voluntary, which makes it particularly difficult to put them into practice in the farming community – a major source of diffuse water pollution.

Almost all coastal waters are failing to achieve good status. This is a particular concern since half of all bathing waters in Estonia are on the coast. Coastal waters represent around

16% of the total area of water bodies. They are affected by eutrophication due to nutrient loads from diffuse and point sources. Nonetheless, in 2014, the quality of more than 80% of coastal bathing waters (compared to over 90% of inland bathing waters) met at least sufficient[14] water quality standards; bathing water quality in Estonia, however, could still be improved (EEA, 2014d). In addition to national measures, this would require more concerted actions among the countries bordering the Baltic Sea.

Water supply and sanitation

Groundwater is the main source of drinking water. Surface water is used for water supply in Tallinn and Narva (ESTEA, 2014b). Public water supply decreased by 14% between 2000 and 2014, accounting for only about 4% of total freshwater abstraction in 2014.

The share of the population connected to public wastewater treatment plants has increased by 13 percentage points since 2000. After reaching 82% in 2010, the share has remained stable. Around 80% of urban and industrial wastewater is treated using facilities with tertiary treatment, while the remainder goes through secondary treatment. Since 2000, the government has invested extensively in wastewater treatment facilities and public water supply and sanitation. It has drawn primarily on EU funds and, to a lesser extent, on revenues from pollution and resource taxes.

A share of the population still does not have access to drinking water of acceptable quality; challenges also persist with the quality of wastewater treatment, which is sometimes inferior to EU requirements (NAO, 2013). One of the main challenges is the discharge of hazardous substances into the public sewer, as municipal wastewater treatment facilities do not have adequate technologies to treat them. In addition, industrial pre-treatment standards do not cover all discharged hazardous pollutants (Chapter 2). There are no reliable data on hazardous substances reaching water bodies with storm water and agricultural runoff.

Recommendations on climate change, air pollution, biodiversity and water management

Climate change

- Develop and implement specific climate change mitigation measures to achieve GHG reduction goals for 2030 and 2050, consistent with the aims of EU climate policy and the UNFCCC Paris Agreement; identify the expected contribution of each sector to these measures; set intermediate targets to track progress towards the goals and adjust measures as necessary; adopt a climate change adaptation strategy; ensure adequate implementation and monitoring of the planned actions.
- Reduce the GHG emission intensity of the economy by taking advantage of Estonia's integration into European electricity markets, reducing the share of oil shale in the energy mix and encouraging the use of renewable energy sources and energy efficiency; promote cost-effective measures to reduce emissions in the non-ETS sectors, particularly by increasing the use of low-carbon energy in transport; continue efforts to further improve public transportation networks, including rail infrastructure.

Air quality

- Strengthen measures to reduce emissions of SO_x, NO_x and NH_3 from the industrial power generation sector, transport and agriculture, respectively; consider promoting more efficient residential space heating; raise awareness about the negative environmental impacts of waste burning in households.

Recommendations on climate change, air pollution, biodiversity and water management *(cont.)*

Biodiversity

- Promote better co-ordination in this field between the Ministries of the Environment, Rural Affairs and Finance to strengthen sustainable forest management; enhance the dissemination of knowledge on good forestry practices among private forest owners.

Water resources

- Address diffuse water pollution from agriculture and promote environmentally friendly farming practices with the use of EU funding and other sources of finance and through better inter-ministerial co-operation; develop and manage high-quality data on agricultural discharges; design and implement measures to reduce pollution of surface water and groundwater in the oil shale mining area.

Notes

1. This term is part of the OECD typology, based on the percentage of regional population living in rural or urban communities, which allows for meaningful comparisons among regions of the same type.
2. The gross final consumption of energy from renewable sources is calculated as the sum of a) gross final consumption of electricity from renewable energy sources; b) gross final consumption of energy from renewable sources for heating and cooling; and c) final consumption of energy from renewable sources in transport (Directive 2009/28/EC).
3. The following biofuels are exempt from excise duty: non-synthetic biodiesel, vegetable oils made from biomass and bioethanol made of agriculture products or plant products (MoE, 2013).
4. Non-ETS sectors include transport, agriculture, waste, buildings, fuel combustion in small installations, industrial processes and solvents.
5. Defined as the proportion of people living in areas with annual concentrations exceeding the WHO guideline value of 10 $\mu g/m^3$.
6. Exposure to $PM_{2.5}$ is measured as the number of deaths from ambient air pollution multiplied per the value of a statistical life (VSL), which is calculated as an aggregation of individuals' willingness to pay to secure a marginal reduction in the risk of premature death (OECD, 2014).
7. Deaths from ambient air pollution are calculated based on data from the Global Burden of Disease assessment (Brauer et al., 2016) and on OECD methodology (OECD, 2014).
8. Average PM_{10} concentrations are measured as an equivalent annual average rate of microgrammes per cubic metre [$\mu g/m^3$] of air.
9. While defined as charges by Estonian law, these instruments are referred to as taxes in accordance with the OECD definition.
10. Amounts treated reflect waste actually treated that year, and do not match amounts generated because of temporary storage.
11. Recycled municipal waste includes only recyclable MSW, i.e. paper, metal, plastic and glass.
12. In Estonia, these data refer to the intensity of the use of forest resources available for wood supply. Such resources represent over 80% of the total forest cover (Eurostat, 2016).
13. The main directives on water issues are the Water Framework Directive (WFD) (Directive 2000/60/EC), the Drinking Water Directive (Council Directive 98/83/EC), the Marine Strategy Framework Directive (2008/56/EC) and the Urban Wastewater Directive (Directive 91/271/EEC and Directive 98/15/EC).
14. The category "sufficient" is the minimum quality threshold that all EU Member States should attain by the end of 2015.

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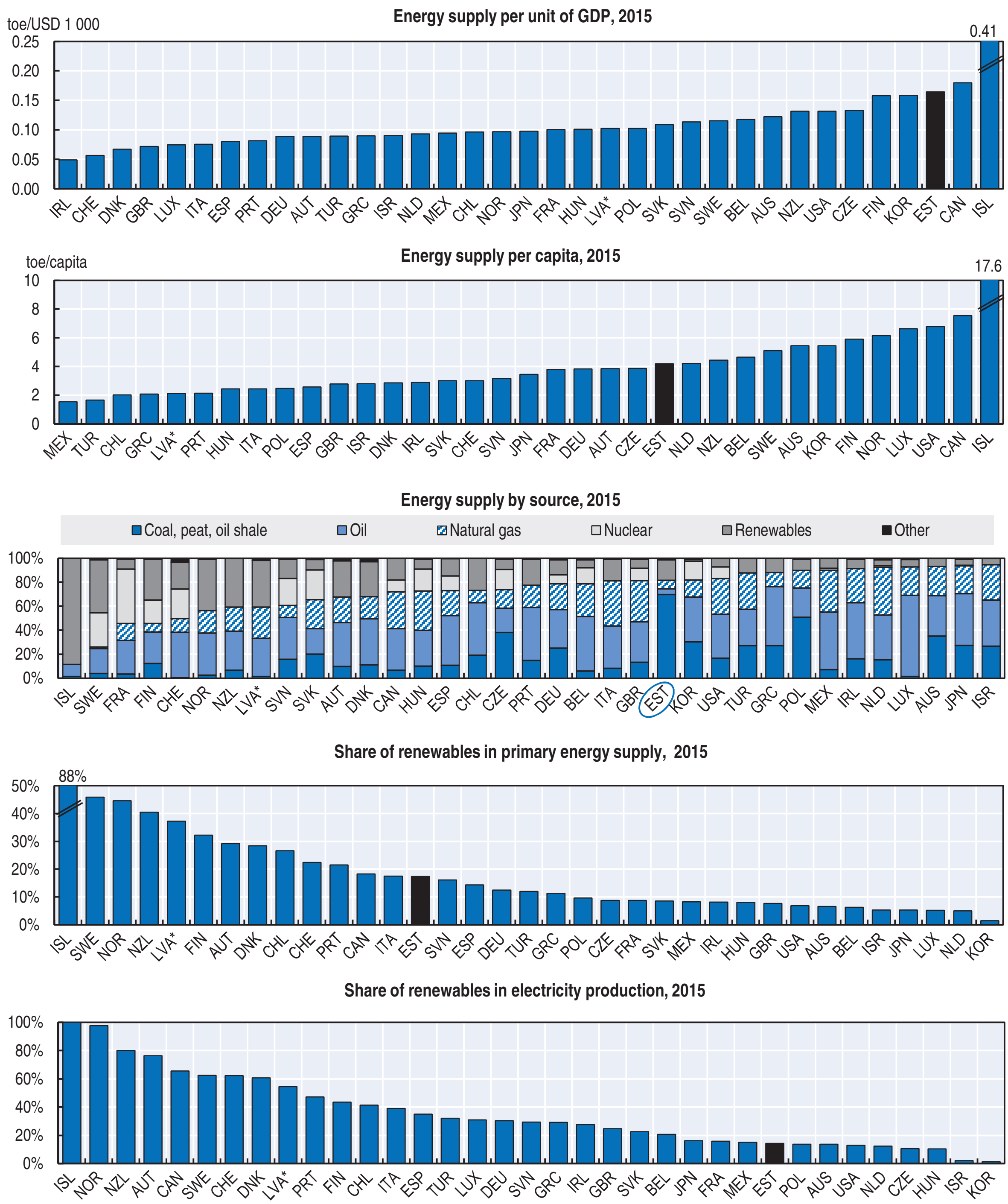
ANNEX 1.A

Energy and transportation data

Figure 1.A1. **Energy Structure and Intensity**



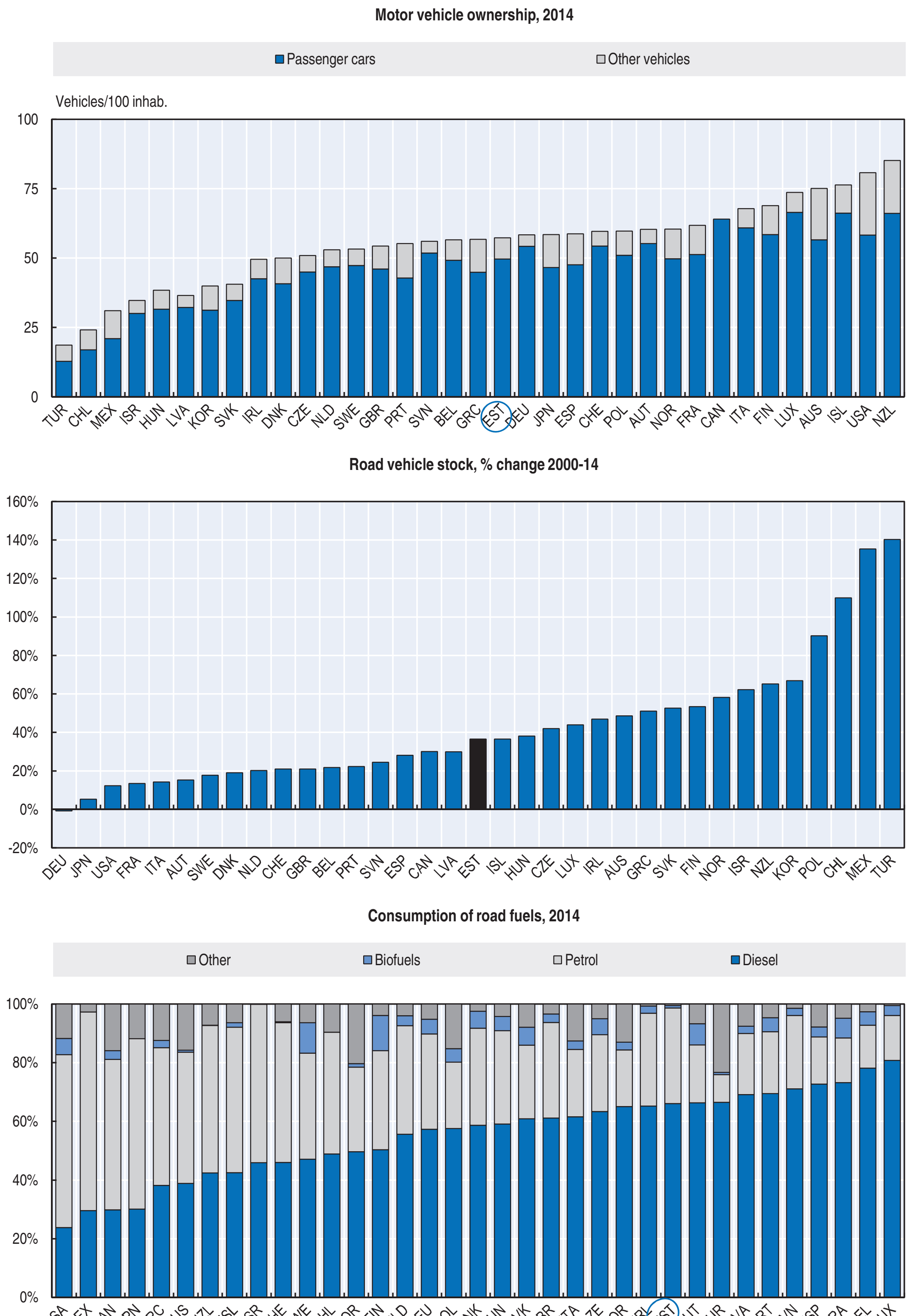
Notes: Data may include provisional figures and estimates. Total primary energy supply: the breakdown excludes electricity trade. GDP at 2010 prices and purchasing power parities.

* 2014 data.

Source: IEA (2016), IEA *World Energy Balances* (database); OECD (2016), "Labour Force Statistics: Population projections", *OECD Employment and Labour Market Statistics* (database); OECD (2016), *OECD National Accounts* (database).

StatLink http://dx.doi.org/10.1787/888933448408

Figure 1.A2. **Road transport**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Motor vehicles with four or more wheels. Motor vehicles totals may not include the exact same vehicle categories in different countries. CAN: data refer to total vehicles.

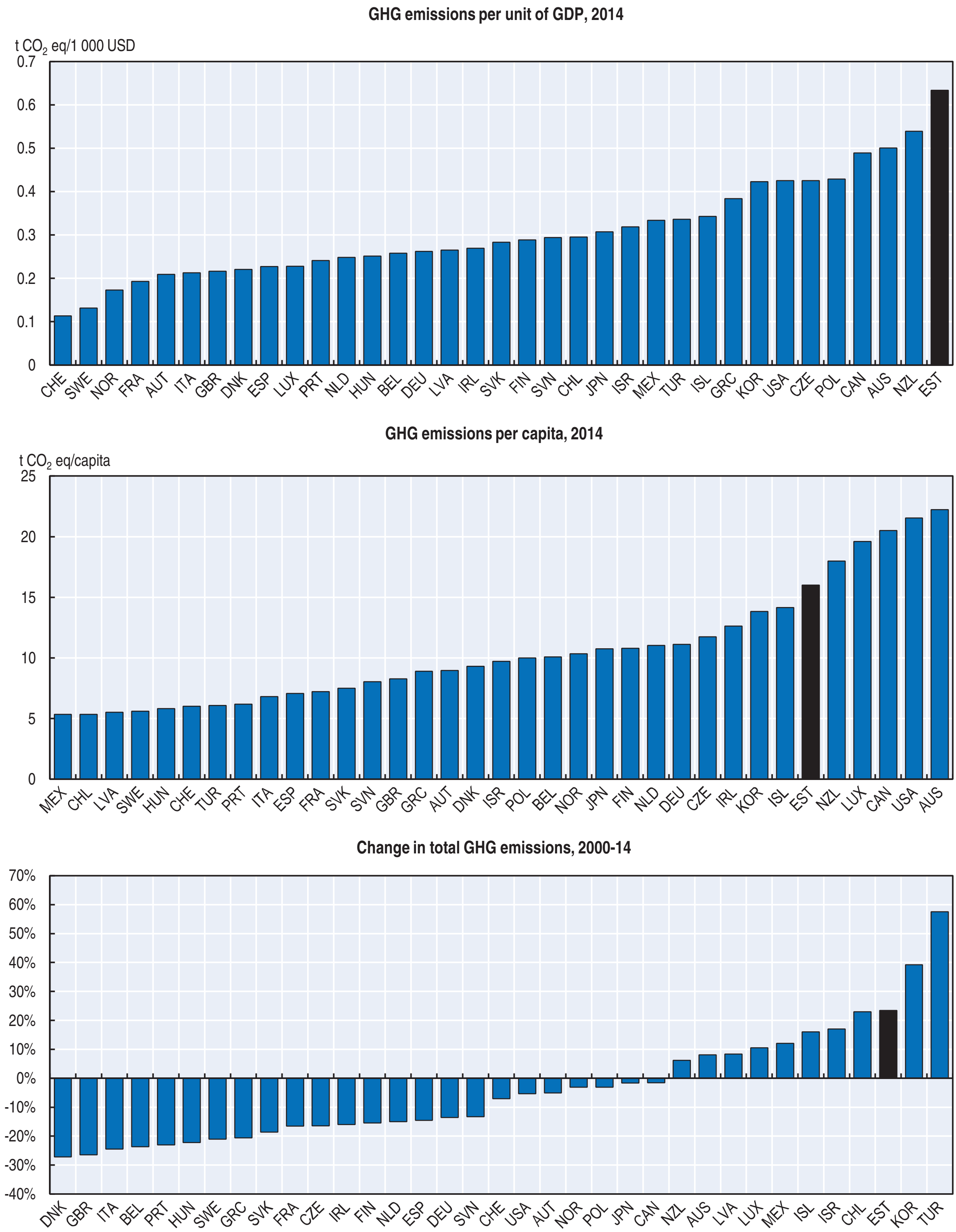
Source: EUROSTAT (2016) "Road Transport Equipment", *Transport* (database), IRF (2016); *World Road Statistics*; North American Transportation Statistics (2016), *NATS* (database); UNECE (2016), *UNECE Transport Division Database*; and national sources; IEA (2016), *IEA World Energy Statistics and Balances* (database).

StatLink http://dx.doi.org/10.1787/888933448415

ANNEX 1.B

Climate change and air pollution data

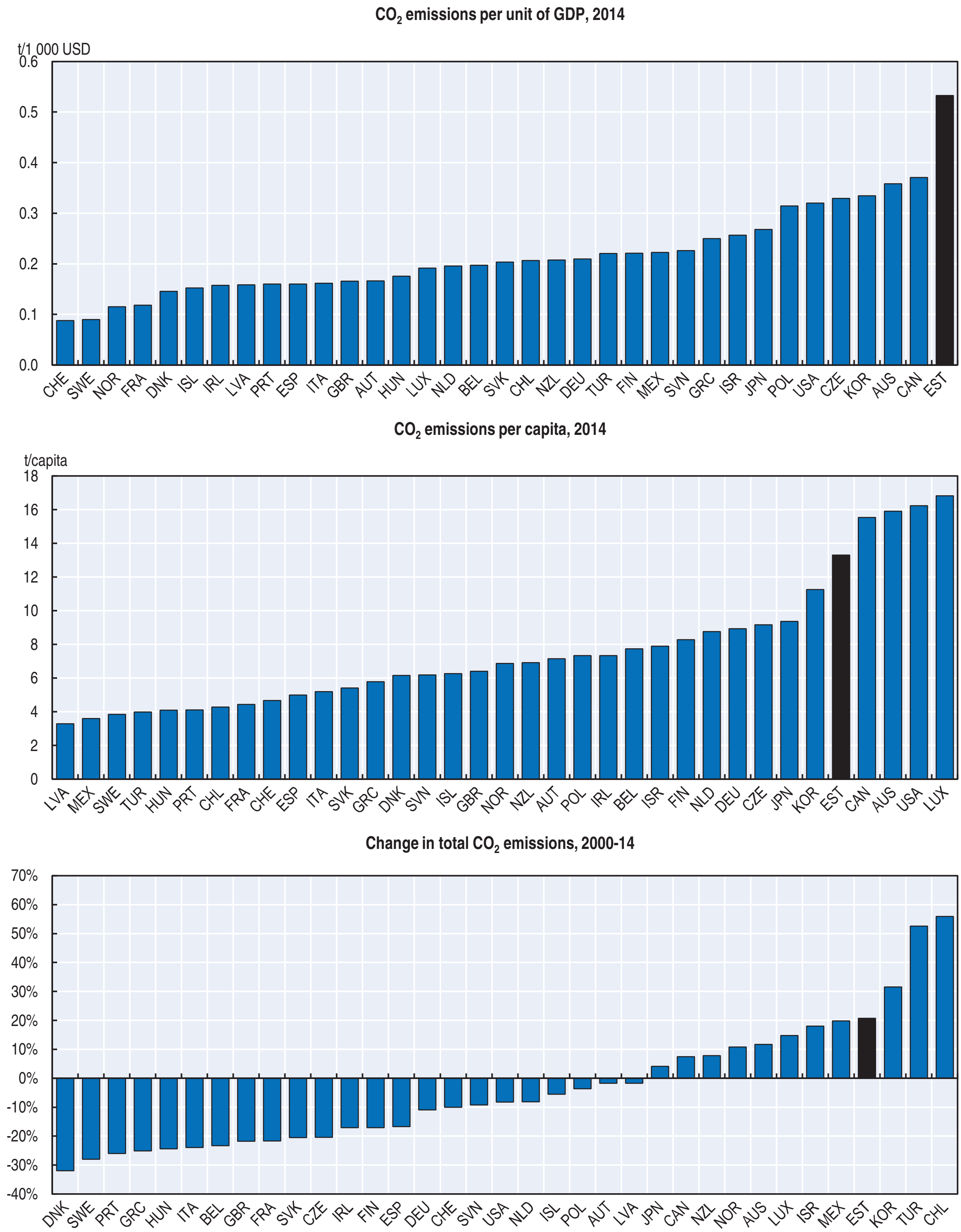
Figure 1.B1. **GHG emissions and intensity**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. GHG emissions excluding emissions/removals from land use, land-use change and forestry (LULUCF). Mexico: data include emissions or removals from land-use change and forestry (LUCF). GDP at 2010 prices and purchasing power parities.
Source: OECD (2016), "Greenhouse gas emissions by source", OECD *Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448422

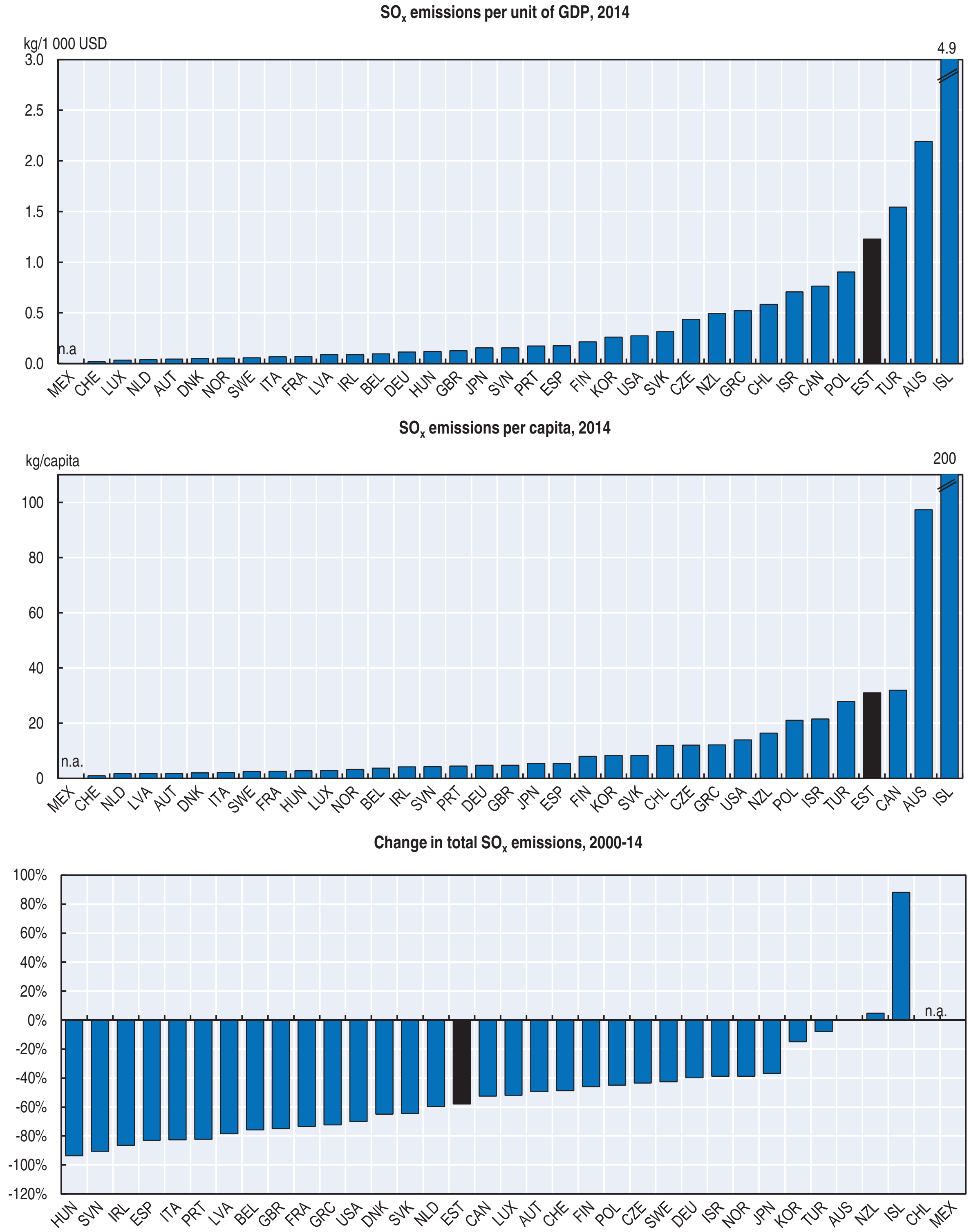
Figure 1.B2. **CO_2 emissions and intensity**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.
CO_2 emissions from energy use only; excluding international marine and aviation bunkers; sectoral approach. GDP at 2010 prices and purchasing power parities.
Source: IEA (2016), *IEA CO_2 Emissions from Fuel Combustion Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448433

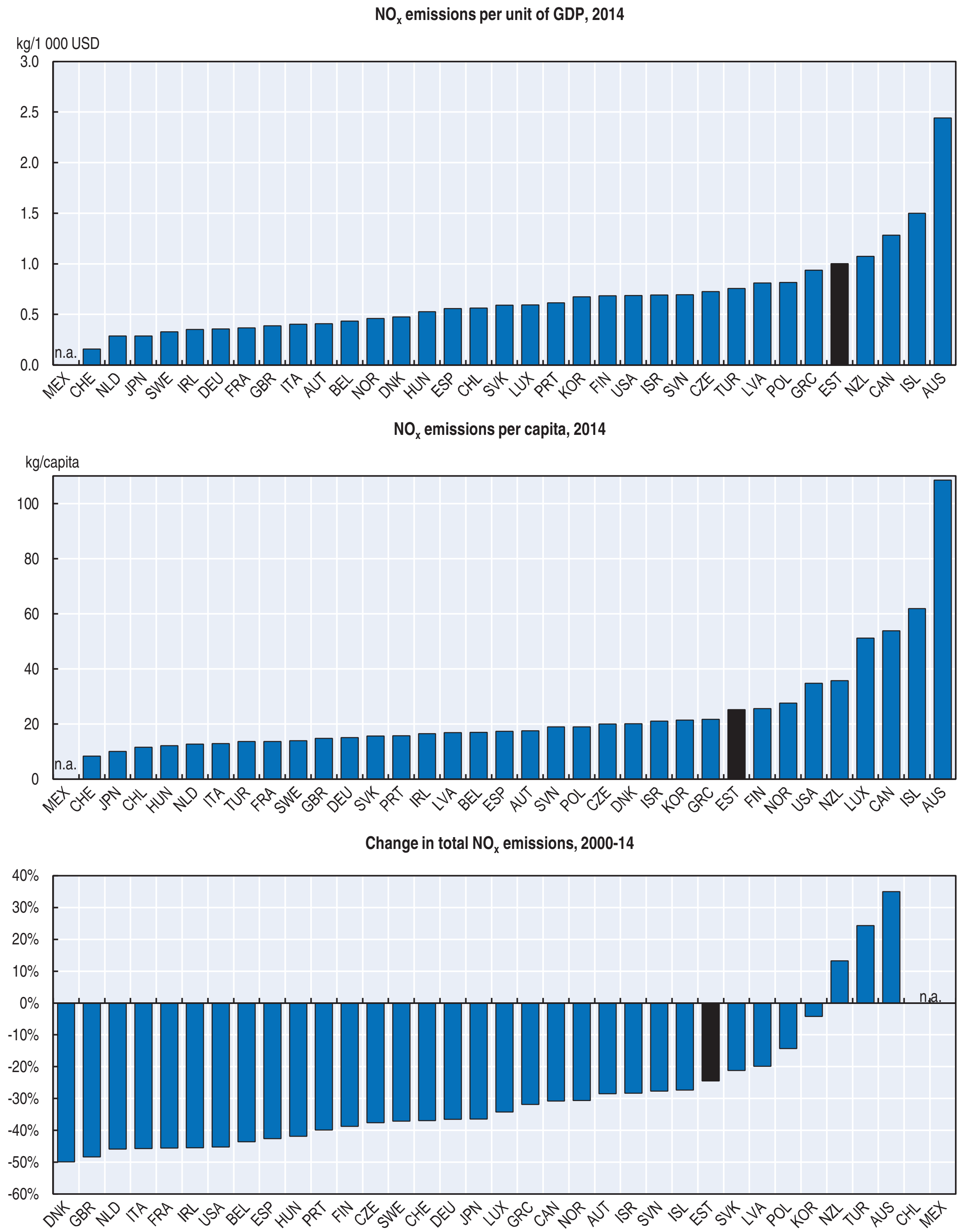
Figure 1.B3. **SOx emissions and intensity**



Source: OECD (2016), "Air emissions by source", OECD *Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448440

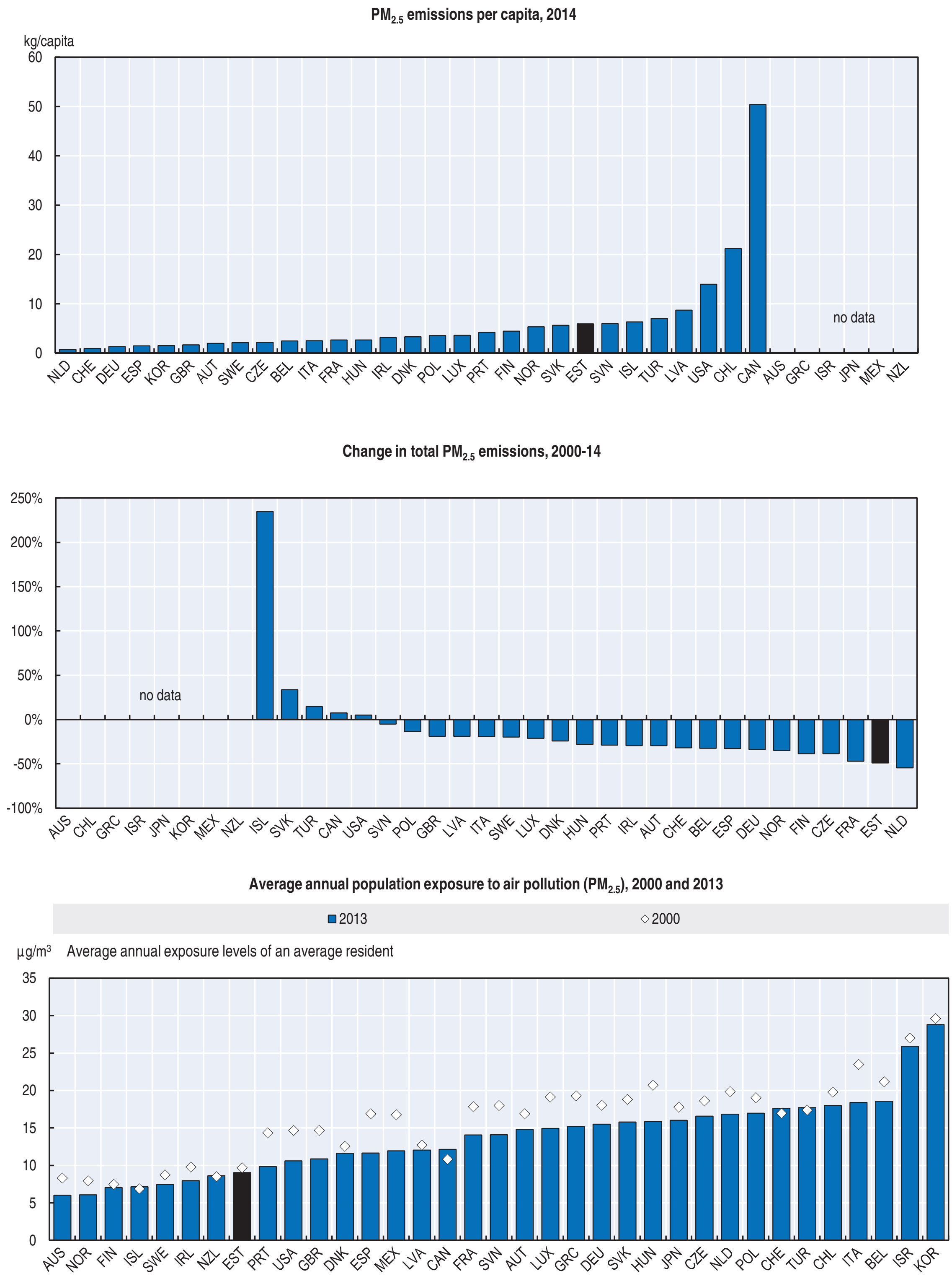
Figure 1.B4. **NOx emissions and intensity**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. GDP at 2010 prices and purchasing power parities.
Source: OECD (2016), "Air emissions by source", OECD *Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448450

Figure 1.B5. **$PM_{2.5}$ emissions and intensity**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Population exposure to air pollution: estimates based on satellite observations and chemical transport models, calibrated against ground-based measurements.

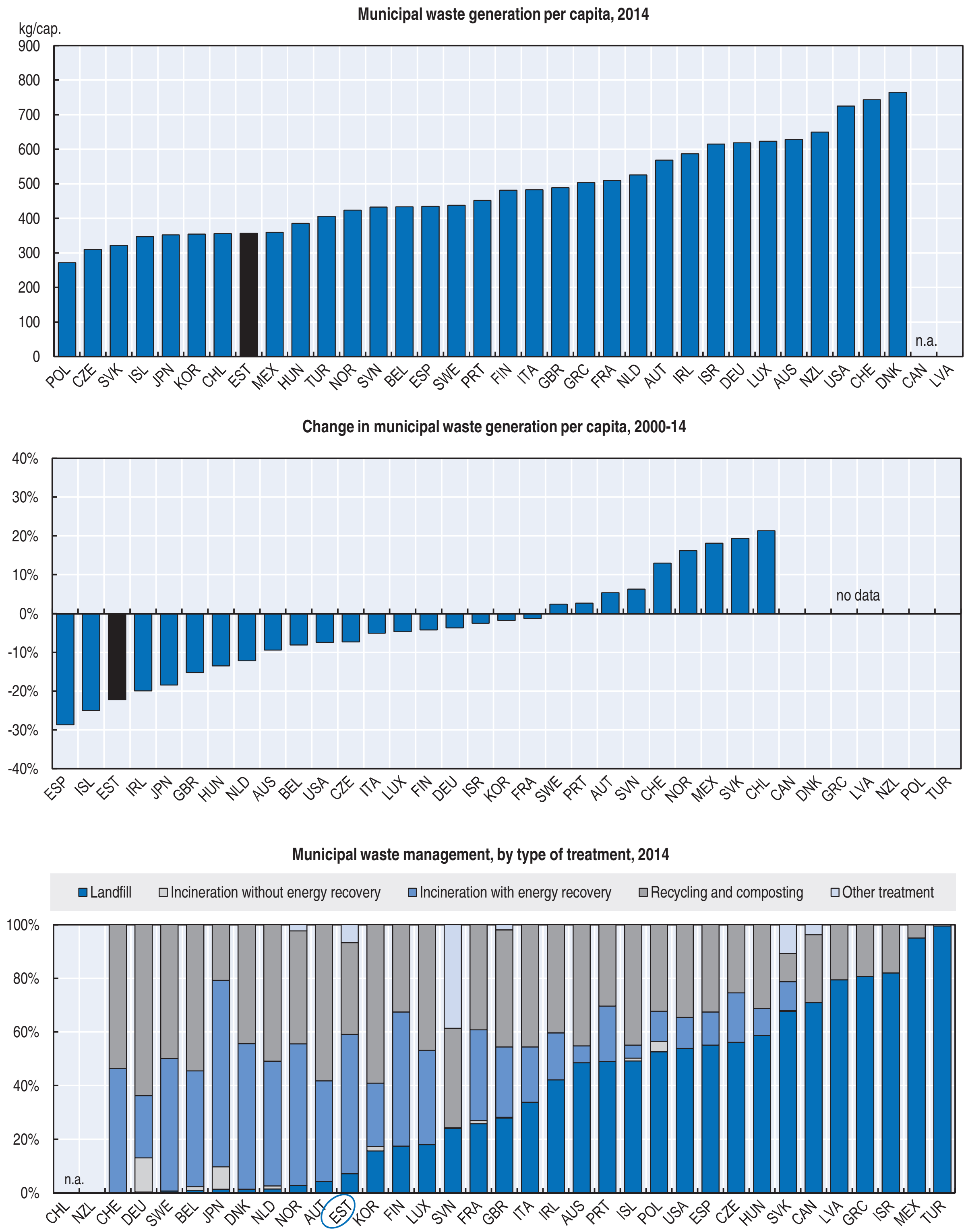
Source: OECD (2016), "Air emissions by source", OECD *Environment Statistics* (database); OECD (2016), "Exposure to air pollution", OECD *Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448468

ANNEX 1.C

Waste and resource management data

Figure 1.C1. **Waste generation and management**

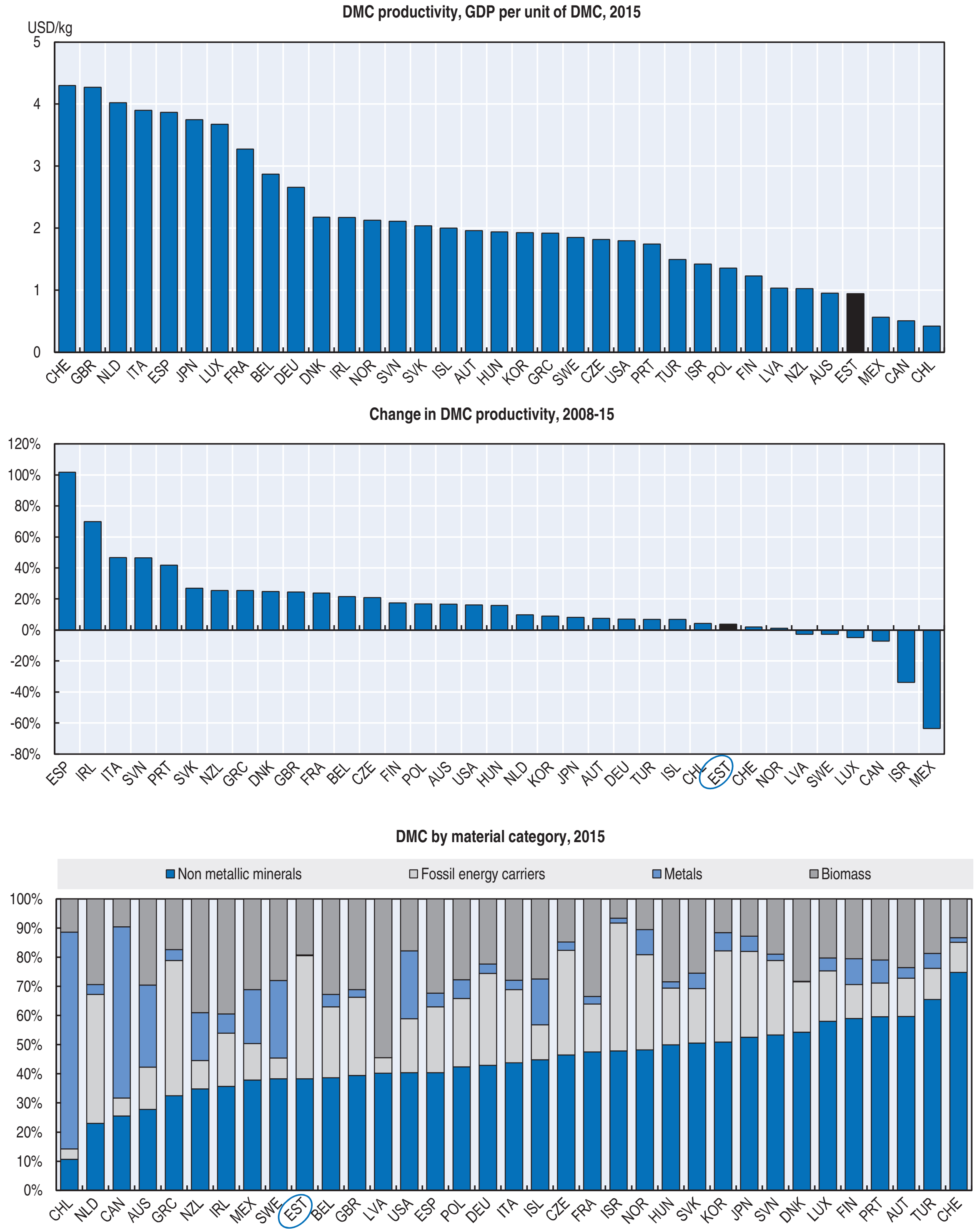


Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Household and similar waste collected by or for municipalities, originating mainly from households and small businesses. Includes bulky waste and separate collection. CAN: data include construction and demolition waste.

Source: OECD (2016), "Municipal waste", *OECD Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448476

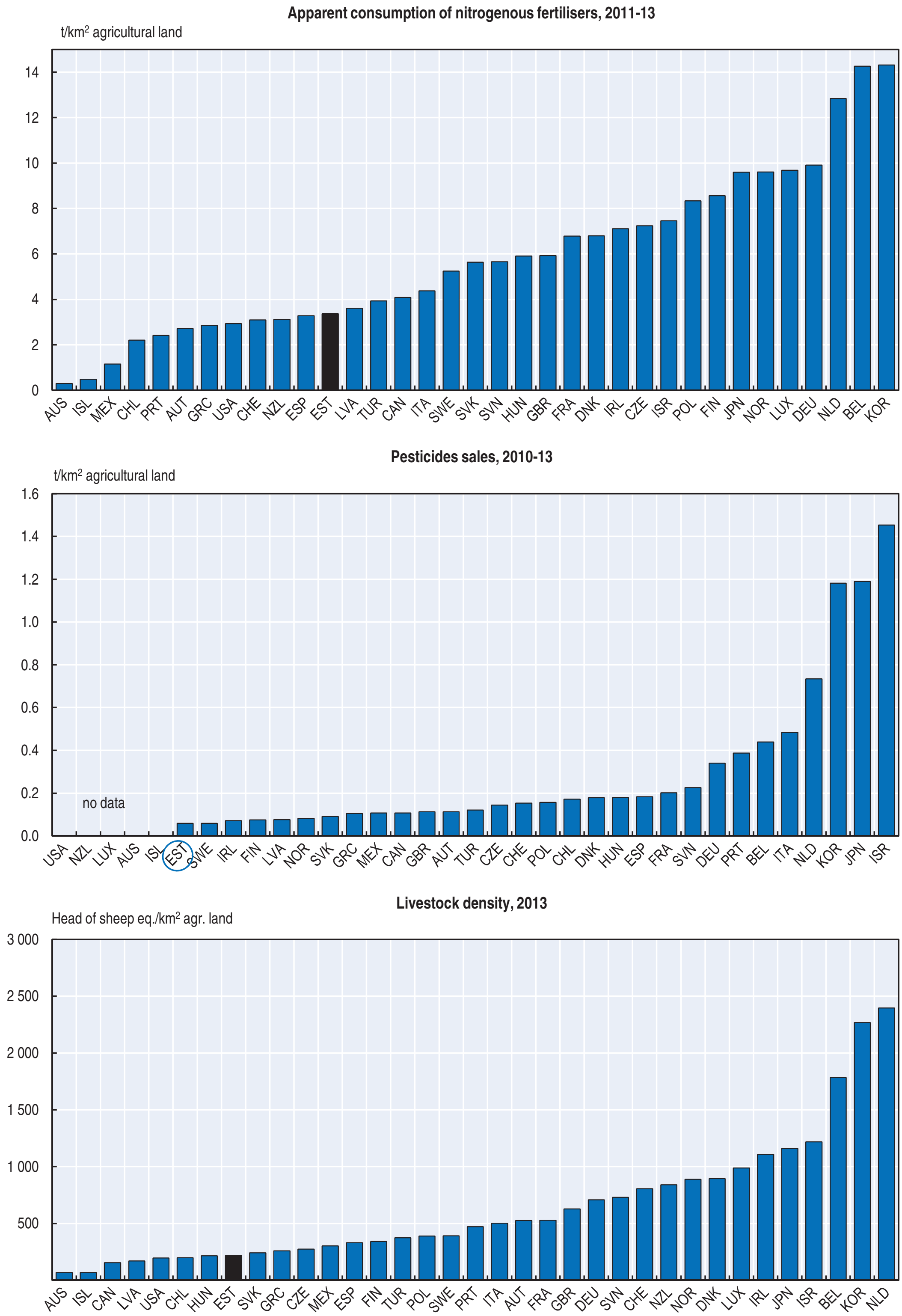
Figure 1.C2. **Domestic material consumption**



Notes: KOR: 2013 data for DMC productivity, 2010 data for DMC breakdown. Data refer to the indicated year or to the latest available year.They may include provisional figures and estimates. Domestic material consumption (DMC) equals the sum of domestic extraction of raw materials used by an economy and their physical trade balance (imports minus exports of raw materials and manufactured products). DMC productivity designates the amount of GDP generated per unit of materials used. GDP at 2010 prices and purchasing power parities. It should be born in mind that the data should be interpreted with caution and that the time series presented here may change in future as work on methodologies for Material Flow accounting progresses.
Source: OECD (2016), "Material Resources", OECD *Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448488

Figure 1.C3. **Agricultural inputs and livestock density**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Conversion coefficients used to convert livestock heads in sheep equivalent: 1 for sheep and goats, 6 for cattle and buffaloes, 4.8 for equines, 1 for pigs, and 0.06 for poultry birds.

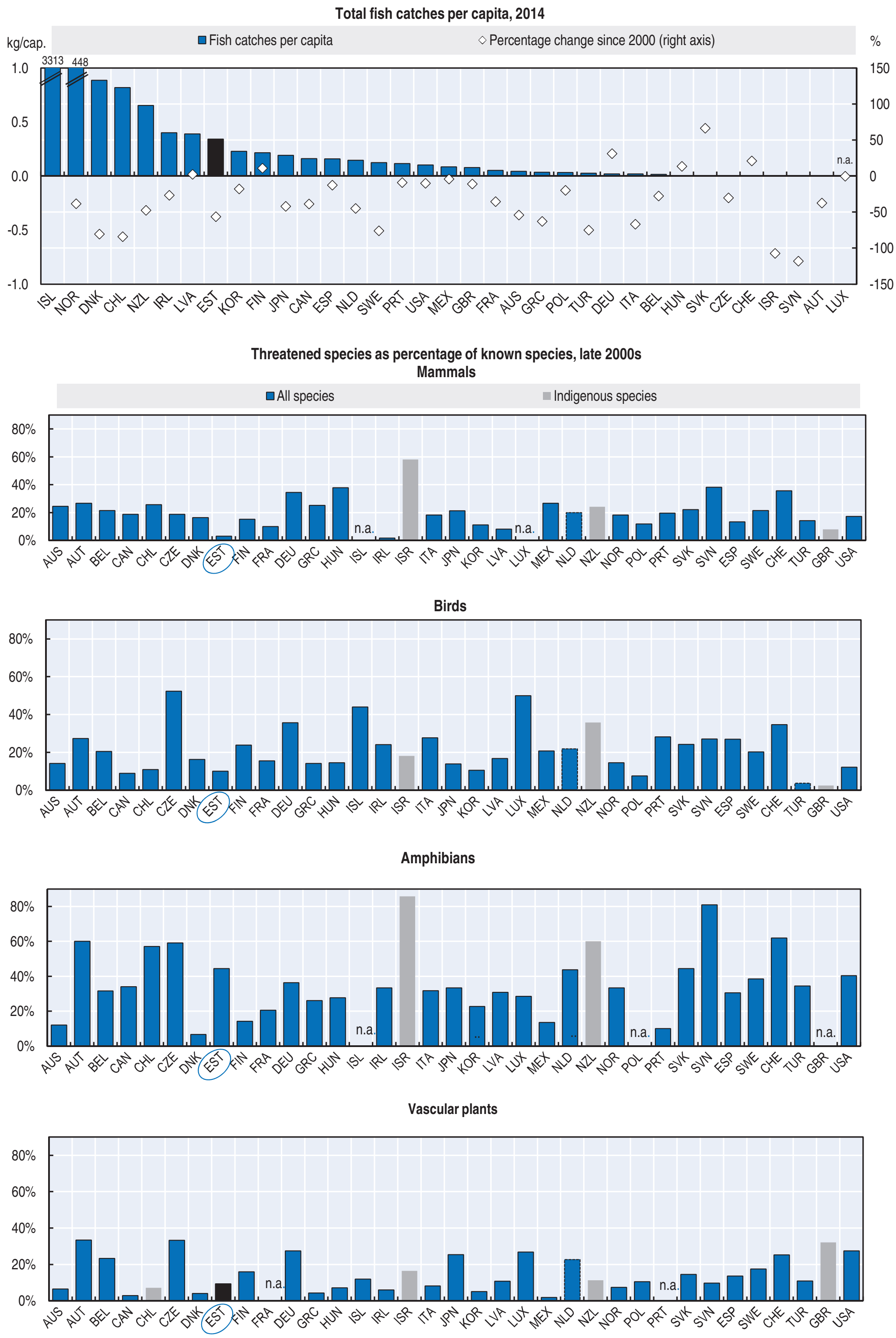
Source: FAO (2016), *FAOSTAT* (database); OECD (2016), *Environmental Performance of Agriculture* (database).

StatLink http://dx.doi.org/10.1787/888933448497

ANNEX 1.D

Biodiversity and water data

Figure 1.D1. **Fish catches and threatened species**

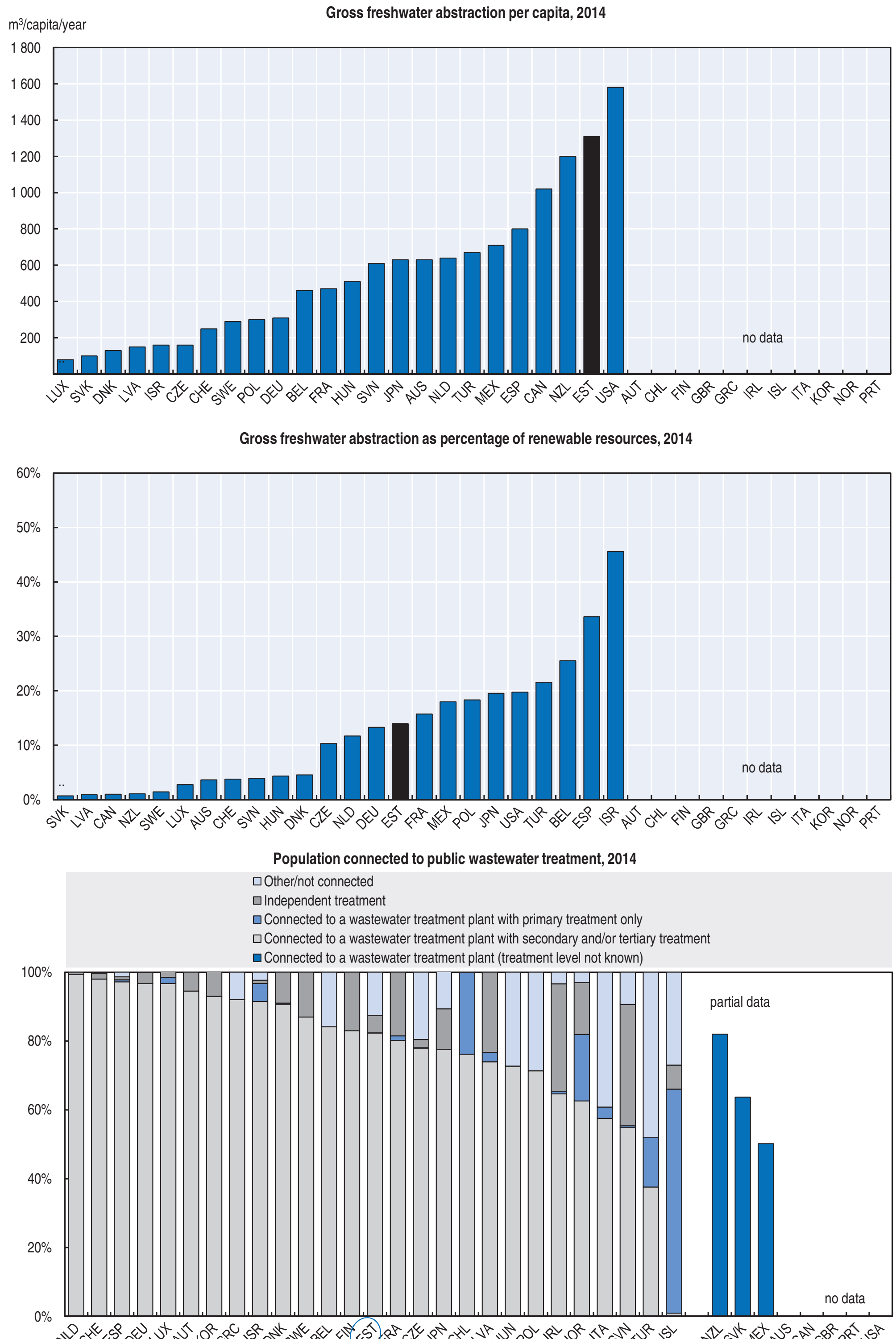


Notes: Fish data excludes aquaculture and whales, seals and other aquatic mammals, aquatic plants and other miscellaneous aquatic animal products. IUCN: categories critically endangered, endangered and vulnerable in percentage of known species. Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.

Source: FAO (2016), *FAOSTAT* (database); OECD (2016), "Threatened species", OECD *Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448508

Figure 1.D2. **Water abstraction and wastewater treatment**



Notes: Data refer to the indicated year or to the latest available year. They include provisional figures and estimates. Freshwater abstraction: for some countries, data refer to water permits and not to actual abstractions. Wastewater treatment: "other" includes connected without treatment, not connected or independent treatment (where there is no data for independent treatment).

Source: OECD (2016), "Water: Freshwater Abstractions", OECD *Environment Statistics* (database); OECD (2016), "Water: Wastewater treatment", OECD *Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448515

PART I

Chapter 2

Environmental governance and management

Estonia has made significant progress in upgrading its regulatory framework for environmental management and advancing environmental democracy. However, more needs to be done to improve the coherence of environmental requirements and ensure better compliance with them, as well as to build human and technical capacity at the local level. This chapter analyses Estonia's environmental governance system. It reviews the regulatory framework for environmental impact assessment and permitting, as well as compliance assurance instruments. The chapter also assesses progress in promoting public participation in decision making and access to environmental information, education and justice.

1. Introduction

Estonia has come a long way down the road of European integration, making its legal framework consistent with the European Union (EU) environmental *acquis*. Estonia's achievements in the field of environmental democracy can also be largely attributed to this process. However, the transposition of EU directives has required multiple and frequent changes in national legislation. This has imposed a considerable administrative burden on the regulated community and complicated business planning. Until recently, legislative reform had been piecemeal, which led to inconsistent and fragmented environmental requirements and procedures. These problems are being addressed through the codification of environmental legislation.

The upgrade of Estonia's legislative and regulatory framework was much needed, as many specific policy instruments (permitting, economic instruments, enforcement sanctions and the liability regime) remained rooted in the Soviet legacy. These practices are embedded both in the legislation (e.g. the Environmental Charges Act, liability provisions in issue-specific environmental laws) and in the operation of environmental authorities (e.g. guidance for evaluation of environmental damage). The key drawback of this legacy is its orientation towards raising revenue through different channels (pollution taxes and their penalty components, damage compensation mechanisms) rather than how effectively the respective instruments reduce pollution, remediate environmental damage or deter against violations. Estonia is gradually revising its approaches to follow best international practices, but this process is likely to continue for many more years.

2. Institutional framework for environmental governance

Estonia has a centralised system of environmental governance with national authorities responsible for all environmental management except local environmental services. The reorganisation back in 2000 of environment departments of county governments into regional offices of the Ministry of the Environment (MoE) reinforced this centralised model. Territorial reforms underway are expected to reduce the number of local jurisdictions.

2.1. National institutions and horizontal co-ordination

The MoE is responsible primarily for environmental policy and legislative development, land management, natural resource accounting and protection, compliance monitoring and enforcement, and ambient environmental monitoring. Institutions under the auspices of the MoE include the Environmental Board, Environmental Inspectorate, Estonian Environment Agency (ESTEA), Estonian Land Board, State Forest Management Centre, Foundation Private Forest Centre, Estonian Environmental Research Centre and Geological Survey of Estonia.

The Environmental Board, which has six regional offices, is the main executive institution within the MoE's jurisdiction. It is responsible for permitting, environmental impact assessment, environmental liability regulations, environmental monitoring and administration of nature protection areas.

The Ministry of Economic Affairs and Communications also has important environment-related responsibilities, particularly for energy and transport (via the Road Administration). Economic development plans also often have considerable environmental implications. The Ministry of Social Affairs has responsibilities for chemical safety and health protection (covering, among others, regulation of drinking and bathing water quality). The Ministry of Rural Affairs deals with agriculture and fisheries. Finally, the Ministry of Finance, in addition to managing a major part of environmental tax revenues, has recently become the competent authority for land-use planning in the context of territorial reform (Section 2.2).

Estonia does not have a special body charged with horizontal environmental co-ordination. The Strategy Unit of the Government Office oversees sustainable development and green growth issues. An inter-ministerial working group at the deputy secretary-general level is in charge of integrating sustainable development considerations into sectoral development plans. However, this may not be enough to ensure effective policy co-ordination and coherent actions in several areas of environmental concern, such as land-use planning (Section 3.4).

2.2. Sub-national institutions and territorial reform

County governments liaise between the national and local governments. Estonia is divided into 15 counties, presided by a county governor, who is a direct representative of the central government at the regional and local levels. County governments monitor municipal services, control the performance of state functions assigned to local governments, advise municipalities and manage county-level land-use planning. However, their legal status is relatively weak because almost every final decision is taken at either the central or the local level. Over the years, in parallel to county governments, several sectoral ministries have created their own regional administrations. As a result, county government does not play a role in balancing sectoral interests at the sub-national level.

Municipalities have environmental responsibilities (including the issuance of local ordinances and ensuring compliance with them) with regard to drinking water supply, wastewater treatment and waste management, noise pollution and land-use planning. There are 213 municipalities in Estonia: 30 towns and 183 rural municipalities. Most of them are small, with a median population size of 1 745 residents. Over one-third of the population resides in Tallinn (427 000) and the main university city of Tartu (98 000).

Given their small size and low institutional capacity, municipalities within a county need to co-operate. Apart from 9 regional water utilities covering 73 municipalities, however, there is little collaboration between local governments. The Association of Estonian Cities and the Association of Rural Municipalities of Estonia are voluntary unions to represent common interests and promote co-operation of towns and rural municipalities, but their role in environmental issues is limited.

The national government has taken several actions to assist municipalities. The Environmental Investment Centre has helped the two associations of municipalities to organise training, while the Environmental Board has advised county governments on issues that can support municipalities. Local capacity, however, remains a concern.

The government is carrying out territorial reform to address the budgetary and human resources challenges faced by many local governments since the 2009 economic crisis and to improve efficiency of local public services. By 2018, voluntary mergers or – as a last resort – government-ordered consolidation will reduce the number of municipalities to fewer than 100.

3. Setting of regulatory requirements

The transposition of EU directives, which govern much of Estonia's environmental legislation, was conducted hastily and unsystematically, creating a considerable degree of regulatory inconsistency. Many transposition issues have been gradually rectified. In 2014, Estonia had only 2 environmental infringement procedures initiated against it (while the average across EU Member States was 12); until 2012, this number had consistently been over 10 in Estonia (EC, 2014b).

The process of codification of Estonia's environmental law, begun in 2007, continues to date. Its main purpose is to reduce fragmentation of environmental legislation, increase coherence and cut red tape for the regulated community. In 2011, Parliament adopted the General Part of the Environmental Code Act (ECA), which lays out the main environmental legal principles, rights and obligations, as well as a harmonised permitting procedure (Section 3.3). This General Part entered into force in August 2014; the Special Part of the ECA, consisting of streamlined issue-specific legislation, is close to completion. The amended Industrial Emissions Act, Atmospheric Air Protection Act, Environmental Impact Assessment and Environmental Management System Act, Forest Act, Fishing Act and Nature Protection Act, Environmental Monitoring Act and the Radiation Act have been adopted since 2013. The Earth's Crust Act is expected to be adopted in 2016. The government has not yet approved drafts of the Water Act and the Waste Act.

3.1. Regulatory impact analysis

Regulatory impact analysis (RIA) must be carried out when a draft law is prepared, using the assessment methodology approved by the government in 2012. Methods to identify the economic impact of different policy options include cost-benefit analysis, cost-effectiveness analysis, multi-criteria analysis and standard cost modelling. The RIA requirements are expected to be fully implemented by 2018. So far RIA has only covered EU transposition-related laws and regulations. None of the elements of the Environmental Code Act has undergone RIA, as it was not considered to be new legislation. RIA has been conducted mostly qualitatively (in the form of "explanatory notes" for different pieces of legislation); it has included budgetary projections, but not cost-benefit analysis.

In 2012, Estonia introduced *ex post* evaluation for all new major primary laws adopted, but none has yet been conducted due to the absence of an agreed methodology and lack of resources. Few OECD member countries have used *ex post* evaluation of regulations systematically. Where they occur, such evaluations tend to analyse the administrative burden and compliance costs rather than predicted and actual regulatory impacts.

3.2. Key regulatory requirements for economic activities

This section provides a brief overview of issue-specific requirements for environmental quality and pollution releases, as well as nature protection-related requirements for the siting and operation of economic activities. Waste management regulations are addressed in Chapter 4, and the regulatory framework for the mining industry (including the Earth's Crust Act) in Chapter 5.

Air quality and emission standards

The 2004 Ambient Air Protection Act, which transposes nearly all EU Air Directives, specifies 13 pollutants of primary importance in assessing and monitoring ambient air quality. These include sulphur dioxide, nitrogen dioxide, fine particulate matter and heavy metals. The MoE establishes ambient air quality standards for these pollutants. In areas where the level of air pollution exceeds these standards, the Environmental Board must prepare an action plan for reducing emissions of the problematic pollutant. In addition, local governments have a right to restrict the movement of motor vehicles in areas where air quality standards are likely to be exceeded due to unfavourable weather conditions. In practice, however, there has been no need to apply these measures.

Emission limit values (ELVs) for stationary pollution sources subject to an air pollution permit are calculated for each regulated pollutant so the amount emitted does not cause the exceedance of the respective ambient air quality standard. Such calculations are labour-intensive and costly; the resulting ELVs stimulate the use of end-of-pipe technologies rather than production process-oriented best available techniques (BAT). Only integrated environmental permits (Section 3.3) establish ELVs explicitly based on BAT.

With respect to mobile sources, the MoE sets ELVs for pollutant emissions for motor vehicles, aircraft, boats, etc. However, as these emission standards are difficult to enforce, they have been largely superseded by environmental requirements for liquid fuels based on respective provisions of EU law.

Water quality and effluent standards

The Water Act, the main law for the protection of water resources, has been amended more than 30 times since its adoption in 1994 (sometimes twice a year), mainly to accommodate the requirements of EU directives. These multiple amendments have led to a number of inconsistencies and overlaps across its provisions. At the same time, the regulatory framework for water quality protection is in line with good practices in other EU Member States.

Quality standards for surface water bodies and groundwater are consistent with the environmental objectives (corresponding to the "good status") of the EU Water Framework Directive (2000/60/EC). Less stringent water quality objectives can be set if three conditions are met: the achievement of "good status" objectives is unfeasible or disproportionately expensive; the highest possible biological and chemical quality is achieved; and no water quality deterioration is allowed. Surface water quality standards depend on the type of a particular water body, but not its designated use (except for special standards for water bodies used for the abstraction of drinking water).

Wastewater discharge standards are set for municipal wastewater treatment plants for five parameters (biochemical oxygen demand [BOD_7], chemical oxygen demand [COD], total phosphorus, total nitrogen and suspended solids) depending on the pollution load (expressed in terms of population equivalents). Other standards for municipal wastewater treatment plants (e.g. for hazardous substances) are uniform and do not depend on pollution load. For industrial discharges, effluent standards (laid out in a government regulation No. 99 of 2012) were elaborated based on recommendations under the Convention on the Protection of the Marine Environment of the Baltic Sea Area following the definition of BAT for specific industry sectors. However, the recommendations did not prescribe use of any technique or specific technology. These effluent standards can be made 30% more stringent if the receiving water body does not meet EU "good status" requirements. In Estonia, effluent limit values are not linked to surface water quality standards of the receiving water body. For industrial wastewater discharges into municipal sewerage systems, existing pre-treatment standards are outdated and do not cover many important hazardous substances (Lääne and Reisner, 2011).

Nature protection-related requirements

The Nature Conservation Act (2004) defines three types of protected areas: national parks, nature conservation areas and landscape conservation areas. In those areas, a consent from the Environmental Board (which administers protected areas) is required to develop a comprehensive or detailed spatial plan (Section 3.4) or to issue a building permit. Depending on the stringency of nature protection requirements, the act distinguishes strict nature reserves (all human activity prohibited), conservation zones (all economic activity prohibited) and limited management zones (exploitation of natural resources prohibited). The act also defines limited management zones and building exclusion zones along sea shores and banks of fresh water bodies.

There are no special types of protected area associated with Natura 2000 sites (protected under EU legislation). However, requirements for environmental impact assessment (EIA) and strategic environmental assessment (Section 3.3) with respect to potential impacts on a Natura 2000 site are significantly more onerous than for other areas. The proposed project or activity should be proven beyond doubt not to contravene the protection procedure of a Natura 2000 site. However, if the activity is judged to be vital for public interests and has no viable alternatives, a development consent may be issued or a strategic planning document adopted with government approval regardless of the potential significant negative effect.

3.3. Environmental impact assessment and permitting

The developer submits an application for development consent[1] to a competent authority (i.e. issuer of the development consent), which decides on the need for an EIA. EIA is mandatory if the proposed activity falls into the respective list of activities with significant environmental impact contained in the Environmental Impact Assessment and Environmental Management System Act (EIA & EMS Act). Otherwise, the competent authority decides based on criteria defined in the act.

Important amendments to the EIA & EMS Act went into effect on 1 July 2015. Prior to that date, the developer had to submit for approval an EIA programme and subsequent report to the MoE or the Environmental Board, which would specify environmental conditions to be taken into account in the development consent. As of July 2015, the leading role in the EIA approval process was transferred to the competent authority, which in cases of building permits is the municipal government. This decision creates a risk of inadequate evaluation of EIA reports due both to low technical capacity of local governments and the potential conflict between the environmental scrutiny of the competent authority and its economic and social interests.

The environmental permitting system includes integrated pollution prevention and control (IPPC) permits (in line with the EU Industrial Emissions Directive), issue-specific permits (for air and water pollution releases and waste management) and other environmental protection permits (for mining, hunting, fishing, logging, etc.). The Environmental Board issues all environmental permits except permits for marine and coastal zone activities and permits for extraction of mineral resources in deposits of state importance, which are granted by the MoE. The Environmental Board issues IPPC permits, permits for exploration and extraction of mineral resources, air pollution permits, special water use permits (for water abstraction over certain daily thresholds and wastewater discharges), waste generation and management permits, hazardous waste management licences, local mining permits and radiation permits.

In a lingering legacy of the Soviet period, environmental permitting requirements had long been scattered throughout several laws and regulations. The General Part of the ECA integrated the application and delivery process for issue-specific permits, but not their substance. A single application has to state all intended activities for which an environmental permit is required, and if these activities are spatially or technologically related, a single permit will be granted.

The application process (including public consultation) is handled entirely through the electronic environment permit information system. If the activity is subject to an EIA, the permit application process is suspended until the EIA report is approved. Information about environmental permits is published on the ESTEA and MoE websites.

However, some issue-specific permits are required for activities with relatively low environmental impact, creating an excessive administrative burden for small enterprises. For example, boilers with capacity of just 0.3 MW require an air pollution permit (Veinla and Relve, 2012). To further simplify the regulatory regime, Estonia may consider replacing tailor-made permits with sector-specific general binding rules for a range of activity sectors. This would follow the example of other OECD member countries (e.g. the United Kingdom and the Netherlands), as well as its neighbour Latvia.

3.4. Land-use planning and strategic environmental assessment

Spatial planning is regulated by the Planning Act whose new version entered into force on 1 July 2015. There are national (Ministry of Finance[2]), county-wide and local (comprehensive or detailed) spatial plans. For county, comprehensive and detailed plans, the size of covered territory is flexible. In principle, spatial plans at the higher level serve as the basis for those at the lower level. In many cases, county plans are adopted after the local plans within the county (e.g. new county spatial plans will come into force in 2017). Municipalities have the right to propose changes to county plans, which may also undermine consistency between different levels of land-use planning. Since 2015, county governors have larger oversight powers with respect to local plans.

The new Planning Act distinguishes clearly between terrestrial planning and maritime spatial planning; the latter has to be conducted at the national level. A methodology for maritime spatial planning, developed in 2015, has been tested in two pilot projects in Hiiu and Pärnu counties in the context of development of offshore windmill parks.

Local comprehensive and detailed plans may stipulate environmental requirements in addition to those contained in environmental laws and regulations. For example, a comprehensive plan may designate green areas and establish provisions for their protection and use; a detailed plan may identify buildings whose construction would require an EIA. An approved land-use plan is usually a prerequisite for environmental and building permits. At the same time, the legislation does not clearly indicate whether an environmental permit is needed before applying for a building permit; this has occasionally led to controversial decisions by local authorities. Most small municipalities lack adequate capacity for spatial planning, with one person often responsible for all planning and environmental issues.

Local spatial plans usually do not incorporate transport development and urban mobility issues. Municipalities generally consider these issues as beyond their jurisdiction, while the government believes that transportation policies should not be legally binding

(Eltis, 2015). The National Spatial Plan "Estonia 2030+" (MoI, 2013) and the National Transport Development Plan 2014-20 envisage developing sustainable urban mobility planning and mobility management. However, since mobility issues are not limited by municipal boundaries, it is uncertain whether they should be handled at the county level. At the same time, Tallinn, Tartu and Pärnu have been actively participating in a number of sustainable mobility projects. The Tartu Transport Development Plan 2012-20 is the official urban transport plan with the most sustainable mobility elements. Tallinn has made several attempts to have an integrated transport strategy, but none has gone through an official participatory process or been adopted by the city council.

The EIA & EMS Act regulates strategic environmental assessment (SEA), which is obligatory for all spatial plans, strategic development plans[3] and other government programmes and strategies in certain fields, such as forestry or waste management. To ensure better co-ordination between the EIA and SEA processes, local detailed spatial plans consisting of specific development projects are subject to EIA rather than SEA, which is consistent with good practices in other OECD member countries such as France. The authority responsible for the strategic planning document initiates SEA, and its report must be approved by either the Environmental Board or the MoE. However, the quality of SEA reports varies considerably, and in many cases they have little impact on planning decisions (Veinla and Relve, 2012).

4. Compliance assurance

Compliance assurance covers the promotion, monitoring and enforcement of compliance, as well as responsibility for environmental damage. As with environmental requirements, Estonia combines approaches and instruments inherited from its Soviet past with international best practices. This is particularly true in the fields of administrative sanctions and liability, where further reforms are needed to achieve greater coherence and effectiveness of policy implementation.

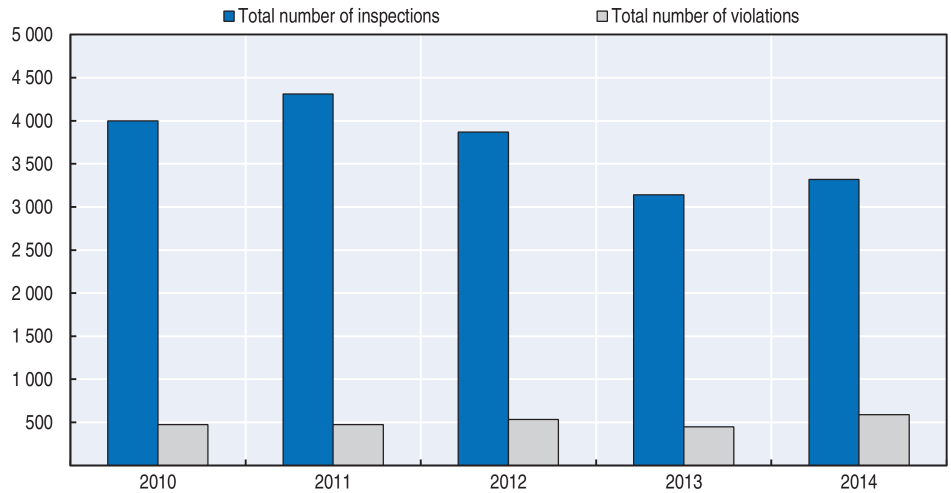
4.1. Environmental inspections

In accordance with the Environment Supervision Act (whose latest version entered into force in 2014), the Environmental Inspectorate (EI) monitors compliance in collaboration with other state institutions in several domains, including the Environmental Board, the Technical Regulatory Authority, and the Tax and Customs Board. Municipalities are responsible for local environment-related decisions (particularly on water supply, sanitation and waste management), but rarely have sufficient capacity to monitor compliance. At the same time, the EI has inspection powers over environment-related functions of local governments.

The principal areas of the EI's activity are environmental protection, nature conservation and fish protection. Over 60% of infringements in the area of environmental protection are related to waste. For example, illegal dumping of waste continues to be a problem (ESTEA, 2014). Between 2010 and 2014, the number of detected environmental offences increased by 25% (Figure 2.1). Over the same period, the number of conducted inspections decreased slightly, which may point to better targeting of inspections and, as a consequence, a higher detection rate.

Compliance monitoring follows a risk-based planning approach with respect to installations subject to IPPC permits, using an electronic tool developed within the EU Network for the Implementation and Enforcement of Environmental Law (IMPEL). However,

Figure 2.1. **More violations detected with fewer inspections**



Source: Country submission.

StatLink http://dx.doi.org/10.1787/888933448529

the average share of planned inspections, about 55% for 2010-14, can be considered low compared with best practices in OECD member countries. This indicates that compliance monitoring is largely reactive. To increase its effectiveness, the risk-based approach should also be used for other regulatory regimes, where inspection planning is less formal.

4.2. Enforcement tools

Administrative enforcement tools include penalty payments (preceded by a written warning and imposed if corrective measures prescribed in the warning have been ignored) and substitutive enforcement (having a third party execute the corrective measures at the expense of the offender). Misdemeanours are punished by fines, whose upper limit was increased in 2015 to EUR 400 000 per offence for legal entities. However, in practice these fines are quite low: in 2014, the average fine was just EUR 248 per offence. While this was the highest average figure since 2010, it is likely still too low to deter future offences.

A higher rate of pollution taxes (Chapter 3) is charged for exceeding emission/effluent limit values or limits for the use of natural resources specified in a respective environmental permit, or operating without such permit. This could be from 5 to 100 times the basic rate depending on the hazardousness of activity or substance emitted. In another legacy of the Soviet era, these punitive taxes play the role of fines (the revenue, albeit going to the state budget, is earmarked for environmental purposes). The operator can substitute payments by spending an equal amount of money on qualified environmental measures. As in several other countries of Eastern Europe, Caucasus and Central Asia, this system runs contrary to the polluter pays principle since, essentially, it allows operators to write off non-compliance penalties in exchange for expenditures that they should bear in full.[4] Estonia should consider replacing this system with administrative fines that would remove the operator's economic benefit from non-compliance in accordance with best practice implemented by the US Environmental Protection Agency for over 30 years.

The EI also carries out pre-trial criminal investigations of environmental violations under the supervision of a prosecutor. Criminal offences (entailing "significant or major damage") are punished by a financial penalty for both physical and legal persons (expressed in daily rates based on the average daily income of the convicted offender) or imprisonment. The EI has developed internal guidance on identifying criminal offences. However, the failure to obtain an environmental permit is also considered a criminal offence, which is excessive in most cases. A clear policy is needed on applying administrative and criminal sanctions that are proportionate to the seriousness of non-compliance.

4.3. Environmental liability

Liability for damage to the environment

There are two parallel environmental liability regimes in Estonia: the older national regime and the regime resulting from the transposition of the EU Environmental Liability Directive (ELD, 2004/35/EC) into Estonian legislation through the 2007 Environmental Liability Act. The act did not integrate the fragmented provisions of the prior regimes, which are scattered across issue-specific environmental laws such as the Water Act, the Waste Act and the Forest Act. Rather, its sole purpose was literal compliance with the EU legislation (Veinla and Relve, 2012).

The ELD regime covers only damage to water, land and biodiversity. As the competent authority under the Environmental Liability Act, the Environmental Board must prove a causal link between the activity and the damage except for a list of hazardous activities, including those requiring an integrated permit or waste management licence, or that are related to dangerous chemicals. However, the law exempts the responsible person from bearing the costs of remedial actions if, at the time damage occurred, the person was in compliance with applicable permits and licences.

The Environmental Board determines the extent of the damage and approves the remediation plan. A person who is or may be affected by environmental damage, or an environmental non-governmental organisation (NGO), may request that the Environmental Board impose preventive or remedial action on the responsible party, but this provision is not applied in practice. Overall, the ELD regime has been rarely implemented, partly because in most cases it does not allow the competent government authority to impose remediation costs on the responsible party (Justice and Environment, 2012).

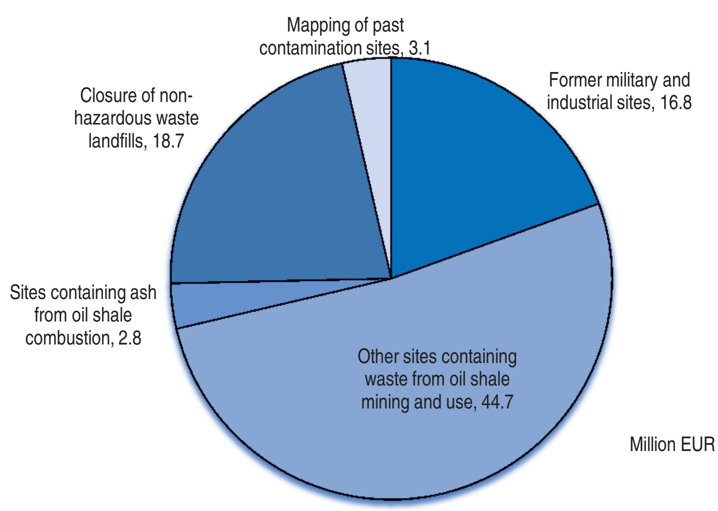
The issue-specific liability regimes have a broader combined coverage. Generally, however (with the notable exception of mandatory land restoration after mining activities stipulated in the Earth's Crust Act), they mandate monetary compensation from the responsible party to the state rather than environmental remediation. These liability regimes are fault-based, with a person liable only for deliberate or negligent actions. In most cases, the competent authority is the Environmental Inspectorate, which calculates and collects compensation for environmental damage. These amounts, however, are based on fixed rates or formulas and do not reflect the real damage to the environment. Moreover, revenue is earmarked for environmental projects, and not specifically for remediation. The Water Act and the Waste Act require the offender to clean up the damage at its own cost, but the respective provisions are ambiguous and rarely applied in practice. At the same time, the provisions may require compensation in situations with no real environmental damage (such as exceeding limit values for emissions of non-toxic air pollutants).

Contaminated sites

Neither the ELD liability nor the issue-specific liability regimes cover past contamination, which makes it difficult to assign responsibility for rehabilitation of old mining sites (Chapter 5). The remediation of abandoned sites with residual land and water contamination, most of it stemming from Soviet-era activities, also presents a significant challenge. Estonia has identified 70 former military and industrial areas as priority contaminated sites. These include old Soviet military bases, where soil polluted by fuel spills is the most important remaining type of contamination. Another major category is that of mining areas, mainly abandoned open-cast mines and peatlands damaged by mining. The most prominent site for clean-up is a hill containing high levels of oil shale and pyrite, parts of which have occasionally self-ignited. Other sites include now-closed factories for wood treatment and phosphorus fertilisers. As past owners of these sites are not identifiable, current land owners, the state and local governments share obligation for remediation.

Since the 1990s, Estonia has devoted significant resources to the clean-up of contaminated sites. In total, Estonia has allocated EUR 86.5 million from the 2007-13 and 2014-20 programming periods for clean-up work (Figure 2.2). In addition to money from the EU Cohesion Fund, EUR 5.5 million of revenues of environmental taxes was channelled through the Environmental Investment Centre. Old industrial and municipal landfills have been largely remediated. Estonia's Operational Programme for 2007-13 set a goal to clean up 53 sites by 2015, mostly using EU structural funds. By the end of 2014, only 46 sites had been cleaned up (Living Environment, 2015). In early 2016, Estonia's government estimated that clean-up of the biggest abandoned oil shale-contaminated site would cost approximately EUR 7 million. In addition, rivers and wetlands downstream from former mining areas have sediments containing phenol and other pollutants.

Figure 2.2. **Significant funds allocated for clean-up of contaminated sites**



Source: Country submission.

StatLink http://dx.doi.org/10.1787/888933448531

Many lower-priority contaminated areas still require attention. These include asphalt and tar residues, fuel and oil waste, waste paint and metal scrap, which pose a lower health hazard, but are a significant public nuisance. In recent years, the government started compiling an inventory of abandoned quarries of natural construction minerals and planning further restoration actions.

The Estonian Environmental Strategy (MoE, 2007) sets an objective to eliminate abandoned hazardous sites by 2030. In addition to the MoE, the National Audit Office regularly monitors the progress of clean-up activities, which shows the priority the government assigns to this issue. Over EUR 3 million is allocated to the mapping of contaminated sites (Figure 2.2), and their identification and clean-up is expected to continue for some years. Achieving the 2030 target will require sustained government funding.

4.4. *Promotion of compliance and green practices*

Government promotion of compliance can reduce costs for businesses by allowing them to achieve and maintain compliance as efficiently as possible. It may also reduce regulatory costs by increasing the efficiency of compliance monitoring and enforcement. Compliance promotion is particularly effective when targeted at small and medium-sized enterprises.

Compliance promotion

The Environmental Inspectorate has only recently started to give compliance promotion the attention it deserves. It recently conducted a number of information campaigns in selected activity sectors with acute environmental issues (through mass mailings and county-level meetings with sector representatives) before launching sector-wide inspections. One such campaign targeted waste oil handling in car repair shops (Box 2.1).

Box 2.1. Compliance promotion campaign in car repair shops

The 2013-14 compliance promotion campaign was triggered by concern expressed by the Association of Car Dealers and Service Providers (AMTEL) about a significant number of repair shops not turning over all the waste oil they produce to waste management companies. The Environmental Research Centre corroborated this complaint, reporting that up to half of repair shops' waste oil was not reaching the legal waste management system.

The Environmental Inspectorate (EI) verified this information and drew up a preliminary selection of potentially problematic repair shops. An information letter was sent to each of these repair shops reminding them about their legal obligations for waste management. In addition, the Environmental Board, Estonian Waste Management Association and AMTEL jointly organised an "Information Day", accompanied by a press release. More than half of the 100 operators invited took part in the event. Over the next several months, the EI monitored, based on waste management companies' data, possible changes in the repair shop operators' behaviour.

At the end of this "grace period", the EI and the police undertook a massive campaign over two months to inspect 105 repair shops. Follow-up inspections were carried out in non-compliant establishments.

Source: Country submission.

Corporate social responsibility

Voluntary agreements related to environmental issues have been in use since 1999. The agreements are bilateral – between one firm (or a business association) and the MoE. So far, 11 such agreements have been signed, including those with the Estonian Water Works Association, the Fishermen's Association, the Forestry and Wood Industries Association, the Mining Companies Association, the Federation of Estonian Chemical Industries, Kunda

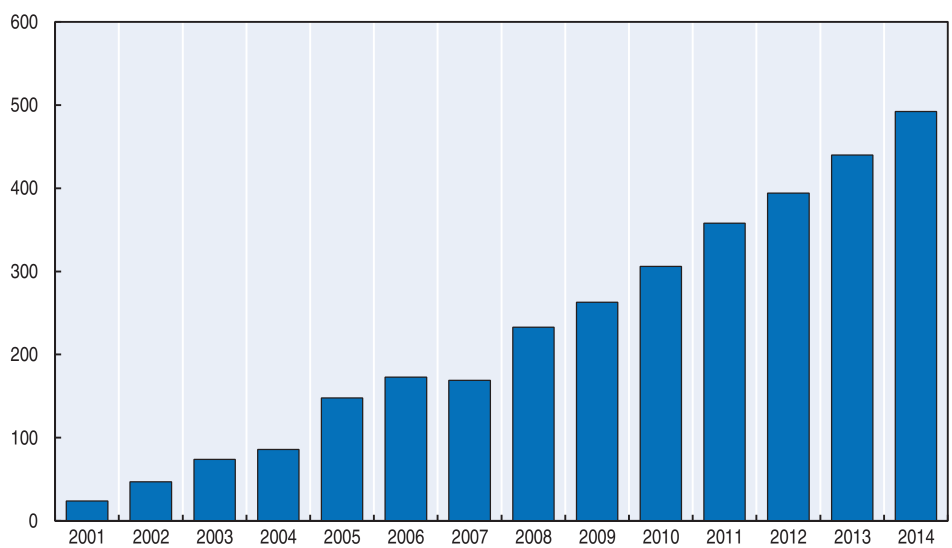
Nordic Cement and Estonian Deposit Packaging. In most cases, businesses commit to BAT or environmental management systems (EMS), while the MoE provides the other party with information on best practices (but no financial support) and involves it more closely in the process of developing relevant legislation. There is, however, no evidence that such agreements promote green business practices or significantly improve the environmental performance of the respective enterprises. Voluntary agreements could be strengthened by setting ambitious sector-specific environmental targets.

Business groups play a significant role in promoting corporate environmental management by organising seminars, improving webpages, distributing information letters, etc. For example, the Estonian Association for Environmental Management is a cross-sectoral organisation that liaises between enterprises and government institutions, while representing its members' interests on environmental issues.

Environmental management system certifications and awards

The government has run several programmes to promote the European Eco-Management and Audit Scheme (EMAS), including financial support available from the Environmental Investment Centre. As of August 2015, there were 6 EMAS and 521 ISO 14001 registered organisations compared to fewer than 100 in 2004 (Figure 2.3). These certifications are driven entirely by market demand in the absence of regulatory or economic incentives (such as lower inspection frequency or reduced pollution taxes) from the government.

Figure 2.3. **Rapid growth of ISO 14001 EMS certifications in Estonia**



Source: ISO (2015).

StatLink http://dx.doi.org/10.1787/888933448543

Since 2014, the MoE has organised an annual competition – Environment-Friendly Enterprise of the Year. Winners in the three categories (environmental management, environment-friendly product or service and environment-friendly technological process) are given the right to use an environmental label, are announced through the media and have a chance to compete for the European Business Awards for the Environment. Acknowledging the winners is also intended to help inspire other companies, organisations and private persons to use similar nature-friendly solutions.

5. Promoting environmental democracy

Estonia ranks 14th in the world (but behind Lithuania and Latvia) on the Environmental Democracy Index (WRI, 2015). The index is a composite indicator that considers public participation, transparency and access to justice. Estonia scores well on transparency and access to justice mainly due, respectively, to the public's clear right to access environmental information and legal provisions for the review of administrative decisions related to the environment.

5.1. *Public participation in environmental decision making*

The 2012 Code of Good Practice of Involvement declares the government's commitment to stakeholder and public engagement in decision making and lays out a procedure for public consultation in the development of policies and legislation. The Sustainable Development Commission under the government's Strategy Unit consists of representatives of 19 NGOs and meets four to five times per year to recommend different sustainable development topics and strategic documents before they are adopted by the government.

According to the 2011 government regulation "Rules for Good Legislative Practice and Legislative Drafting", stakeholders and the public are involved in the preparation of legislative proposals and draft laws. The public can participate in legal drafting through the webpage of the MoE, social media, different public events and discussions, generally having four weeks to submit comments and proposals. In the case of draft legislation of particular public resonance, the MoE develops a special "inclusion programme". The Estonian Environmental Law Centre actively guides the public through different participation options.

EIA and SEA proceedings are open to any member of the public, and all proposals and objections must be considered. According to the Administrative Procedure Act, persons whose rights may be affected by the proposed activity or implementation of the strategic planning document have a special status in the proceedings. During the permitting process, the public is notified on a relevant webpage, and all interested persons have a right to comment on the draft permit.

The role of the public is also important in land-use planning. The national spatial plan "Estonia 2030+" (adopted in 2012) was prepared for the entire territory of the country through extensive consultation and public participation: a special website and different working groups were established to ensure broad-based consultation.

Many environmental NGOs receive financial support from the state to partly cover their overhead costs. This funding is unconditional and does not compromise the organisations' independence. For example, the Ministry of the Interior supports environmental associations through the Network of Estonian Nonprofit Organizations.

5.2. *Access to environmental information*

The Public Information Act (2000) and the General Part of the ECA guarantee access to environmental information. According to the 2014 environmental awareness survey of the Estonian population, 74% of respondents thought that environmental information in Estonia is available, among whom 14% considered access to such information to be very good. Public opinion about the availability of environmental information has been steadily improving from year to year (MoE, 2014). According to an EU-wide study of citizens' attitudes on environmental matters (EC, 2014a), 69% of Estonians consider themselves well informed about environmental issues, which is 4% higher than in 2011 and higher than the EU average (62%).

ESTEA collects, processes and analyses information about the state of the environment, and communicates it to the MoE and its subordinate institutions, Statistics Estonia, the European Environment Agency and public information networks. ESTEA publishes regular environmental reviews in electronic and paper formats (Estonian Environmental Review, Estonian Environmental Monitoring, Estonian Environmental Indicators, etc.). ESTEA also maintains public domain-specific databases: Estonian Environmental Register, Estonian Nature Information System, Waste Reporting System (JATS), Forest Registry, etc. National environmental monitoring data and results are also available to the public. Although information is accessible, it often takes a long time to find, and its completeness and quality may not always be reliable (NAO, 2013).

5.3. *Access to justice*

The Administrative Procedures Act regulates appeals against administrative decisions. A person who finds his or her rights violated by an administrative action may file a challenge. In addition, an environmental NGO can contest an administrative decision if it can prove the decision has violated its rights or is related to its environmental goals and activities. If the administrative appeal is rejected, a suit can be filed in an administrative court. Physical persons and environmental associations are eligible for waivers and reductions of legal fees related to administrative court proceedings.

While administrative appeals are fast, accessible and inexpensive, in practice their usefulness is limited. Actions taken by ministers are explicitly excluded from the scope of such proceedings. In environmental cases, the same authority that made the original decision is typically also the reviewing body, which is unlikely to change its point of view. The general weakness of administrative court appeals is that courts can only review the legality of administrative discretion; they cannot overturn the administrative decision on substantive grounds only.

The public does not have access to courts of general jurisdiction for other environmental protection issues, as there is no reference to the right to a clean environment in the Estonian Constitution. Civil judicial proceedings are only open for direct actions against persons under private law and, in environmental matters, are only relevant for suits related to damage to health and economic interests (under the so-called traditional liability regime).

5.4. *Environmental education*

The Environmental Education Department of the Environmental Board and the MoE itself are actively promoting environmental education. The Environmental Board manages an online environmental education database that includes contact details of institutions offering environmental education programmes, irrespective of their affiliation. It also contains a list of study programmes offered by these institutions that can be ordered by schools. The selection of study materials, worksheets, movie clips for educational purposes and a calendar of events are also available in the database.

The Environmental Board also runs a competition called "Keskkonnakäpp" aimed at acknowledging educational institutions for the promotion of environmentally friendly behaviour. In 2014, more than 86 000 kindergarten and schoolchildren participated in educational programmes run by the institutions subordinated to the MoE (MoE, 2015).

Environment and sustainable development is a mandatory topic in national curriculums of primary and secondary education. The "Development of Environmental

Education" programme supported by the European Social Fund focused on integrating environment and sustainable development issues into national curriculums. About 600 school and kindergarten teachers and supervisors of environmental education centres participated in training activities. The Ministry of Education and Research supports environmental education activities of the Baltic Sea Programme and the Global Learning and Observations to Benefit the Environment Programme (GLOBE) in over 100 schools across the country.

The Environmental Investment Centre under the MoE offers grants for environmental awareness and education activities. Grants are focused on a number of thematic areas, including sustainable consumption, nature conservation, awareness-related research, etc. The annual budget of this programme is EUR 3-3.2 million. In addition to the Environmental Investment Centre, local governments and universities also contribute to the financing of environmental awareness-related activities. The European Regional Development Fund supports a EUR 21.2 million programme for the establishment and renovation of 30 nature houses (run by the State Forest Management Centre) and environmental education centres in all Estonian counties. New environmental education centres have recently been established in Tallinn, Tartu and Pärnu.

Recommendations on environmental governance and management

- Strengthen inter-ministerial co-ordination on environmental and sustainable development issues, including climate change, to better incorporate environmental concerns into strategic planning, sectoral policies and spatial planning; encourage collaboration between local governments in all areas of their environmental competence.
- Complete the process of codification of environmental legislation to improve its coherence and reduce the administrative burden on the regulated community; reinforce the *ex ante* evaluation of environmental regulations and policies through rigorous regulatory impact analysis, including extensive use of economic analytical tools; encourage *ex post* evaluation of their implementation.
- Consider replacing bespoke permits with sector-specific general binding rules to simplify the regulatory regime for installations with low environmental impact; update pre-treatment standards for industrial wastewater discharges into municipal sewerage systems; ensure close MoE oversight and evaluation of EIA implementation by municipal governments.
- Improve the co-ordination and consistency between national, county and local land-use plans; increase the capacity of local governments to conduct spatial planning and related strategic environmental assessment; integrate sustainable mobility issues into spatial planning at the local level.
- Further enhance risk-based planning of environmental inspections; reform the system of penalties for environmental violations by adopting a sound methodology for the determination of fines, based on the gravity of the offence and economic benefit from non-compliance; develop an enforcement policy with clear guidance on applying administrative and criminal sanctions proportionately to the seriousness of non-compliance.
- Scale up government efforts to promote environmental compliance and green business practices through a range of information-based tools and regulatory incentives; strengthen voluntary agreements with industrial associations by setting ambitious sector-specific environmental targets and encouraging investment in eco-innovation.

Recommendations on environmental governance and management *(cont.)*

- Streamline the environmental liability regime by integrating liability provisions of issue-specific environmental laws into the Environmental Liability Act, while assigning priority to remediation of damage to the environment at the expense of the responsible party over monetary compensation; accelerate the programme for the clean-up of contaminated sites by securing adequate financial resources for its implementation.
- Expand citizens' access to justice beyond the review of administrative decisions related to the environment in order to guarantee broader human rights on environmental matters in county courts of general jurisdiction; enhance the completeness and quality of environmental information available to the public.

Notes

1. A development consent is usually a building permit, an environmental permit or a natural resource extraction permit; in the latter two cases, the Environmental Board is the competent authority.
2. The Estonian Land Board under the MoE is also an active participant of the land-use planning process. It administers state-owned lands, maintains the Land Cadastre, manages geodetic, geological and topographic data, etc.
3. The environmental impact of regional development plans is assessed in accordance with the 2013 guide "Through themes in development plans". The guide offers a methodology for evaluating potential impacts and conflicts along five horizontal themes, one of which is environmental protection and climate.
4. Such substitution of pollution tax payments is reported by Estonia to the European Commission as a form of state aid.

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PART I

Chapter 3

Green growth

Estonia is pursuing an ambitious green tax reform, operates several support schemes to stimulate green investment and has a growing environmental goods and services sector. However, vehicle taxation is limited, and pollution taxes are too low to have an impact on environmental performance of firms. This chapter presents Estonia's progress in using economic and tax policies to reach environmental objectives. It analyses public and private investment in environment-related infrastructure and reviews the promotion of environmental technologies, goods and services as a source of economic growth and jobs.

1. Introduction

Estonia is a small and open economy. It experienced strong growth after its accession to the European Union (EU) in 2004, followed by a sharp contraction due to the global financial crisis (OECD, 2012a, 2011). The economy rebounded quickly, with an export-led recovery. Gross domestic product (GDP) rose in real terms above pre-crisis levels in 2015. Unemployment has fallen to 6%, below the OECD average of around 8%, but skill mismatches keep structural unemployment high (OECD, 2015a).

Estonia's fiscal position is strong, and the government is initiating further substantial reforms. The country has a large potential for improving productivity, but the productivity gap compared to high-income countries has been slow to narrow (Kappeler, 2015) for several reasons. Low foreign direct investment inflows in high value-added activities, a focus on low value-added manufacturing and limited knowledge transfer from domestic research institutions and foreign firms to Estonian firms have all contributed to the productivity gap. Transport infrastructure has been upgraded, but bottlenecks remain. The government is reforming a number of areas (e.g. labour market, research and development), which can help strengthen growth (Chapter 1).

Estonia faces challenges in moving to a more environmentally sustainable economic model (OECD, 2015a). Within the OECD, Estonia's economy is the most greenhouse gas intensive and carbon intensive, and among the most energy intensive (Annex 1.A1; Annex 1.B1; Annex 1.B2). This is largely a result of the dominance of oil shale as an energy source (70% of supply). Under existing policies, income growth will continue to increase greenhouse gas (GHG) emissions. Given that over two-thirds of its emissions fall under the EU Emissions Trading System (ETS), potential increases in the ETS carbon price could have a larger economic impact in Estonia than in other European countries.

2. Framework for sustainable development and green growth

Estonia's National Strategy on Sustainable Development, "Sustainable Estonia 21", adopted in 2005, sets out the government's framework for pursuing social, economic and environmental objectives, as well as preserving the viability of the Estonian cultural space. The strategy is implemented through various sectoral strategies and action plans, with progress monitored via a set of sustainable development indicators. The latest monitoring report shows progress towards several targets for improving economic welfare and environmental quality (Statistics Estonia, 2015). Estonia's Sustainable Development Commission is reviewing the Sustainable Estonia 21 strategy to analyse to what extent it complies with the UN Agenda 2030 goals. Based on this review, the government will decide whether to renew the strategy.

The 2007 Estonian Environmental Strategy to 2030 defines long-term development objectives and identifies the most problematic areas in the field of environment. The Environmental Strategy was complemented by an Environmental Action Plan for 2007-13 in line with the EU programming period (as it relied extensively on European structural funds for implementation). However, the plan was not renewed after 2013. Therefore, it is unclear how the Environmental Strategy objectives will be achieved by 2030.

There is no dedicated green growth strategy, but green growth initiatives are included in various governmental strategies and plans. The Entrepreneurial Growth Strategy 2020 includes "more efficient use of resources" as one of its priorities, but is not specific about attaining it. The Estonian government has an ambitious agenda for a green tax reform for the coming years. It aims to shift part of the tax burden from income to consumption, use of natural resources and pollution of the environment. At the same time, it aims to keep the tax system simple and transparent with as few exceptions and differences as possible (Ministry of Finance, 2015). Authorities have launched a multi-year process involving relevant ministries, stakeholders and academia to inform the effort of revising the structure of environmentally related taxes. The project will assess external costs of all main forms of pollution with the intent to adjust environmental taxes so that they better reflect assessed values. The project is expected to finish in 2017, with changes to the tax system made by 2020.

Reducing the high carbon intensity of the energy sector is a priority for Estonia, but progress has been limited. In 2017, the Ministry of the Environment is expected to adopt the General Principles of the Climate Policy until 2050. This is in line with the Paris Agreement and the EU long-term climate and energy objectives for 2050. After 2020, Estonia intends to reduce GHG emissions by 70% by 2030 compared to the 1990 level. This target is significantly more ambitious than that of the EU's Nationally Determined Contribution under the United Nations Framework Convention on Climate Change (UNFCCC).

The Ministry of Economic Affairs and Communications has recently developed a new National Development Plan of the Energy Sector until 2030. It aims to ensure an energy supply at a reasonable price for consumers with an acceptable environmental impact, in accordance with the long-term energy and climate policies of the EU.[1] The plan includes benchmarks for renewable energy and energy efficiency operational programmes and general goals for thermal insulation of buildings. However, it does not incorporate a vision of minimal reliance on fossil fuels in the context of achieving GHG emission reduction by 2050 and beyond.

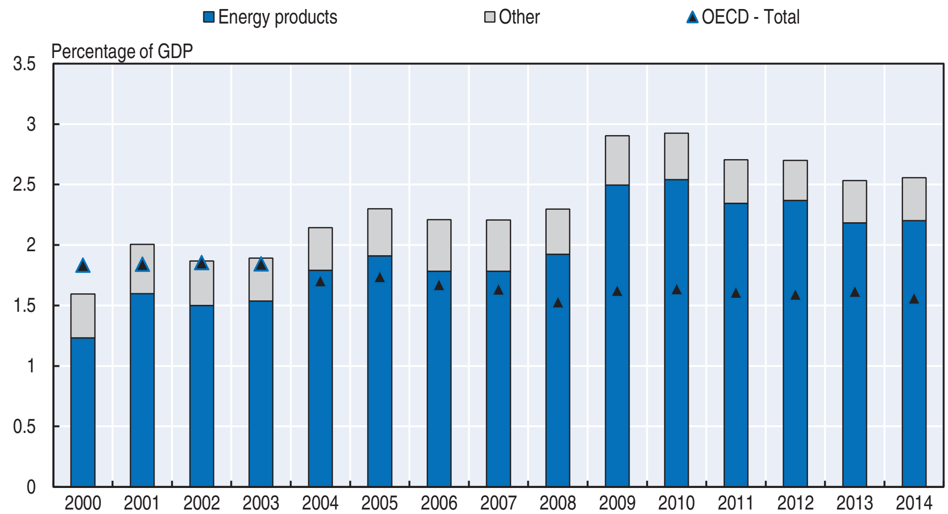
3. Towards greener taxation

3.1. Overview

Revenues from environmentally related taxes increased from 1.6% to 2.6% of GDP between 2000 and 2014, mostly due to increased excise taxes on petrol and diesel; this puts Estonia in the upper third of OECD member countries on this indicator (Annex 3.A). Environmentally related taxes raised a significant amount of tax revenue, accounting for 8% of total tax revenues in 2015, up from 5.2% in 2000 (OECD, 2016a) and above the OECD average (Basic Statistics).

In 2014, taxation of energy products made up 86% of revenues from environmentally related taxes, well above the OECD average of about 70%. The overall increase in environmentally related tax revenue was due mainly to a significant increase in energy tax rates between the mid-1990s and 2010. A new excise tax on electricity was also introduced during this period. The increases were driven by both the requirement to increase some tax rates to at least the minimum levels prescribed by the 2003 EU Energy Taxation Directive, as well as the government's green tax reform agenda. New energy tax rates were adopted by Parliament for 2010-15, partly in response to the 2009 fiscal crisis (Hogg et al., 2014). Since 2010, revenue from energy taxes as a share of GDP has declined (Figure 3.1).

Figure 3.1. **Environment-related tax revenue has declined since 2010**



Note: 2014 data for OECD are estimates.
Source: OECD (2016), "Instruments Used for Environmental Policies and Natural Resources Management", OECD *Environment Statistics* (database).

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In OECD member countries, taxes on motor vehicles and transport are, on average, the second most important category in terms of revenue as a share of GDP. For Estonia, however, these taxes are modest, raising an amount equal to just 0.06% of GDP in 2014. Estonia is one of the few EU Member States that does not tax passenger cars, despite road transport being a significant source of air pollution and CO_2 emissions (Chapter 1).

Since 2005, Estonia has been implementing a green tax reform, whose goal is to increase taxation of pollution and other negative environmental effects while decreasing labour taxes. Raising environmentally related taxes could indeed give the government leeway to lower labour taxes that may be putting a brake on growth and employment, as the tax burden as a percentage of labour cost (the so-called tax wedge) in Estonia is higher than the OECD average (OECD, 2015a). The rates of environmental taxes[2] have been increased, while the rate of personal income tax was reduced from 26% to 21% between 2005 and 2012 (Oras and Salu, 2013). Total tax revenues compared to GDP have varied considerably over this period, increasing from almost 30% to about 35% between 2005 and 2009, and declining again to less than 33% in 2014. The green fiscal reform should be pursued further.

The design of the environmental tax system has recently been the subject of active study and debate. In 2013, in the context of the government's review of environmental taxes, the government commissioned the Stockholm Environment Institute (SEI) in Tallinn and the Tartu University Social Science Research Centre to assess the impact of environmental taxes in Estonia. The study, which examined the use of these instruments over 2000-10, recommended increasing environmental tax rates by up to 5% per year over 2016-30 (Lahtvee et al., 2013). The additional revenue could compensate for inflation and motivate resource-use efficiency, as well as eliminate existing exemptions (discussed below). For the oil shale extraction tax, the study proposed a 16% nominal rate increase annually over 2016-30, starting from the 2015 level. It also proposed to significantly increase tax rates for oil shale-related waste (Chapter 4).

3.2. Taxes on energy products

Tax rates on energy in Estonia are rather low and vary considerably across energy sources and uses. There is broad scope to increase and adjust energy tax rates, which do not reflect well the negative impact of energy use on the environment and fail to provide a consistent carbon price signal.

Estonia taxes most energy products, although there are a number of exemptions and reduced rates for various users. An excise duty is levied on all energy products, except for peat and wood, which are important sources of local air pollution. Energy taxes on petrol and diesel are well above the minimum tax rates prescribed by the 2003 EU Energy Taxation Directive,[3] and future rate rises are planned. However, there are several exemptions and reduced rates for specific uses of fuel, such as agriculture and fisheries[4] (OECD, 2013a). These exemptions weaken incentives to use energy efficiently and result in tax revenue losses.

Estonia implemented a CO_2 pollution tax in 2000. Initially, it was applied to large energy producers with a total thermal capacity greater than 50 MW. With the entry into force of the Environmental Charges Act on 1 January 2006, the tax was applied to all power plants, regardless of size, duplicating the coverage of the ETS. The tax rate gradually increased from EUR 0.32 to EUR 2 per tonne of CO_2 from 2009 onwards. The effect of this measure on inducing carbon abatement was likely negligible given the low level of the tax rate; the tax is primarily intended to raise revenue (OECD, 2012b). However, companies can opt to invest the payable amount in low-carbon technologies instead of paying the tax, which most energy producers do (Kearns, 2015).

A tax on electricity generation was abolished in 2008 and replaced by an electricity excise duty (EUR 4.47 per MWh, as of 1 January 2014). Companies that control the power networks pay this tax, but the excise duty is unrelated to the emission intensity of the fuel used in the production of electricity. Thus, fuels with lower carbon content are subject to a relatively higher tax per tonne of CO_2, which provides no incentive for switching to less carbon-intensive fuels. The CO_2 pollution tax still remains in place for heat generation (OECD, 2012b).

Estonia also has a "renewable energy tax" levied on electricity consumers to finance the feed-in premium subsidy for renewable energy (Section 4.2). It is paid by all consumers in Estonia in proportion to their consumption. The renewable energy tax is listed separately on electricity bills so that consumers can see exactly how much is paid. The rate of the tax is set under the Electricity Market Act (2007). The tax for 2015 was 1.07 EUR cents/kWh, including VAT (Elering, 2015).

As in most OECD member countries, petrol is taxed at a higher effective rate than diesel. This is regrettable from an environmental perspective as diesel emits more CO_2 and local air pollutants, including NO_x and PM, than an equivalent volume of petrol. Moreover, Estonia's petrol and diesel prices are among the lowest in OECD Europe, although Estonia's taxes on diesel have been rising faster than those on petrol. Taxes represent just over half of the end-use price of petrol, among the lowest rates in OECD Europe. Despite numerous increases in fuel taxes up to 2010, emissions from cars have not lowered noticeably; newly registered cars in Estonia still have high average CO_2 emissions (EEA, 2014).

As a result of exemptions for biomass and for natural gas not used for heating, just over half (56%) of the energy use for heating and process purposes and 55% of CO_2 emissions from such uses are untaxed (OECD, 2013b). Despite increases in taxes on natural gas and fuel oil, tax rates on fossil fuel use in heat and electricity generation (based mostly on oil shale) remain much lower than those on transport fuels. This difference is more pronounced than in many other OECD member countries. Natural gas is taxed only when used for heating. The use of biomass, biofuels, coal or liquefied petroleum gas is exempt from taxes if used for heating (OECD, 2013b).

There is a low effective tax rate (in terms of energy content and CO_2 emissions) on oil shale – the dominant energy source for electricity generation and the largest source of CO_2 emissions. The coverage of electricity generation by the EU ETS may partly explain the low effective rate for it. However, the use of oil shale is responsible for a number of other negative environmental impacts, including those on air quality (Chapter 1), which calls for a higher tax on it. In its recent audit (NAO, 2014a), the National Audit Office concluded that environmental taxes on oil shale use failed to motivate companies to prevent or reduce potential environmental damage (Chapter 5).

To provide a consistent carbon price signal, tax rates for CO_2 emission sources not already covered by the EU ETS should be raised in accordance with their carbon content, to the extent that taxes already levied on these sources do not already reflect the social costs of carbon. This can be done gradually, taking into account the need to compensate the potential impact on low-income households.

3.3. Carbon pricing via the EU Emissions Trading System

In addition to the implicit and explicit carbon taxes described above, Estonia is pricing some of its GHG emissions via the EU ETS, which covers 71% of the country's GHG emissions – the highest share of any EU country. These emissions are generated by 46 stationary installations and three entities in aviation (EEA, 2015). Power and heat generation in Estonia is responsible for more than 80% of all ETS-regulated emissions (IEA, 2013).

In its early stages, the EU ETS allocated nearly all emission allowances for free. In the first two trading periods (2005-12), Estonia was granted emissions allowances of around 19 million tonnes (Mt) of CO_2 per year – more than the actual emissions from sectors covered by the ETS. In the third period (2013-20), it was granted 13.3 Mt per year, 30% less than in the previous period (IEA, 2013), but still representing about 98% of Estonia's verified emissions (EEA, 2015). From 2013, an increasing share of emission allowances is being auctioned (Box 3.1). However, Estonia, like some other economies in transition, was eligible for temporary exemptions from auctioning by developing a national plan of investments in modernising power generation. As a result, the ETS has so far had no effect on the dominance of oil shale in the country's energy mix.

The NAO found that the government had not sufficiently used the ETS to encourage GHG emission reductions: companies that received allowances exceeding their actual emissions during the first commitment period did not use money gained from the sale of allowances for environmental investments (NAO, 2009). It has been estimated that companies earned substantially from sales of allowances in the first commitment period. For example, Eesti Energia (the state-owned energy company) received EUR 179 million from such sales, which was transferred to the state budget (NAO, 2009). During 2005-10, the use of gas in electricity production, in fact, was cut in half, indicating the EU ETS did not encourage a fuel switch from oil shale to gas (OECD, 2012b).

Since the ETS covers a large portion of the country's GHG emissions, the Estonian economy is vulnerable to increases in the allowance prices of the ETS, which would make high GHG emissions very costly in the future. A study by Ernst and Young (2014) of the

Box 3.1. **EU Emissions Trading System: Third phase**

The EU ETS is in its third phase (2013-20), having undergone significant changes from the second phase. It now covers CO_2 emissions from petrochemicals, ammonia and aluminium; N_2O emissions from the production of nitric, adipic and glyocalic acid; and fluorocarbons emissions from the production of aluminium. There has been a transition from a system of national caps to a single, EU-wide cap that will decrease by 1.74% per year until 2020 (due to the decreasing cap, emissions in the sectors covered will be 21% lower in 2020 than in 2005).

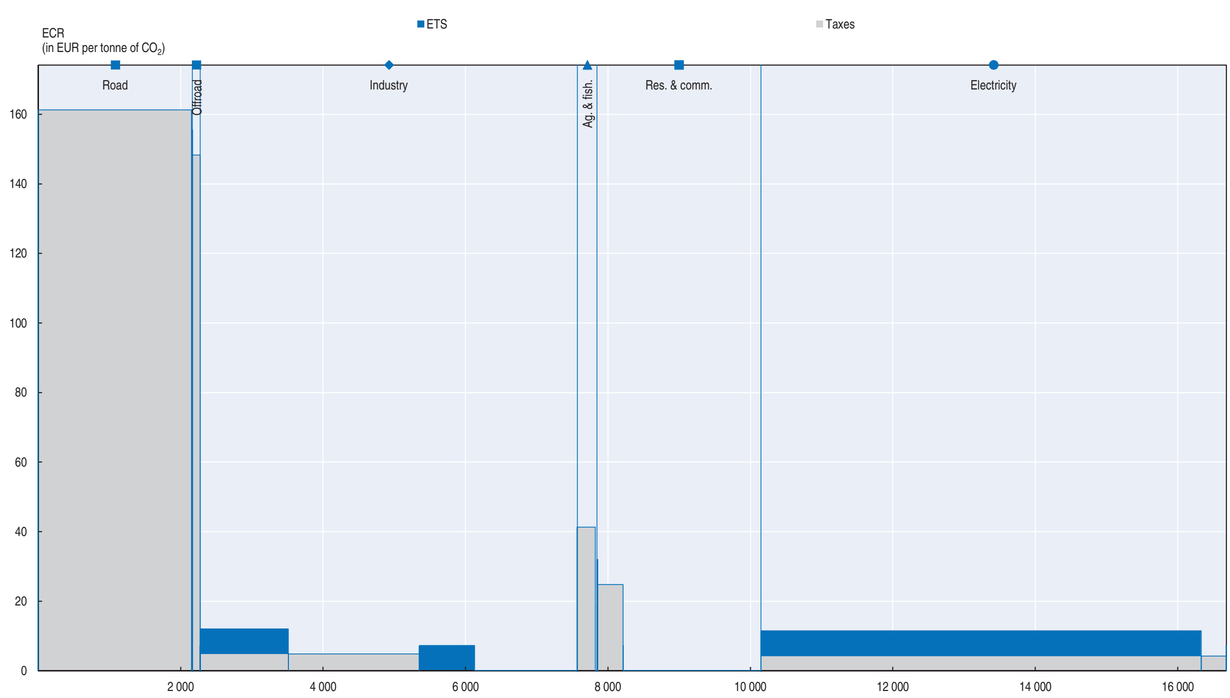
The share of auctioned allowances has increased from less than 4% in Phase II to more than 40% in Phase III. In the coming years, the amount of freely allocated allowances will decrease gradually each year until 2020; at that time, only the trade-exposed, energy-intensive manufacturing industry will receive free allowances. In the interim, allocation rules have been harmonised based on performance benchmarks for the remaining free allocation of allowances.

Source: OECD (2015f).

macroeconomic impacts of Estonian oil shale mining and production identified CO_2 price (along with oil prices and changes in environmental tax rates) among the main risks to the sector (Chapter 5).

In total, Estonia priced 80% of its CO_2 emissions from energy use in 2012, and 17% were priced above EUR 30 per tonne of CO_2 (OECD, 2016e). This can be clearly seen on Figure 3.2, where the tax rates and prices of emission allowances for various energy sources have been converted into effective carbon rates, taking into account the average carbon content

Figure 3.2. **Large differences in the effective carbon rate on energy use**



Source: OECD (2016), *Effective carbon rates: Pricing CO_2 through taxes and emissions trading systems.*

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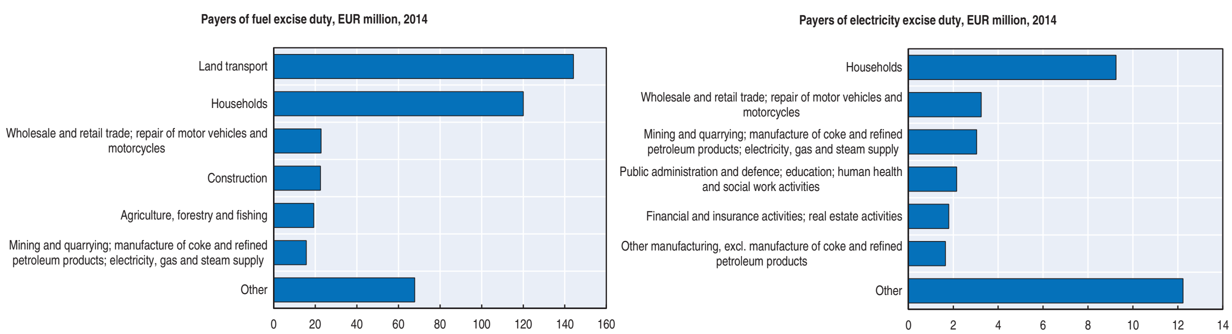
of each fuel.[5] For example, about 58% of industrial sector emissions are subject to a tax of EUR 5 per tonne of CO_2, two subsectors are covered by the ETS at EUR 7 per tonne and about 28% of the sector's carbon emissions are not priced at all.

3.4. Distributional issues of energy taxation

Households bear a significant share of the tax burden on fuel and electricity. As shown in Figure 3.3, households, together with land transportation businesses, paid two-thirds of the total amount of fuel taxes in 2013. Households also paid a significant share of the electricity excise duty in 2013. A recent study looking at the distributional effects of energy taxes in Estonia suggests that, overall, such taxes are progressive (Poltimäe, 2014). In the mix of energy taxes, the progressive effect of the motor fuels excise outweighs the regressive impact of electricity excise duty.

Figure 3.3. **Households bear a significant share of fuel and electricity taxes**



Source: Statistics Estonia (2016).

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Compared to other EU countries, Estonia has one of the highest energy consumption levels per capita (INSIGHT_E, 2015), driven in part by low energy prices. While households benefit from these low prices, the large energy use increases their vulnerability to price increases. As energy costs rise, energy poverty may become a concern (Kappeler, 2015).

A study for the European Commission has estimated the number of households in energy poverty. It assessed how many households in each country spend double the national average energy share of household expenditure.[6] The results show that Estonia has a relatively high incidence of energy poverty compared to most Western European countries, with almost 20% of the population affected. For comparison, several EU Member States, such as Estonia's Baltic neighbours Latvia and Lithuania, as well as Ireland, Greece and Hungary, have energy poverty rates between 30% and 40%, while Romania is at almost 50% (INSIGHT_E, 2015). Only 3% of Estonian households are unable to afford to keep their homes adequately warm (EC, 2015).

Tackling the challenge of energy poverty requires a mix of instruments. These range from financial support to households for energy-savings investments (e.g. purchase of low-consumption appliances) to regular adjustment of subsistence payments to account for changes in energy prices (e.g. due to increased energy taxes) (OECD, 2015a). There are no specific measures for integrating poverty and distributional concerns into environmental policy decisions in Estonia.

3.5. *Transport taxes*

There are few taxes on motor vehicles in Estonia. In 2014, revenue from these taxes amounted to 2.5% of environmentally related tax revenues, well below the OECD average. There is a heavy goods vehicle tax on vehicles weighing 12 tonnes or more, which was introduced in 2004. Tax rates correspond to EU minimum levels and vary according to the type of vehicle. There is also a car registration fee, which applies to personal vehicles and is based on either the type or origin of the vehicle.

Estonia should consider policy measures to better address the environmental impacts of road transport. These could include a road pricing system, a congestion charging system for Tallinn, or taxes on motor vehicles (either a purchase or annual tax, or both) adjusted to reflect the environmental characteristics of the vehicle. Well-designed measures would help reduce the high vehicle emissions of NO_x and PM; they would also help meet the GHG emission target for non-ETS sectors, which Estonia is at risk of missing if no additional measures are taken.

The government is analysing options for vehicle taxation, including taxation of vehicle use based on environmental characteristics. It commissioned a study to identify road transport taxation options to help better implement the user pays and polluter pays principles. The study examined several taxation approaches, including time-based or distance-based road charging for trucks and an annual tax on passenger cars. It analysed the economic and technical practicality of various options and their potential socio-economic impact, but not the external costs of vehicle use (Ernst and Young, 2015). Based on this study, the government is planning to introduce road charges for heavy duty vehicles, but not taxes on passenger cars.

A road pricing system that varies with the time and location of driving and with vehicle category, combined with fuel taxes that reflect CO_2 emissions caused by use of different fuels, is probably the optimal way of addressing negative social and environmental impacts from road transport. If that is considered difficult to implement, one-off and/or annual taxes on passenger vehicles can play a useful role if they vary according to emissions of local air pollutant of the vehicles, as is done, for example, in Israel (OECD, 2016f).

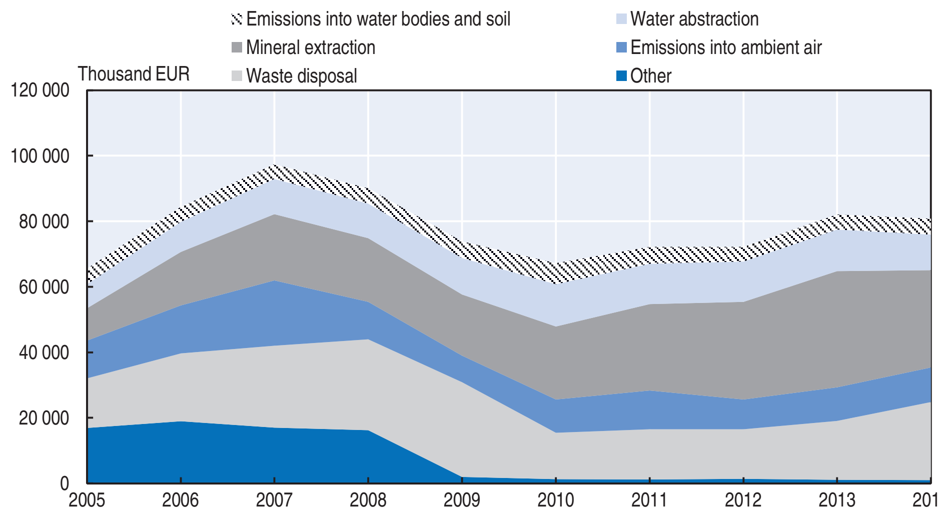
3.6. *Other environmental taxes and fees*

Estonia has had numerous environmental taxes in place since 1991, including resource extraction, pollution and water abstraction taxes currently regulated by the Environmental Charges Act (2006). Their revenues grew modestly in real terms (2010 prices) between 2005 and 2014. Most revenue comes from extraction and waste disposal taxes, both of which are related to oil shale mining and processing (Figure 3.4). As the largest source of pollution, the oil shale industry paid 72% of environmental taxes in 2013 (MoE, 2015a). Municipal wastewater treatment plants contribute about two-thirds of total water pollution tax revenues (MoE, 2015b).

Polluters can avoid paying all or part of pollution taxes if they invest the corresponding funds in a new project that will reduce pollution by at least 15% per product unit. However, according to the government, substitution (offsetting) of pollution taxes accounts for a small share (less than 1%) of the total revenue collected from these taxes.

Revenues from environmental taxes are shared between the state and local authorities within whose jurisdiction the given activity is located. Allocating a portion of the revenues to local authorities helps compensate for the environmental impacts imposed in that area.

Figure 3.4. **Extraction and waste disposal taxes provide most revenues (2010 prices)**



Source: Country submission.

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A part of these revenues channelled to the state budget is allocated to the Estonian Environmental Investment Centre (EIC) to finance projects to protect the environment (discussed below). In 2014, EUR 90 million in revenue was collected from environmental taxes and allocated to the EIC (EUR 36 million), the state budget (EUR 39 million) and local authorities (EUR 15 million) (MoE, 2015a).

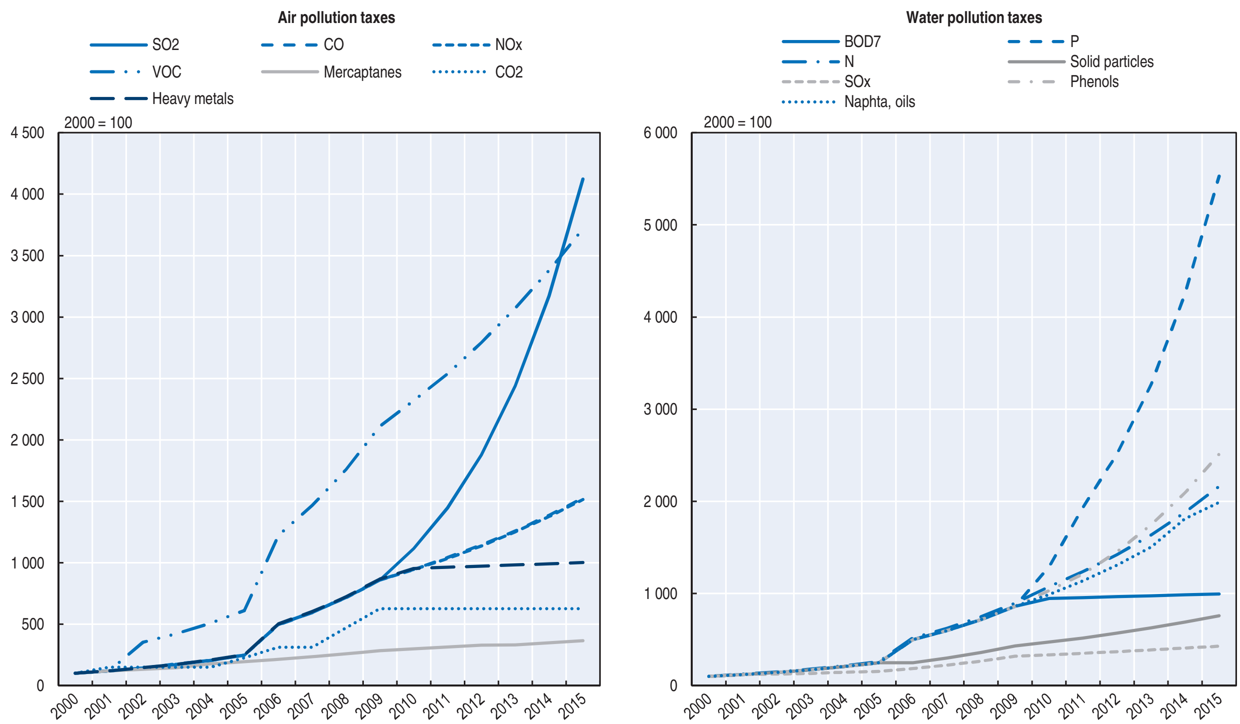
Resource extraction

Mining companies pay a tax for extraction and use of mineral resources belonging to the Estonian state with the aim of capturing a share of their profits. Taxed minerals include oil shale, peat and a range of construction materials, such as dolomite, limestone, gravel and sand. These taxes should be based on the estimated value of the resource in the given mine or quarry, essentially amounting to a rent. However, no methodology for assessing the financial value of mines and quarries has yet been developed (MoE, 2014). By the end of 2017, the ongoing codification of environmental law is expected to have changed the procedure for calculating mineral extraction taxes (Chapter 2). In 2016, the extraction taxes for oil shale mining were significantly reduced to alleviate the burden on industry in the context of a dramatic drop in the market price of oil that made the transformation of oil shale into shale oil much less profitable. This tax break is inconsistent with the green tax reform pursued by the Estonian government (Chapter 5).

Air and water pollution

Pollution taxes, especially for air and water pollution, are imposed on a wide range of parameters, including numerous heavy metals and other hazardous substances. Emissions and discharges of most of these hazardous pollutants are not monitored. Rather, they are estimated based on technological characteristics of the production process, thereby removing the potential incentive impact of the taxes for these pollutants. Rates vary depending on the location of polluters (with polluters located in bigger towns and recreational areas paying more). A non-compliance fee, with rates of up to 100 times the basic rate, applies to emissions of air and water pollutants that either exceed permitted levels or are emitted without a permit (Chapter 2). All water users also benefit from a 50% discount on water pollution tax rates if their discharges stay below permitted effluent limit values, and if they submit self-monitoring reports on time. This, together with non-compliance rate multipliers, constitutes a double compliance incentive, which is hardly justified.

Figure 3.5. **Significant increase in air and water pollution tax rates since 2000**



Source: Country submission.

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Since 2000, basic air and water pollution tax rates have increased significantly (Figure 3.5). However, they remain well below marginal abatement costs, making it preferable for polluters to pay the tax rather than to take abatement actions. Indeed, the impact of Estonian pollution taxes on the environmental performance of firms appears limited to date (NAO, 2014a). Yet the government is reluctant to raise rates further due to a concern about burdening industry and hindering investment. For greater effectiveness, air and water pollution taxes should focus on a limited number of priority pollutants whose emissions or discharges are monitored, and tax rates for these pollutants should be increased to provide a real incentive for their abatement (Box 3.2).

Waste disposal

A waste disposal tax applies to municipal, construction, mining waste and hazardous waste, including oil shale ash and semi-coke (Chapter 4). Basic rates vary according to the type of waste and its hazard level. The disposal tax is also often referred to as landfill tax, even though the disposal tax is levied not just on landfilling, but also, according to the Environmental Charges Act, on "other activities that result in the discharge of waste into the environment", which includes on-site storage. As part of the same system, non-compliance

Box 3.2. **Focusing and strengthening pollution taxes: International experience**

Pollution taxes levied on the quantity of pollution released into the environment can have two primary functions: changing environmentally damaging behaviour and raising revenues for the treasury. To achieve an incentive impact, polluters should be sensitive to production-cost changes represented by the pollution tax; the tax rate should be high enough to make pollution reduction cost-effective; and emission monitoring and payment enforcement should be strong. A fairly stable tax base with low administrative costs could provide a predictable revenue stream, which is why OECD member countries generally rely on product taxes rather than pollution taxes as a source of revenues.

Regardless of the primary purpose of a pollution tax, it must be levied only on pollutants that are routinely monitored. Pollution taxes that exist in Western European countries (e.g. Sweden, Denmark, Norway, Italy) are limited to a few pollutants. Those are usually SO_2 and/or NO_x for air emissions, and nitrogen, phosphorus and organic substances for wastewater discharges.

An analysis of the country's main environmental problems and respective government priorities should guide the choice of pollutants to be taxed. Pollution taxes are most effective when targeting a limited number of big stationary sources. If major contributors to the problems are numerous small sources, mobile sources or diffuse pollution (e.g. from agriculture), pollution taxes may not be the best policy tool.

Source: OECD (2012d).

fees of up to 500 times the basic rate (for hazardous waste) apply in case of disposal of waste in quantities higher than those specified in a facility's permit, reaching 1 000 times the basic rate for promiscuous hazardous waste dumping. The revenues go to the state and municipal budgets and the EIC, as discussed above.

In addition, landfill operators impose a "gate fee" on waste brought to landfills in order to recover their costs. This service fee (usually EUR 20-25 per tonne) is paid on top of the waste disposal tax (about EUR 30 per tonne of non-hazardous waste as of 2015), with the revenue channelled to the operator.

A packaging excise tax was introduced in 1997 with rates depending on the packaging material. Plastic packaging and metal are taxed at the highest rate of EUR 2.5 per kg. There are a number of exemptions, notably for exported products. This tax is only payable by those organisations that fail to meet obligations to recover and recycle their waste as part of an extended producer responsibility (EPR) scheme; the rates are high to encourage compliance and most producers do comply (Hogg et al., 2014). Waste policies are further discussed in Chapter 4, while policies related to mining waste are discussed in Chapter 5.

Water abstraction

Estonia has a water abstraction tax covering abstraction of groundwater and surface water. Water abstraction is metered by users and reported quarterly. Rates vary considerably, depending on the type of water use, with preferential rates for some uses, notably mining. Agricultural irrigation (whose rates are low) is exempt from the tax, as is fish farming and hydropower generation.

The abstraction tax revenue is divided between the state and local government budgets. About 32% of the total revenue of EUR 13 million (2014) comes from the oil shale mining sector, related mostly to the pumping of groundwater from mines. Cooling water accounts for about 20% of the total water abstraction tax revenue, almost solely paid by oil shale-fired power plants in north-eastern Estonia (MoE, 2015b).

3.7. Fees for municipal water supply and sewerage services

A fee (water tariff) is paid for centralised water supply and sewerage services to recover their costs, in accordance with the Public Water Supply and Sewerage Act (1999). The tariff accounts for both water supply and sewerage services, is set per cubic metre of supplied water and based on actual consumption measured by water meters. This tariff for households rose by 77% over 2007-14 – from EUR 1.59 to EUR 2.80 per cubic metre. Households enjoy a slightly lower tariff than business users, but Estonia intends to harmonise these rates by 2021 (MoE, 2015b).

Water tariffs do not allow full cost recovery of municipal water supply and sewerage services. The cost recovery rate has been estimated at 86% nationally in 2014 (it is higher in Tallinn and Tartu). Local water and wastewater utilities receive significant subsidies from the EU Cohesion Fund (EUR 474 million in 2007-13), the EIC (EUR 98 million in 2007-13) and municipal budgets (MoE, 2015b).

3.8. Financial incentives for biodiversity protection

There are provisions for compensating private owners of protected forests, which cover 80 000 ha – one-third of the total protected area. Private owners have a right to compensation only with respect to Natura 2000 areas: EUR 110 per ha per year in conservation zones, EUR 60 per ha per year in limited management zones. In reality, only owners of 50 000 ha of protected forests have asked for such compensation. The compensation is financed by EU funds. In fact, Estonia has the biggest budget for support for Natura 2000 private forest land among EU Member States: EUR 28 million for 2014-20 (Ministry of Rural Affairs, 2014). The few owners of non-Natura 2000 protected forests demand equal compensation for forest management restrictions on their land.

Estonia is not considering other payments for ecosystem services. While the private nature tourism industry generates an annual turnover of EUR 10-15 million (Ehrlich, 2013), access to all protected areas, even on private property, is free in accordance to the commonly accepted Nordic principle of free access to nature.

4. Eliminating environmentally harmful subsidies

The OECD defines environmentally harmful subsidies as "a result of a government action that confers an advantage on consumers or producers, in order to supplement their income or lower their costs, but in doing so, discriminates against sound environmental policies" (OECD, 2003). As in other OECD member countries, environmentally harmful subsidies in Estonia exist in multiple forms. There are exemptions from excise taxes and reduced rates for certain users, including households, agriculture and fisheries, as well as tax breaks for company cars. The excise duty reduction for diesel fuel and light heating oil used for specific purposes amounted to EUR 74 million in 2011, decreasing to EUR 47.6 million in 2014, which corresponds to 9.3% of environmental tax revenues (OECD, 2015b). Peat and wood products used for heating are also exempted from the value added tax (VAT) and excise duty. In addition, according to the Ministry of Finance (2015), the free allocation of EU ETS emission allowances amounted to a subsidy for the energy sector of nearly EUR 74.5 million in 2014 (Section 3.3).

No comprehensive data exist on the extent or magnitude of environmentally harmful subsidies in Estonia. Developing such an assessment would provide robust evidence upon which to develop a clear approach to phasing them out.

Fossil fuels

Despite the removal of some exemptions[7] for oil shale and shale-derived products in recent years, the oil shale industry still benefits from government support. It is estimated that in 2014 support to producers of shale-derived oil amounted to more than EUR 4.8 million (OECD, 2015b). In 2011, support for oil shale-based electricity and heat production amounted to EUR 3.5 million (OECD, 2013a), which dropped to around EUR 170 000 in 2013 (OECD, 2015b).

The recent decline in oil prices represents an opportunity for Estonia to reduce fossil fuel subsidies with a relatively low impact on consumers (Section 3.4). It provides momentum to help alleviate some of the political obstacles in reforming subsidies, which are generally linked to public approval and vested interests (Benes et al., 2015). In addition, subsidy savings can be redirected towards investments in renewable sources and energy efficiency initiatives.

Company cars

Income tax breaks granted to employees for the use of a company car influence the composition of the vehicle fleet and the intensity of vehicle usage. Employees get two types of benefit from a company car: the benefit of not paying or paying lower fixed costs (purchase, insurance, registration, etc.) and the benefit of not having to cover variable costs (fuel, repairs, maintenance) (Harding, 2014). Lower fixed costs may encourage employees to choose a larger car, while lower variable costs may encourage them to drive more at zero marginal cost. These benefits may increase car ownership by households and hence the size of the vehicle fleet. All these factors have substantial negative impacts on the environment and on society (Harding, 2014; Roy, 2014).

A study of 27 OECD member countries showed that no tax system captures all the benefits enjoyed by employees with a company car; on average, countries tax only half these benefits in kind. Estonia is among the ten OECD member countries that capture the fewest taxable benefits of company cars. The non-business use of company cars is subject to a 50% VAT deduction (Estonia has received a derogation until the end of 2017 from an EU directive requiring such use to be subject to VAT).

Forestry

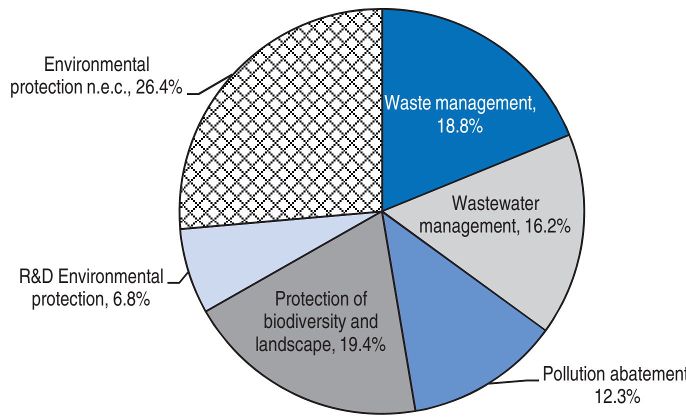
In addition to support for fossil fuels, Estonia has subsidies for agriculture, fisheries and forestry. Whereas VAT exemptions for forestry were abolished at the end of 2011, the sector continues to receive significant subsidies from domestic and EU sources. In 2012, the total domestic forestry support amounted to EUR 3.4 million, while the respective EU funding was EUR 8.7 million (MoE, 2015a). A substantial share of the funding is targeted at promoting sustainable forestry practices and forest protection, which cannot be regarded as an environmentally harmful subsidy.

5. Investing in the environment to promote green growth

5.1. Environment protection expenditure

Government expenditure on environmental protection rose from 0.7% to 0.9% of GDP between 2000 and 2012, just above the EU28 average of 0.8% (Eurostat, 2016b). As mentioned in Section 3.7, major public funds are provided for upgrading the municipal water supply and wastewater treatment infrastructure: 35% of the public expenditure accounts for waste and wastewater management (Figure 3.6). However, the share of environment in governmental expenditure increased from 1.5% in 2000 to 2.5% in the mid-2000s, then fell back to about 1.5% in 2014 (OECD, 2016d), mostly due to the decline in the revenue from the sale of surplus CO_2 credits (discussed below). The government-run green investment initiatives are described in Section 5.2.

Figure 3.6. **Distribution of environmental expenditure by the public sector, 2012**



Source: EUROSTAT (2016), *Environmental Protection Expenditure* (database).

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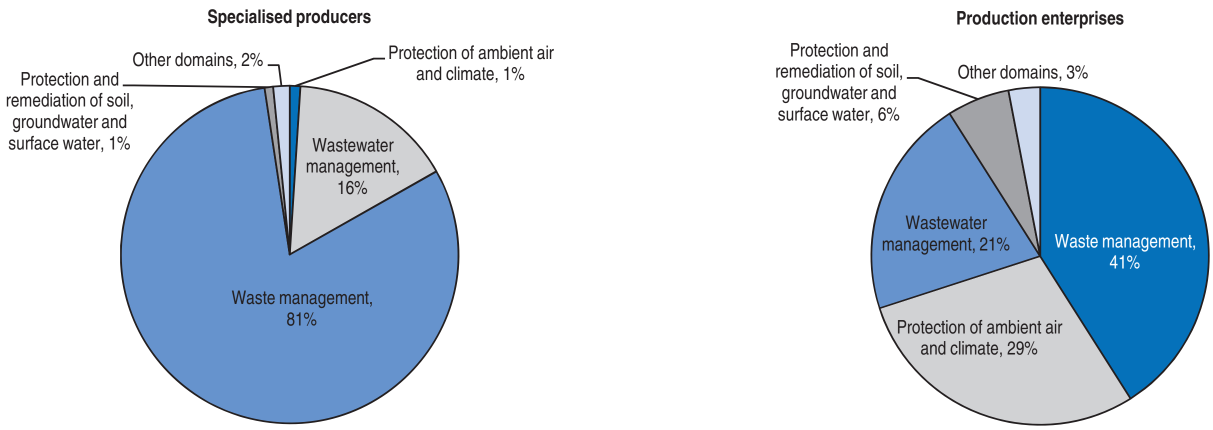
Between 2010 and 2013, pollution abatement expenditure by production enterprises more than doubled from EUR 135.4 million to EUR 298.6 million (with a 71% share of investments) (MoE, 2015a). Production enterprises tend to invest more in end-of-pipe installations (for the reduction of pollution already generated) and less in integrated technologies (for the prevention or reduction of the amount of pollution created at the source). Expenditures of environmental service providers ("specialised producers") also rose significantly: from EUR 547.1 million in 2008 (with a 17% share of investments) to EUR 620.4 million (with a 15% share of investments) in 2014 (Statistics Estonia, 2016).[8] Waste management accounts for the largest share of business sector expenditure (Figure 3.7).

5.2. *Green investment*

Estonia has a dedicated investment agency hosted by the Ministry of Economic Affairs and Communications that provides investment support for environmental projects: the EIC. Established in 2000, the EIC funds a range of environmental projects, including large-scale ones such as reconstructing or constructing combined heat and power plants, district heating systems, and onshore and offshore wind parks. In its 15 years of operation, the EIC has disbursed more than EUR 1.3 billion to support over 18 000 projects. In 2014, the EIC funded 956 projects under its Environmental Programme with EUR 44.1 million (EIC, 2015a). EIC grants and loans are financed from environmental pollution and natural resource taxes, EU structural funds and the sale of excess carbon credits.

Since 2010, the EIC has been the implementing agency for the Green Investment Scheme (Box 3.3), which channels revenue from the sale of surplus CO_2 credits available

Figure 3.7. **Distribution of environmental expenditure by the business sector, 2013**



Source: Country submission; Statistics Estonia (2016).

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Box 3.3. **Estonia's Green Investment Scheme**

The Green Investment Scheme is a financing mechanism that channels funds from the sale of surplus carbon credits (known as assigned amount units, or AAUs) available under the Kyoto Protocol. Between 2009 and the end of 2011, Estonia sold around 60 million AAUs. By October 2012, the value of total sales was nearing EUR 400 million – almost 1% of GDP for each of the three years the scheme had been in full swing.

The rules for AAU sales stipulate that all revenue raised from credit sales must be used to fund projects that lower greenhouse gas emissions. Revenues have funded projects to build wind farms, as well as combined heat and power installations. Projects have also aimed to improve district heating networks and energy efficiency in buildings, industry and transport.

Source: IEA (2013); EIC (2015b).

under the Kyoto Protocol ("assigned amount units", or AAUs) to environmental projects (EIC, 2015a). It is expected that projects financed through this scheme will reduce CO_2 emissions by 1.5 million tonnes over the next 20 years (IEA, 2013).

The financial management of EIC projects is regularly evaluated. However, environmental benefits of individual projects are assessed only with respect to certain EU funds, if required by the conditions of individual support schemes.

Investment in renewable energy

Estonia is actively promoting renewable energy, with subsidies for renewables increasing substantially from EUR 1.5 million to nearly EUR 65 million between 2004 and 2014 (MoE, 2015a). A feed-in-tariff scheme, introduced by the Electricity Market Act in 2007, applies to electricity produced from renewable energy or efficient combined heat and power (CHP). In 2015, 48% of total subsidies for electricity produced from renewable sources were expected to go to wind generators; 37% to electricity produced from biomass by power stations with capacity of more than 20 MW; and 14% to hydropower, electricity produced by small power stations and combustion of waste (Elering, 2015).

Initially, large projects (with installed capacity of over 100 MW) to produce renewable electricity were not eligible for the scheme, but this restriction ended in July 2009. This enabled the use of biomass in the Narva Power Plants to become eligible for support, which significantly increased the amount of subsidies under the support scheme (OECD, 2012b). Boosted by these subsidies, heat production from biomass in CHP plants has risen rapidly beginning in 2008 and reaching 1 400 GWh in 2013 (Kearns, 2015). Over 95% of electricity generated from biomass comes from subsidy-eligible CHP plants.

Subsidies for wind generation are limited to the first 600 GWh of electricity produced in a given year, an amount that Estonian wind farms already produce during a typical year. Although additional proposals for wind farms have been submitted, the economic viability of these projects is uncertain in the absence of additional subsidies (Kearns, 2015).

Overall, an estimated EUR 706 million was invested in renewable energy production in 2013, of which 78% came from private investors and around 22% came from Eesti Energia. Large shares went to wind (EUR 372 million) and biomass (EUR 293 million), with small amounts going to biogas, solar and hydro. In 2014, an additional EUR 55 million was invested in renewables (MoE, 2015a). Low oil prices can also discourage new investments in shale oil production (Chapter 5) and contribute to the uptake of renewable sources in the electricity system, presently dominated by oil shale.

Subsidies for renewable energy are financed, in part, by a renewable energy charge applied to electricity consumers. The transmission system operator Elering manages the subsidy system, tracking production of renewable-based electricity, billing consumers, delivering subsidies to producers and reporting to Statistics Estonia.

Draft amendments to the Electricity Market Act introduced in 2016 aim at aligning the scheme with the European Commission's new state aid guidelines in force since June 2014. A new bidding scheme would get new renewable electricity production capacities to the market starting in 2017. The support level would then be differentiated between existing and new producers: existing producers will keep receiving the current feed-in premium of EUR 53.7 per MWh (a payment on top of the market price), while newcomers will receive a feed-in premium with a capped total revenue of EUR 93 per MWh.

Investment in energy efficiency

According to the National Development Plan of the Energy Sector until 2030, the total 2016-19 funding needs for energy efficiency improvements are EUR 336 million in the housing sector, EUR 87 million in industry and street lighting, EUR 68 million in public sector buildings and EUR 45 million in district heating. Over 2014-20, the EU through its Cohesion Policy will invest some EUR 238 million in energy efficiency improvements in public and residential infrastructure, as well as in high-efficiency cogeneration and district heating in Estonia. This investment is expected to lower energy consumption in about 40 000 households (EC, 2015).

Estonia also had a small, but successful, loan programme to improve energy efficiency by renovating apartment buildings (IEA, 2013). It was funded through the sale of surplus carbon credits and implemented by Estonia's Credit and Export Guarantee Fund (KredEx) and Germany's KfW. In 2011, loans and grants under this initiative were estimated to have reduced energy use by an average of 40% (MoE, 2013). In 2014, 25 apartment associations used long-term loans from KredEx to finance renovations, totalling EUR 4.3 million; EUR 9.1 million was allocated to reconstruction grants for 97 apartment buildings (KredEx, 2015).

Overall, incentives for energy efficiency could be strengthened, in both heating networks and in buildings (OECD, 2015a). There is either no metering or inadequate metering in many district heating systems. The government's plan to introduce regulations to improve incentives for efficiency in heating networks by reducing losses to 15% by 2017 is a step in the right direction. The government has also proposed draft regulation that encourages the use of renewable biomass in district heating.

The Estonian real estate market is characterised by a high level of home ownership, with only a small rental market. Still, the government may need to provide tax incentives for landlords to invest in improving the energy efficiency of their residential properties (OECD, 2015a). In another issue of concern, some local governments have established district heat supply areas, in which customers cannot change the type of heat supplied unless they switch to renewable energy. This prevents customers from investing in economically justified high-efficiency alternatives (IEA, 2013).

Investment in sustainable transport modes

Investment in transport infrastructure represented 1.3% of GDP in 2013, more than the OECD average of 0.8%, but with more than half of it allocated to road infrastructure. Estonia has also invested significantly in modernising public transportation. Over 2005-12, close to EUR 430 million was invested in public transport services, including railways, buses and streetcars. The EU plans to invest EUR 232 million over 2014-20 in energy-efficient rail transport (including the Rail Baltica project) under its Cohesion Policy (EC, 2015).

Estonia's Electromobility programme supported the purchase of electric cars through KredEx, as well as the building of charging stations (167 of which have been installed as of early 2016, at 40-60 km from each other). The programme, deemed excessively costly, ended in 2015. KredEx disbursed around EUR 1 million for electric car subsidies in 2011 and around EUR 6.8 million in 2014 (KredEx 2015), amounting to over EUR 15 000 per car. However, clean vehicles accounted for less than 1% of new passenger cars purchased in 2013 (Eurostat, 2016c).

Biofuels were exempt from excise duties until July 2011; the value of the exemption reached a peak in 2010 at nearly EUR 85 million (Ministry of Finance, 2015). Since 2013, biofuel use in road transport has been subsidised under the Ambient Air Protection Act, which allocates EUR 43 million from the sale of AAUs to promote biomethane for road use (OECD, 2015c). The National Transport Development Plan aims to increase the share of alternative fuel vehicles to make biomethane or compressed gas generated from biomass the main alternative fuel in Estonia (OECD, 2015c). Estonian cities have also tried to promote alternative fuel use in transport. In 2011, the city of Tartu took part in the EU-supported Baltic Biogas Bus projects to promote biogas buses in urban public transport. However, to achieve the 2020 EU target of the 10% share of renewable energy sources in the transport sector, Estonia would need to step up efforts to promote blending of biofuels into regular motor fuel and the use of biogas.

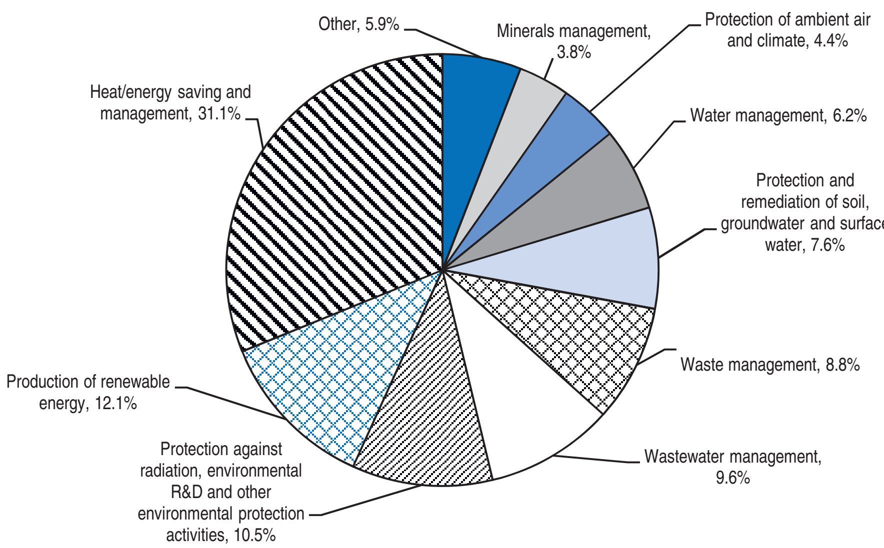
Support for environmentally friendly practices in agriculture

There are a number of environment-related payments under the 2014-20 Rural Development Programme, developed under the EU Common Agricultural Policy (Government of Estonia, 2014). It includes EUR 170 million for environmentally friendly agricultural practices (e.g. planning and management practices, awareness of environmental impact of different methods) and EUR 78 million for organic farming.

5.3. *Promoting green markets and jobs*

Producing environmental goods and services (EGS) generates growth and employment, while contributing to greener growth. According to a pilot study, the value added of the EGS sector accounted for almost 6% of GDP (EUR 732 million), compared to the EU average of 2.2% of GDP (Eurostat, 2016a; Statistics Estonia, 2016).[9] The study suggests that energy saving and management and renewable energy generation are the main contributors to the EGS sector, in terms of both value added and employment (Figure 3.8). In 2013, the share of direct and indirect renewable energy-related employment in Estonia's total employment was 0.71%, above the EU average of 0.53% (EC, 2015).

Figure 3.8. **The energy sector dominates green employment, 2010**



Note: "Other" includes noise and vibration abatement, minimisation of the use of fossil energy as raw materials; management of wild flora and fauna; R&D activities for resource management and other resource management activities; management of forest resources; and protection of biodiversity and landscapes.
Source: Statistics Estonia (2016), *Environmental Goods and Services Data.*

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The Estonian Commission on Sustainable Development reviewed the potential for green jobs in a report commissioned by the State Chancellery (Värnik et al., 2012). The report examined the types of jobs that would be considered "green" in four sectors (agriculture, forestry, construction and transportation) and concluded that better environmental education would contribute to the "greening" of jobs.

Public procurement can be a tool to boost a market for green products and services, as well as to promote environmentally friendly business behaviour. Governments can create demand by making it a condition of tendering for government contracts that the applicant commit to maintaining specified environmental standards up and down the supply chain. Among OECD member countries, the United States, Germany and Japan have been at the forefront in promoting green public procurement (GPP) by setting targets via the legal framework and issuing guidelines (OECD, 2013c).

The number of environmental friendly procurements in Estonia should rise from 6% to 15% between 2014 and 2018, according to the MoE Development Plan for 2015-18. This is significantly lower than the EU average of 26% of all public contracts satisfying the EU core GPP criteria (EC, 2012), which itself is way below the indicative 50% target the EU had set for 2010. To promote GPP in Estonia, training sessions for local government and specialists from state authorities explain the concept and procedures of environmentally sound procurement. An electronic platform is under development to increase the role of environmental criteria in the procurement process.

6. Promoting eco-innovation as a new source of growth

6.1. Overall innovation performance

Estonia's eco-innovation performance is below the EU average, ranking 19th among EU Member States in 2015. Estonia ranked higher than its Baltic neighbours Latvia and Lithuania, but lower than Western European and Nordic countries (Eco-Innovation Observatory, 2016). Since 2000, Estonia has been catching up with EU innovation leaders, building on strong economic growth and a well-developed information and communication technology (ICT) sector and strengthening its research and development (R&D) through market-oriented reforms (Eco-Innovation Observatory, 2016).

Over 2005-10, Estonia had one of the highest growth rates in gross domestic expenditure on R&D (GERD) in the OECD at 11.8% per year. At 1.74% of GDP in 2013, this is lower than the OECD average of 2.4%, but higher than the European average of 1.9% (OECD, 2015d). Business innovation remains below the OECD median in terms of R&D expenditure, the number of top firms, patents and trademarks (OECD, 2012c). R&D expenditures by businesses (BERD) almost doubled over the same period, increasing from 0.42% to 0.82% of GDP. R&D spending by business is highly concentrated in a limited number of high-technology sectors and firms: just 58 companies account for three-quarters of BERD (OECD, 2012c).

Framework for innovation

Estonia has no specific eco-innovation policy, but it incorporates eco-innovation measures into the strategic development plans of various ministries. For example, the National Development Plan of the Energy Sector until 2030 includes targets for the share of renewables in final energy consumption of 50% by 2030. At the same time, the Estonian Research and Development and Innovation Strategy 2014-20 "Knowledge-based Estonia" does not mention eco-innovation.

The economic impact of the Estonian R&D system appears to have been limited to date (EC, 2013; NAO, 2014b, 2013), spurring the government to reform innovation policies (Kapeller, 2015). Access to finance appears to be a limiting factor and many firms remain either unaware of R&D grants (Deloitte, 2015) or complain that the application is long and bureaucratic (Eco-Innovation Observatory, 2016). In addition, poor co-ordination between different ministries responsible for innovation in their respective areas has been cited as another problematic area (OECD, 2015e).

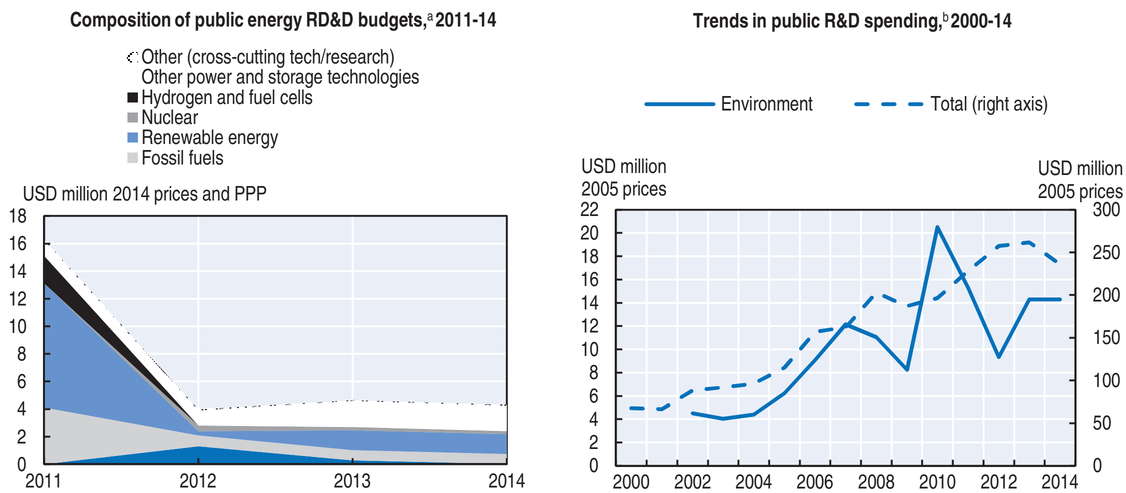
"Knowledge-based Estonia" puts "smart specialisation" at the heart of the R&D approach. ICT, healthcare and resource efficiency, among others, have been identified as having the greatest potential for adding value. By 2020, the strategy aims to increase total investment in R&D to 3% of GDP (and private R&D spending to 2% of GDP), and enhance labour productivity to 80% of the EU average (Ministry of Education and Research, 2014). Given current R&D levels, these targets may be difficult to achieve.

6.2. Eco-innovation performance

Although clean energy and environmental issues are increasingly important government priorities, Estonia still lags behind many EU countries in terms of eco-innovation. Estonia has managed to reach EU-28 average levels of eco-innovation inputs and activities, but is considerably behind on eco-innovation outputs, socio-economic outcomes and resource efficiency outcomes – key components determining overall performance (Eco-Innovation Observatory, 2016).

Public R&D spending allocated for the environment has followed the upward trend of public R&D spending since 2000; it peaked in 2010 due to considerable one-off investments in the oil shale industry (Figure 3.9). In 2014, Estonia ranked second among OECD member countries in terms of environment-related R&D as a share of total public R&D budgets (about 6%) (Annex 3.A2).

Figure 3.9. **Public R&D spending on the environment rose, while share for energy declined**



a) Government budgets for research, development and demonstration (RD&D).
b) Government budget appropriations or outlays for R&D; breakdown according to the NABS 2007 classification; environment: excluding R&D funded from general university funds.
Note: Data contain estimates.
Source: IEA (2015), IEA *Energy Technology and RD&D Statistics* (database); OECD (2015), OECD *Science, Technology and R&D Statistics* (database).

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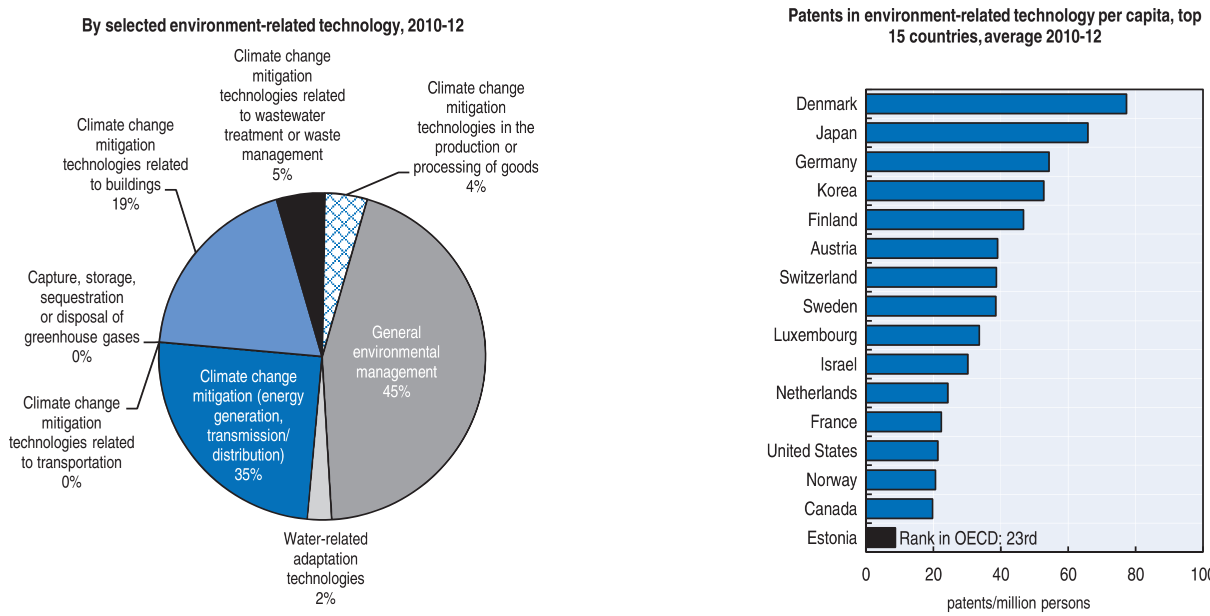
Among OECD member countries, Estonia has the lowest share of energy efficiency in total energy-related public R&D budget (Annex 3.A2) and ranks 23rd in terms of patents per capita for environment-related technologies (Figure 3.10). The share of environment-related technology in patent applications went from 0.7% in 2000-02 to 21.2% in 2010-12, exceeding the OECD average of 12% (OECD, 2016g).

The Estonian government stimulates business R&D and innovation with direct funding, as well as non-financial measures, such as awareness raising and award competitions. In addition to investments in environmental projects and promotion of entrepreneurship (discussed above), the Green Industry Innovation programme (co-financed by Norway) aims at increasing the competitiveness of green businesses and "greening" existing industries by optimising their process management, especially through the use of ICT. The most prominent examples of eco-innovation in Estonia are the use of novel ICT to optimise energy production, encourage energy efficiency and reduce waste (Eco-Innovation Observatory, 2016).

Figure 3.10. **Estonia lags behind many OECD member countries in green patents**



Note: Patent applications based on the priority date and the inventor's country of residence, and having sought protection in at least two jurisdictions (family size = 2 or more). The shares are computed out of the sum of the presented categories (the sum of the sub-components can be equal or higher than the total because patents can be classified in more than one category).
Source: OECD (2016), "Patents: Technology development", OECD *Environment Statistics* (database).

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A good example of efforts in the energy sector is the Estonian Energy Technology Programme. It involves multiple stakeholders to develop more efficient oil shale technologies and new energy resources, mainly renewables (OECD, 2012c). In 2011, the oil shale sector accounted for one-quarter of public R&D expenditures before declining to 17% in 2014 (IEA, 2016). Innovation policy is also a main driver of the Electromobility programme (Section 4.2).

The EU supports investments to increase the competitiveness of small and medium-sized enterprises (SMEs) in Estonia, focusing on resource efficiency. It has allocated over EUR 145 million under its Cohesion Policy for R&D and adoption of low-carbon technologies across the SME community (EC, 2015).

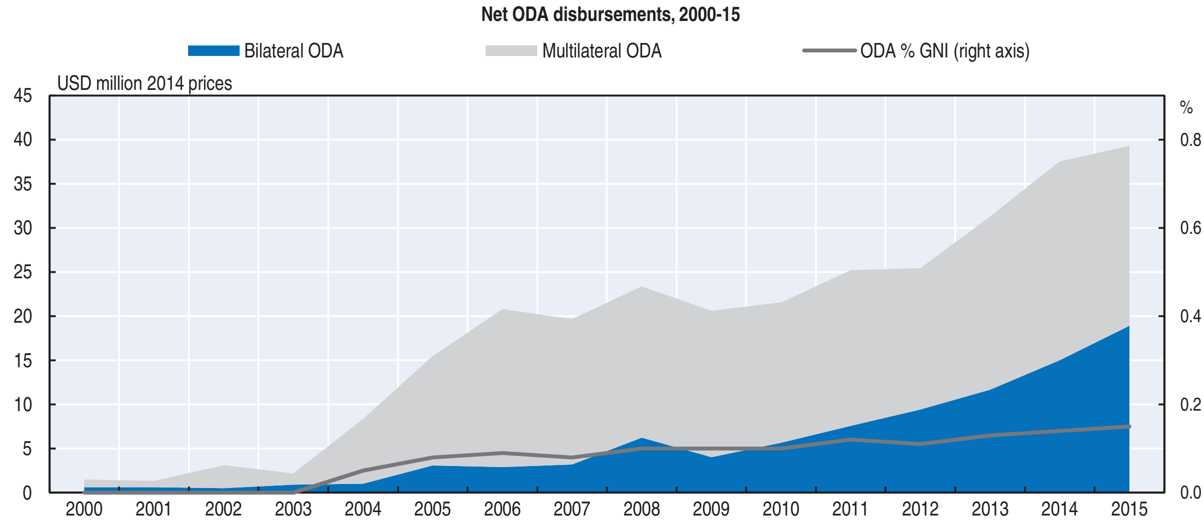
Eco-innovation in Estonia could be enhanced on a number of fronts. For instance, there is significant potential to strengthen the focus on energy efficiency: in 2014, only a tiny share of public R&D for energy went to energy efficiency (Annex 3.A2). In addition, access to finance could be improved by raising firms' awareness about existing instruments and reducing their administrative complexity. Green public procurement could be strengthened to provide demand-side stimulus. Better co-ordination among ministries on eco-innovation could reduce duplication and reinforce the impact of current efforts.

7. Environment, trade and development

7.1. Development co-operation

Estonian's net official development assistance (ODA) has increased steadily since 2000 (Figure 3.11). In 2014, ODA reached USD 38 million with the ratio of ODA as a share of gross national income (GNI) rising to 0.15% in 2015, up from 0.14% of GNI the previous year. Estonia intends to continue this steady increase of development co-operation and to advance its status and role among other international donors.

Figure 3.11. **Estonia's net ODA has grown steadily since 2000**



Source: OECD (2016), *International Development Statistics* (database).

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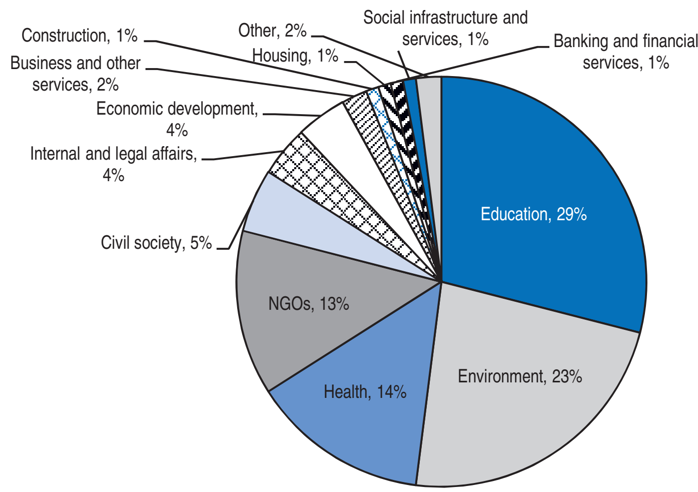
The Ministry of Foreign Affairs manages Estonia's development co-operation. The Strategy for Estonian Development Co-operation and Humanitarian Aid for 2011-15 sets out detailed objectives, as well as sectoral and geographic priorities (OECD, 2015e). Fostering environmentally friendly and sustainable development is one of the five strategic goals of Estonian development co-operation, while other areas cover civil society, good governance, health and education. Bilateral assistance has been mostly provided to Afghanistan, Georgia, Moldova and Ukraine, often in the form of small-scale technical co-operation projects (OECD, 2015e). Estonia is an observer to the OECD Development Assistance Committee (DAC).

Environment-related bilateral ODA accounts for only a small share of Estonian ODA – USD 0.8 million in 2014 and USD 1.2 million in 2013 (in constant 2014 prices) based on data reported to the OECD DAC International Development Statistics database. However, a study of Estonia's development co-operation commissioned by the EU noted that infrastructure projects related to the environment accounted for around a quarter of Estonia's bilateral development over 1998-2012 (Figure 3.12). In addition, the Ministry of the Environment donated over EUR 1.6 million in 2012 to the United Nations Environment Programme for Strengthening Climate Change Adaptation in Rural Communities for Agriculture and Environmental Management in Afghanistan (Rozeik, 2013).

7.2. Export credits

KredEx, the Estonian export credit guarantee agency, helps Estonian firms to develop more quickly and expand into foreign markets by providing loans, venture capital, credit insurance and guarantees. It is financed largely by EU structural funds. To support investments in energy efficiency and renewable energy, KredEx provides loan guarantees, mainly for rebuilding houses and improving their energy efficiency, as well as grants for installing renewable energy generation in private households (solar panels, wind generators). A recent evaluation shows that KredEx funding has a positive impact on the performance of receiving companies, in terms of company size, exports, profitability and labour productivity (Vicente, 2014). Estonia backs the 2012 OECD Recommendation on

Figure 3.12. **Environmental projects accounted for a large share of bilateral support for infrastructure, 1998-2012**



Source: Rozeik (2013).

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Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence. However, by 2016, KredEx had not developed a webpage for environmental and social due diligence and had yet to screen any transactions falling under the Common Approaches (OECD, 2016c).

Enterprise Estonia (EAS) provides grants to support the development of export-capable enterprises that create additional value, including those in the environmental sector. Over 2008-12, EAS awarded close to EUR 60 million in grants to 179 projects under the technology investment programme for industrial firms (MoE, 2015a). An evaluation of the impact of the EAS grant scheme shows that grants are more likely to be given to relatively large, successful and young exporting firms (Vicente and Kitsing, 2015). The study also finds evidence that receiving one or more EAS grants has a strong effect on a firm's performance, as measured by the number of employees, sales revenue, labour costs and gross profits.

7.3. WTO Environmental Goods Agreement

Estonia, as an EU Member State, is taking part in negotiations for a multilateral Environmental Goods Agreement (EGA) within the framework of the World Trade Organization. The EGA would seek to gradually eliminate import duties on a list of goods that help monitor or improve the environment. Several goods considered for inclusion in the list are used to generate renewable energy or to improve energy efficiency.

Recommendations on green growth

- Continue green tax reform by further shifting the tax burden from labour towards environmentally harmful activities without increasing the overall tax burden on the economy; regularly evaluate its economic impact; focus air and water pollution taxes on a limited number of priority pollutants whose emissions or discharges are monitored; increase the tax rates for these pollutants to provide a real incentive for their abatement;

Recommendations on green growth *(cont.)*

develop a methodology for setting resource extraction tax rates based on the value of extracted resource; expand the use of economic instruments for biodiversity protection, including payments for ecosystem services.

- Raise and adjust tax rates on negative environmental externalities of energy production and use, including the tax on CO_2 emissions for sectors not already covered by the EU ETS; set tax rates for diesel at least at the same level as for petrol; strengthen incentives for energy efficiency in both heating networks and buildings by broadening the use of metering and introducing penalties for heating network operators when they fail to meet heat loss targets.
- Consider introducing policy measures to address the environmental damage from road transport via a road pricing system or taxes on motor vehicles adjusted to reflect the environmental characteristics of the vehicle; continue investments in the use of biofuels in motor vehicles; eliminate fiscal incentives for the use of company cars.
- Develop a comprehensive assessment of the extent and magnitude of environmentally harmful subsidies and set priorities for phasing them out; continue to phase out exemptions and preferential rates (of energy excise taxes, water abstraction taxes, resource extraction taxes, etc.) for certain economic sectors, such as agriculture.
- Monitor the effectiveness of the Environmental Investment Centre and other investment support schemes to ensure they support government priorities, add value in addressing environmental problems and reflect the principles of sound public finance.
- Strengthen eco-innovation by improving access to finance by raising firms' (in particular SMEs') awareness about existing support mechanisms and reducing their administrative complexity; improve co-ordination between government institutions, enterprises and academia on research and development; enhance green public procurement by expanding the range of procurement categories with green purchasing criteria and designating and training procurement officials in public institutions on effective use of such criteria.

Notes

1. The plan superseded the National Development Plan of the Energy Sector until 2020, adopted in 2009.
2. OECD defines environmentally related taxes as any compulsory, unrequited payment to general government levied on tax bases deemed to be of particular environmental relevance (e.g. energy use, motor vehicles, measured emissions, hazardous chemicals). In Estonia's Environmental Charges Act, an "environmental charge" is defined as "the price of the right of use of the environment". Such charges are regarded as taxes under the OECD definition and will be referred to as taxes in this report.
3. As of 1 January 2014, the tax rate for petrol in Estonia is EUR 422.77 per 1 000 litres compared to the EU minimum rate of EUR 359 per 1 000 litres. The tax rate for diesel is EUR 393.92 per 1 000 litres compared to the EU minimum rate of EUR 330 per 1 000 litres (Ministry of Finance, 2015).
4. Exemptions for the forestry sector were abolished at the end of 2011.
5. OECD (2013c) discussed effective carbon prices that different economic sectors face within and across countries. They arise either explicitly via carbon taxes or emissions trading systems, or implicitly, via the abatement incentives embedded in other policies that influence greenhouse gas emissions. Figure 3.2 illustrates the effective carbon rates applied in Estonia. These *rates* combine information about explicit carbon taxes, other taxes on energy products (taking into account the average carbon content of each fuel) and the prices of emission allowances in the EU's Emissions Trading System for greenhouse gases.

6. The OECD defines an energy-poor household differently – as one where more than 10% of household disposable income is allocated to energy expenses (OECD, 2015a).
7. For example, oil shale used for heat production in district heating was not subject to excise duty payments between 2005 and 2010. Shale-derived fuel oil used for heat production in district heating has not benefited from a tax exemption since the end of 2007.
8. Statistics Estonia collects data on production enterprises' pollution abatement expenditures using a sample survey. Data on environmental protection expenditures of environmental service companies ("specialised producers") are derived from the annual enterprise questionnaire administered by Statistics Estonia. The expenditure data for the two subsectors cannot be summed up because of the double counting of payments by production enterprises for environmental services.
9. Official statistics for the EGS sector are not available. Statistics Estonia is beginning to collect data on EGS, as required by the European Environmental Economic Accounts Regulation (No. 691/2011). The data for 2014 are scheduled to be published in 2017.

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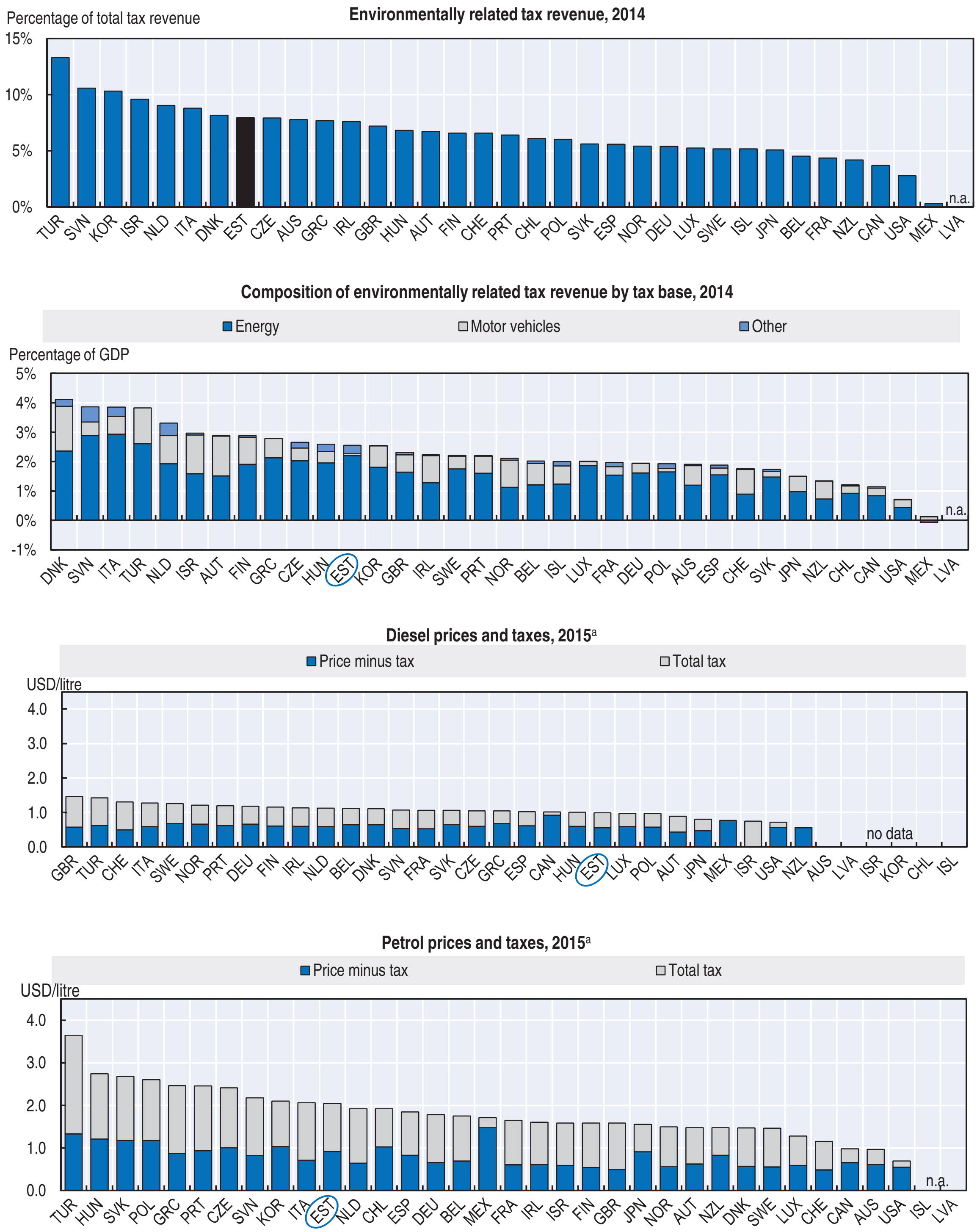
ANNEX 3.A

Data on green growth performance

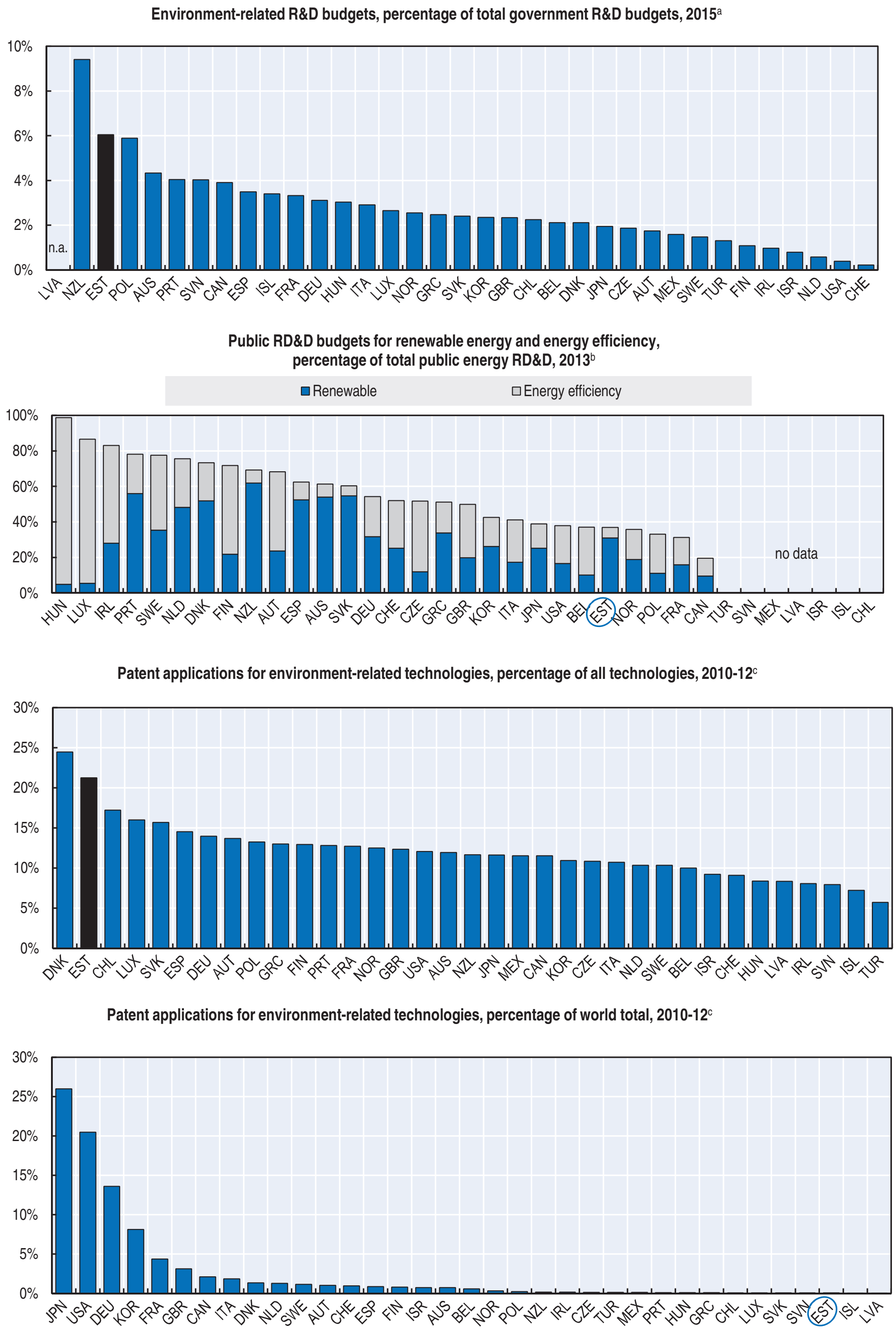
Figure 3.A1. **Environmentally related taxes**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.
a) Diesel: automotive diesel for commercial use, current USD; petrol: unleaded premium (RON 95), except Japan (unleaded regular), USD at current prices and purchasing power parities.
Source: IEA (2016), *IEA Energy Prices and Taxes Statistics* (database); OECD (2016), "Database on Instruments Used for Environmental Policies and Natural Resources Management", OECD *Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448673

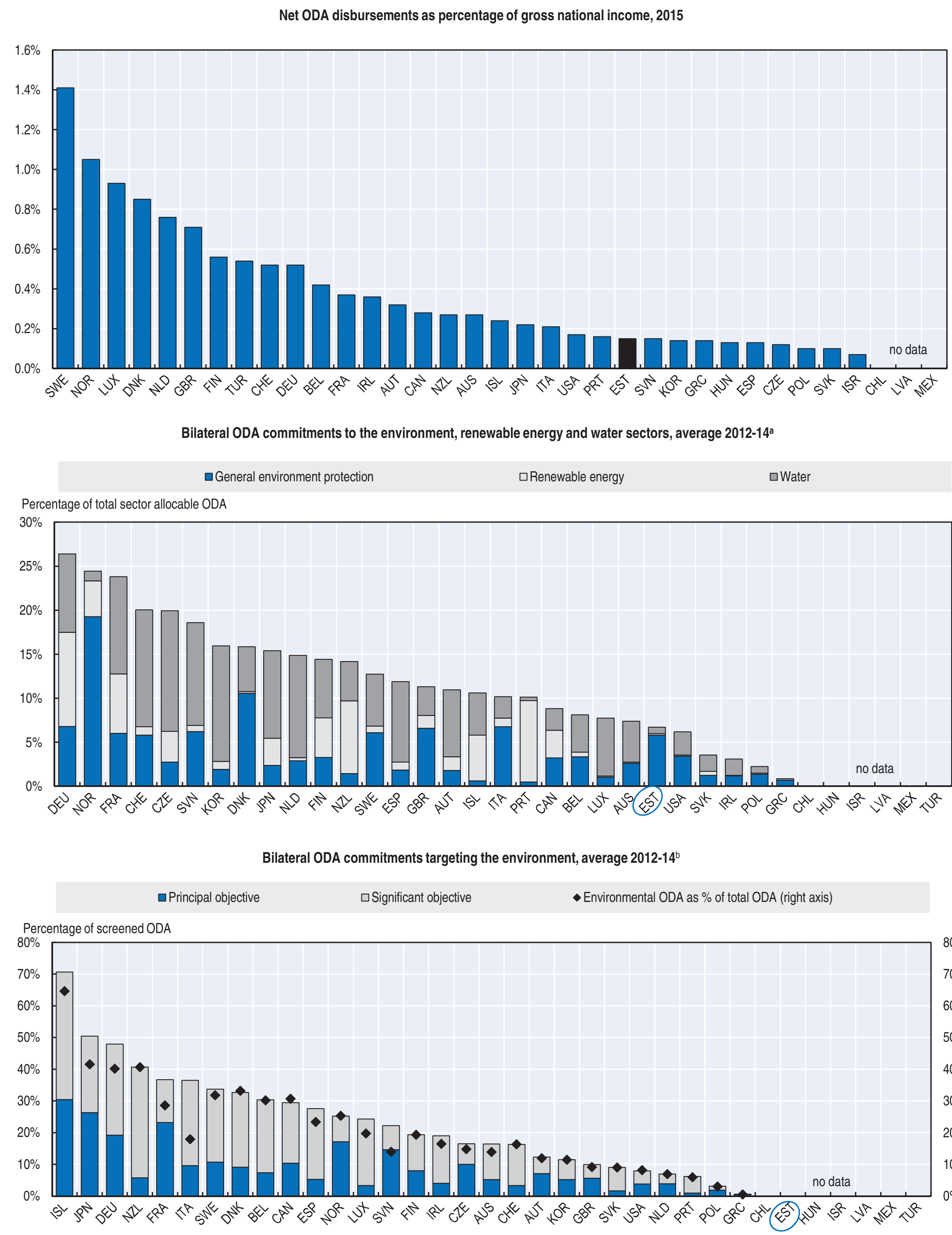
Figure 3.A2. **Green Innovation**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.
a) Government budget appropriations or outlays for research and development (R&D); breakdown according to the NABS 2007 classification.
b) Public energy technology budgets for research, development and demonstration (RD&D).
c) Patents: higher value inventions that have sought patent protection in at least two jurisdictions (family size: two or more). Data are based on patents applications and refer to fractional counts of patents by inventor's country of residence and priority date.
Source: IEA (2016), *IEA Energy Technology RD&D Statistics* (database); OECD (2016), *Government budget appropriations or outlays for R&D* (database); OECD (2016), "Patents: Technology development", OECD *Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448683

Figure 3.A3. **International development co-operation**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. CHL, EST, HUN, ISR, LVA, MEX, and TUR are not members of the OECD Development Assistance Committee and report on voluntary basis, thus data may not always be available, or may be partial.

a) Renewable energy includes power generation/renewable sources; hydro-electric power plants; geothermal, solar, wind and ocean energy; biofuels-fired power plants.

b) Activities are classified as "principal" when environment protection is a primary objective and "significant" when it is an important but secondary objective.
In comparing data across countries it should be noted that the coverage ratio of the environmental policy objective (i.e. the proportion of aid which is screened against the environment policy marker) varies considerably among countries; low coverage rates can increase significantly the shares of environmental-focused aid.

Source: OECD (2016), *OECD International Development Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933448690

PART II

Progress towards selected environmental objectives

PART II

Chapter 4

Waste and materials management

Estonia has successfully undertaken a major transition in municipal solid waste management, from heavy reliance on landfilling to energy recovery through incineration. However, it is unlikely to reach its recycling targets, and managing high volumes of hazardous waste from combustion and processing of oil shale remains an important challenge. This chapter provides an overview of trends in waste generation and material consumption, related policy and institutional frameworks, and analyses Estonia's policies for managing major waste streams and its steps in promoting a circular economy.

1. Introduction

Estonia has one of the most resource-intensive economies in the OECD. The mining of oil shale and its subsequent combustion for heat and power or its refining into oil products require high volumes of mineral resources. This, in turn, generates large amounts of waste, much of which is hazardous.

Joining the European Union (EU) in 2004 has brought significant changes to Estonia's legal and policy framework for waste management. These comprise new standards for waste facilities, including landfills, as well as ambitious targets for recycling. National waste policies make it a priority to achieve the EU objectives of reducing landfilling of municipal solid waste (MSW) and to increase the country's recycling and composting. Over the review period, Estonia has made major changes in the collection and treatment of MSW. The construction of an incinerator near Tallinn, for example, has significantly reduced landfilling.

As a small, open economy, Estonia imports and exports relatively high volumes of some waste streams for treatment and recycling. For example, it sends paper and plastic abroad and imports lead-acid batteries from other Baltic countries.

2. Objectives, policies and institutions

2.1. Policy framework for waste management

Since 2005, Estonia has gone through three cycles of waste management plans, which provide overall policy direction. The first National Waste Management Plan (NWMP), which covered 2003-07, sought primarily to organise "environmentally safe, flexible, institutionally granted and economically justified waste management on all levels". The plan started a major transformation of Estonia's waste sector, particularly in light of the country's accession to the EU; the transposition and implementation of EU waste legislation was a major focus of this plan. The plan (MoE, 2002), which identified waste prevention and waste recycling as broad goals, had several specific objectives:

- Halt the increase in the generation of municipal solid waste per capita (by 2006).
- Halt the increase in the generation of packaging waste (by 2006).
- Increase the reuse of sewage sludge in agriculture and degraded land.

Estonia achieved the first and third objectives (Section 3.2). The generation of packaging waste continued to increase, however, despite the introduction of extended producer responsibility (EPR) for this waste stream (Section 4.3).

The main objectives of the second NWMP (MoE, 2008b), which covered 2008-13, were to reduce the amount of waste disposed in landfills, increase the recovery of waste and reduce the hazard level of waste in order to reduce negative impacts on the environment. In pursuing these objectives, the second plan sought to implement the EU "waste hierarchy" – promoting waste prevention, recycling and recovery, and then reducing the amount of waste deposited in landfills. A further broad objective was to decouple environmental impacts from economic growth. The plan contained a number of specific targets, many of which were taken from the EU (Table 4.1): by and large these have been achieved. Estonia has reduced waste sent to landfills and increased waste recovery; with regard to the third objective, however, there is no clear evidence that Estonia has achieved significant reductions in the level of hazard of waste.

Table 4.1. **Estonia has met key targets set in the 2008-13 NWMP**

Waste stream and treatment	Level in 2005 %	Target for 2013 %	Achieved	EU objective
Increase in total waste recovered	30	50	✓	No
Non-compliant hazardous and industrial waste landfills brought into compliance	83 (2007)	100	✓*	Yes
Non-compliant non-hazardous waste landfills brought into compliance	91 (2007)	100	✓*	Yes
Reduction in biodegradable municipal waste to landfills	50-60 (2004)	30	✓	Yes***
Increase in the recovery and recycling of packaging waste	Recovery: 41; Recycling: 40	Recovery: 60; Recycling: 55-80	✓**	Yes

* Achieved in 2015.
** Achieved according to data reported.
*** Estonia's target was more ambitious than the EU target.

The third NWMP plan runs from 2014 to 2020 and contains three strategic objectives. One objective is to increase waste recycling and reuse: here, the NWMP sets out a series of targets (Table 4.2), again linked to those established in EU legislation. Another objective is to reduce environmental risks from waste, including via improvements in monitoring and enforcement: priority areas include completing closure work for 17 remaining landfills and reducing illegal waste disposal.

Table 4.2. **The NWMP 2014-20 contains further targets**

Selected targets in the NWMP 2014-20

Waste stream and treatment	Level in 2011 %	Target for 2020 %	EU objective
Increase in share of paper, metal, plastic and glass from households reused or recycled	27	50	Yes
Reduction in biodegradable municipal waste to landfills	57	20	Yes*
Increase in biodegradable municipal waste recycled (composted)	5	13	No
Increase in construction and demolition waste recovered	72	75	Yes*
Increase in the recovery and recycling of packaging waste	Recycling: 56*	Recycling: 60	Yes

* Estonia's national target goes beyond the EU target.
Source: Country submission.

A third broad objective is to promote waste prevention and reduction, as well as to reduce both the level of hazard of waste and greenhouse gas (GHG) emissions from waste disposal. The NWMP 2014-20 contains Estonia's Waste Prevention Programme, which sets a broad objective of decoupling economic growth and waste generation and stipulates three targets:

- Up to 2020, growth in the generation of MSW should remain below half of the gross domestic product (GDP) growth rate.
- Up to 2020, growth in the generation of packaging waste should remain below two-thirds of the GDP growth rate.
- After 2020, there should be no further increase in the generation of MSW, irrespective of economic growth.

The first NWMP was accompanied by waste management plans at the county and local levels. In 2008, the system was simplified by eliminating county plans. Local plans are still required; they should follow the provisions of the NWMP, focusing on approaches for the collection, sorting and transport of municipal solid waste (EEA, 2013a).

The NWMPs have evolved, with the first one providing general goals, and the second and third setting more quantitative targets. The plans cite policy mechanisms for their implementation, including new regulatory requirements and funding, such as EU funds. Nonetheless, several key policy decisions affecting waste management have been taken outside the plans. For example, the national government increased the waste disposal tax starting in 2005: this action, which was not foreseen in the first NWMP, had important effects on waste treatment investments. In addition, the third NWMP sets out the EU's 2020 recycling targets for paper, metal, glass and plastic, but does not provide clear policy instruments or a pathway to achieve them (Section 4). As the national plans have not set out detailed mechanisms for their implementation, they do not provide clear guidance for local plans.

Other national policy documents also contain objectives for waste management. Notably, Estonia's Environmental Strategy 2030, released in 2007, calls for a reduction of total waste to landfills by 30% by 2030; this goal is reiterated in the National Environmental Action Plan for 2007-13.

2.2. Legal framework

Estonia's 2004 Waste Act is the central piece of legislation governing waste management. The act specifies obligations for the main actors involved in waste management, establishes procedures for waste permits and includes provisions for fines and other penalties. It also establishes EPR for specific waste streams and provides a legal framework for the establishment of producer responsibility organisations (PROs; Section 4.3). This act, moreover, transposes the EU Waste Framework Directive (2008/98/EC) and its principles. This includes the "proximity principle" (recovery and disposal of mixed municipal waste should occur as close as possible to the source) and the "waste hierarchy" (priority to prevention, then reuse, recycling, other recovery and disposal).

Landfills are governed by the Waste Act and a 2004 Regulation of the Minister of Environment, which transpose the EU's Landfill Directive (1999/31/EC). Two acts establish the main requirements for packaging waste: the 2004 Packaging Act and the 1996 Packaging Excise Duty Act. The two together transpose the EU Directive on Packaging and Packaging Waste (94/62/EC).

Overall, EU legislation sets the framework for waste management policy and legislation in Estonia. As noted in Table 4.1, many of the quantitative targets set in the NWMPs are established in EU law. In some cases, such as the recovery of construction and demolition waste, national targets have gone beyond those set by the EU.

2.3. Resource efficiency and circular economy policy

In 2015, Estonia's government set an overall target to increase resource productivity by 10% to 0.46 EUR/kg by 2019 (MoE, 2015a). A series of specific objectives has been set in national and sectoral policy documents (Table 4.3). The Estonian Entrepreneurship Growth Strategy 2014-20 defines more efficient use of resources as one of three priority growth areas.

In addition, Estonia's Multiannual Financial Framework 2014-20 for the use of EU structural funds includes plans to support resource efficiency in enterprises (Ministry of

Table 4.3. **Several policy documents set objectives for resource efficiency and material productivity**

Date published	Document	Key objectives
2007	*Environmental Strategy 2030*	Achieve a low energy and low resource-intensity economy by 2020 Use technology to improve resource efficiency
2007	*Development Plan for Enhancing the Use of Biomass and Bio-energy 2007-13*	Increase biomass use and bioenergy production, including biogas for transport Prevent waste Increase recycling of oil shale waste and demolition waste
2008	*National Development Plan for the Use of Oil Shale 2008-15*	Enhance efficiency in the extraction and use of oil shale
2011	*National Development Plan for the Use of Construction Minerals 2011-20*	Enhance efficiency in extraction and use of construction materials
2011 (updated 2014)	*National Reform Programme, Estonia 2020*	Increase resource efficiency, including via the use of environmental taxes and public funding
2015	*National Reform Programme: Action Plan for 2015-20*	Map resource efficiency opportunities Carry out research and development on resource efficiency Support energy and resource efficiency in companies Incorporate resource efficiency considerations in public procurement
2016	*National Development Plan for the Use of Oil Shale 2016-30*	Increase efficiency of oil shale extraction and reduce negative impacts Increase efficiency of oil shale use and reduce negative impacts Carry out research and development for oil shale

Finance, 2014). The National Reform Programme "Estonia 2020": Action Plan for 2014-18 calls for programmes to increase resource efficiency. In response, the Estonian government plans to allocate about EUR 100 million from EU structural funds in the 2014-20 programming period to support energy and resource efficiency in companies. The funding will be used first to train national energy and resource auditors and then to carry out initial and detailed audits in selected companies. First projects are expected to be launched in 2016 and would focus on key sectors with high energy or resource use, including mining, timber, pulp and paper and food processing. If well managed, these investments could play an important role in improving resource efficiency. It will be important to ensure strong monitoring of their progress and results. For the oil shale sector, ongoing research and development into methods to reuse waste from oil shale mining and use could also play an important role in improving resource efficiency.

Estonia thus has an overall quantitative target for resource efficiency and sectoral plans to address the major resource-intensive sectors. Diverse policy documents support the target. In addition, efforts to improve waste recovery and recycling will contribute to this target. In April 2016, the government expressed support for the circular economy package of the European Commission (EC, 2015). However, the notion of circular economy is still very new in Estonia: policy initiatives have only started to prioritise this area specifically. The lack of a comprehensive policy framework for circular economy is a barrier to achieving sustainable use of resources throughout the entire product value chain. An overall policy strategy for material productivity and resource efficiency would strengthen co-ordination of efforts across different sectors.

2.4. Institutional arrangements

Estonia's Ministry of the Environment (MoE) is the central institution responsible for the policy and regulatory framework for waste management. The ministry elaborates national strategies and plans, and prepares the legislation. It also takes prime responsibility for material management and resource efficiency; a range of government ministries and other bodies work in this area, focusing on specific sectors such as mining and biomass.

Municipal governments organise municipal solid waste collection, transport and treatment in their territories. Municipalities contract waste collection and transport to private companies and oversee their operations. Municipalities prepare waste management plans, either individually or in collaboration with neighbours.

The Environmental Investment Centre (EIC) uses revenue from environmental taxes to fund investment projects, including those for waste management (Chapter 3). The EIC also manages Operational Programmes under the EU Cohesion Policy: these programmes have supported investments in waste management and, in the 2014-20 programming period, in resource efficiency.

The Environmental Inspectorate is the lead body for enforcement of waste legislation, reviewing documents from waste handlers and inspecting waste facilities and waste shipments. Local governments oversee compliance with MSW collection and treatment requirements within their mandate and territories. The Environmental Board issues waste permits and monitors their implementation, and the Environmental Agency collects information and data on waste and waste treatment (Chapter 2).

The private sector plays an important role in waste management. As noted above, municipalities contract private waste management companies for MSW collection and transport. In late 2015, three main private waste companies provided MSW collection and transport services. Private and municipally owned companies have built and own key treatment facilities for MSW, including an incinerator, mechanical-biological treatment (MBT) facilities and landfills. Private companies also own or operate key facilities for hazardous and industrial waste. Other facilities are owned by municipalities, although many are operated by waste companies (both private and municipally owned). Some of Tallinn's recycling centres are operated by a non-profit organisation set up by the municipal government.

3. Trends in material consumption and waste generation

3.1. Material consumption and resource productivity

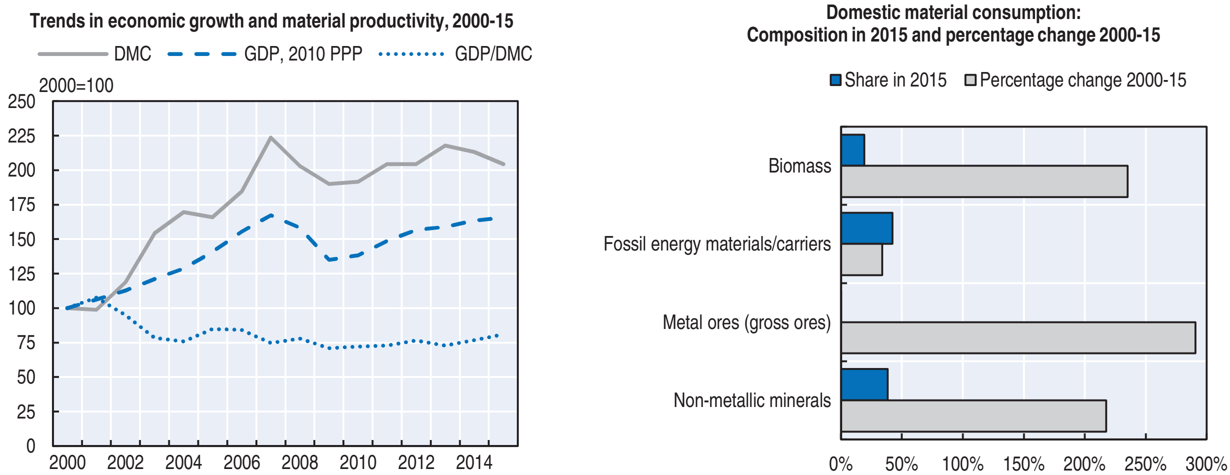
In 2015, Estonia's economy had domestic material consumption (DMC) of 30 tonnes (t) per capita. Between 2000 and 2015, the material productivity (GDP/DMC) of Estonia's economy decreased by 19 percentage points, as DMC grew faster (104 percentage points) than real GDP (65 points) (Figure 4.1).

Consumption of non-metallic minerals and fossil fuels and their derivatives largely dominates the DMC. Oil shale makes up the lion's share of the fossil fuels component, although peat and natural gas are also used. The consumption of fossil fuels grew by 30% between 2000 and 2015. The consumption of non-metallic minerals such as sand and gravel accounts for the other major share of DMC: 38% of the total in 2015. Consumption of non-metallic minerals rose by over 200% between 2000 and 2015 due to a boom in private and then public construction projects.

The third largest component of DMC – biomass – represented 19% of the total in 2015. The consumption of biomass rose by 240% from 2000 to 2015, driven in particular by wood used for energy. Consumption of metal ores was under 1% of total DMC in 2015 (Figure 4.1).

The material productivity of Estonia's economy is among the lowest of OECD member countries, at 0.95 USD/kg in 2015 (Annex 1.C); this is mostly because Estonia relies heavily on domestic oil shale with low energy content.

Figure 4.1. **Estonia's material productivity has declined since 2000**



Source: Eurostat (2016), *Material Flows and Resource Productivity* (database); OECD (2016) *National Accounts.*

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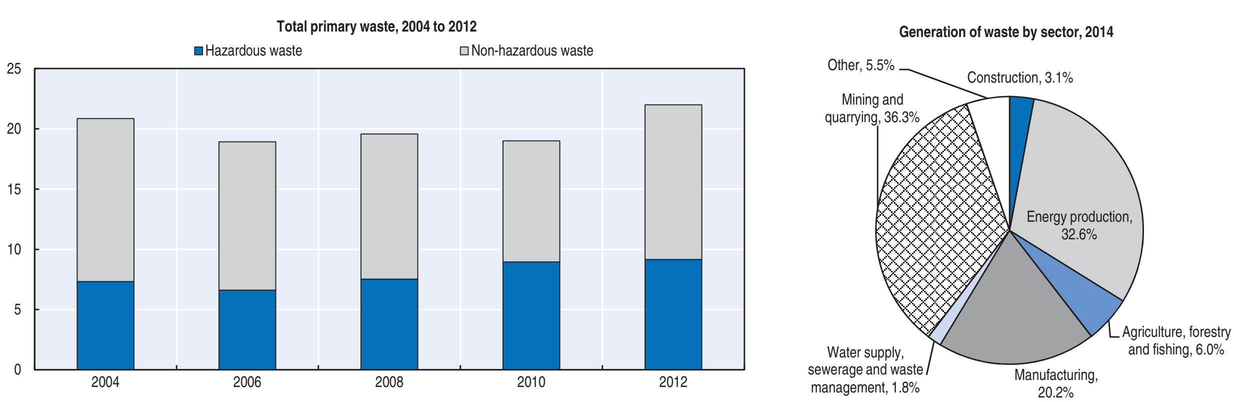
3.2. Waste generation and treatment

In 2014, Estonia generated about 22 million t of waste. Mining and quarrying (36% of the total), energy (33%) and manufacturing (20%) are the macro-sectors that produce the largest amount of total waste (Figure 4.2).

Waste from mining, refining and combustion of oil shale dominates total waste generation, accounting for about 83% of Estonia's total primary waste in 2012 (MoE, 2015a). The mining of oil shale represents the lion's share of mining and quarrying waste, while ash from its combustion is by far the largest component of energy production waste. Moreover, the great majority of manufacturing waste comes from the refining of oil shale into oil products.

Figure 4.2. **Mining and energy production generate most waste, hazardous waste generation grows**



Source: Eurostat (2016), *Generation of Waste* (database); OECD (2016), "Generation of Waste by Sector", OECD *Environment Statistics* (database).

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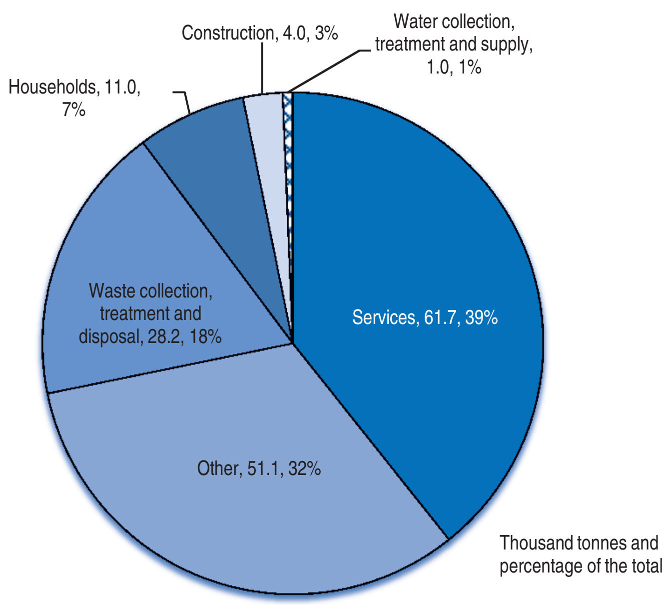
Hazardous waste

A large share of primary waste is classified as hazardous: 9.2 million t in 2012, or 42% of primary waste. Estonia's hazardous waste generation per capita is the highest in the EU, 35 times above average (Eurostat, 2016). The combustion and refining of oil shale account for more than 90% of hazardous waste. In 2012, the power sector produced just over two-thirds of the total, about 6.2 million t, comprised almost entirely of the ash from the combustion of oil shale. Petroleum refining produced almost one-third of total hazardous waste, 2.8 million t, almost entirely due to the refining of oil shale (Eurostat, 2016). The generation of hazardous waste increased from 2006 to 2012, mainly due to higher levels of oil shale refining.

Other sectors accounted for only 157 000 t of hazardous waste in 2012 (Eurostat, 2016). The services sector provided the largest share (39%), followed by the waste sector (18%), in particular ash from waste combustion at the Kunda cement plant (Figure 4.3).

Figure 4.3. **Services and waste management generate most hazardous waste outside the oil shale sector, 2012**



Source: Eurostat (2016), *Generation of Waste* (database).

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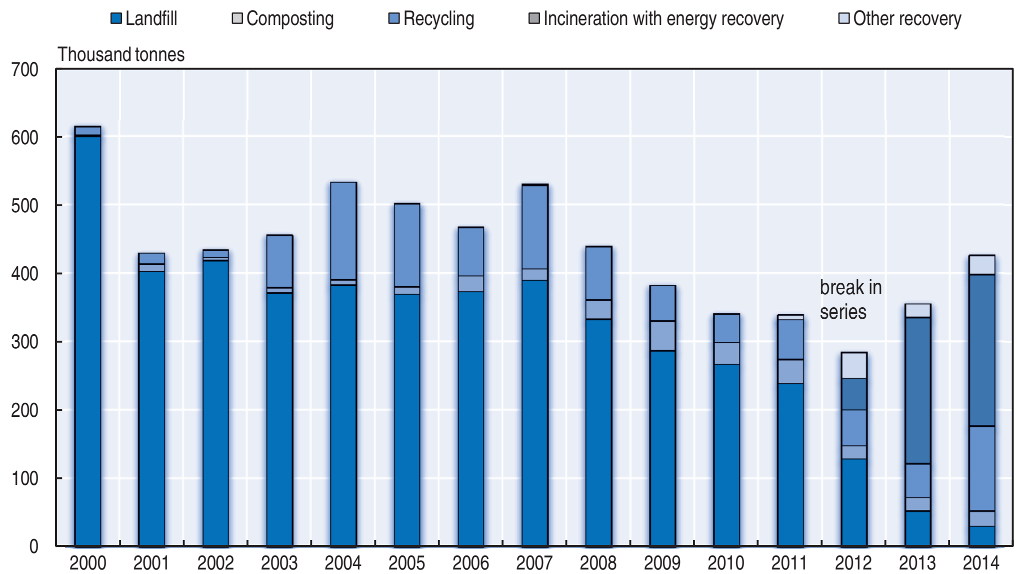
Municipal solid waste

From 2005 to 2014, the level of MSW generated in Estonia fell by 33%, from 435 kg/capita to 357 kg/capita (OECD, 2016). The level of MSW generated has decoupled from GDP, which rose by 15% over the same period. Nonetheless, from 2012 to 2014, the level of MSW generation increased.

Estonia has significantly transformed the treatment of MSW in recent years: amounts sent to landfills decreased drastically, mainly diverted to the new incinerator in Iru, near Tallinn. While at least 74% of MSW treated[1] was sent to landfills for disposal in 2005, that share fell to 7% in 2014. In the meantime, the share of waste incinerated with energy recovery reached 52%, and that of waste recycled and composted amounted to 29% and 5%, respectively; the remainder was used for backfilling (filling excavated areas with mineral waste, such as sand and stones) (Figure 4.4).

Figure 4.4. **Estonia has transformed municipal waste treatment in recent years**



Note: As of 2012, amounts treated refer to waste actually treated during the reference year, and do not necessarily refer to amounts generated during the same year (due to amounts stored temporarily for treatment in the following year).
Recycling may include some waste undergoing a pre-treatment before being recycled (e.g. metal waste); it excludes paper and cardboard waste, and bulky waste recovered.
Other recovery includes pre-treatment of some waste (repacking of hazardous municipal waste) and the recovery of mineral parts (for example sand, stones) from MBT treatment process for closure of landfills or backfilling.
Source: OECD (2016), "Municipal Waste – Generation and Treatment", OECD *Environment Statistics* (database).

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Estonia used to report packaging waste separately from MSW, which gave the impression of a lower total MSW generated compared to other OECD member countries; with the modification in reporting in 2011, however, data are not fully comparable across the review period. Overall, the collection of statistics on MSW has improved: for example, incoming waste is now weighed at most landfills.

Construction and demolition waste

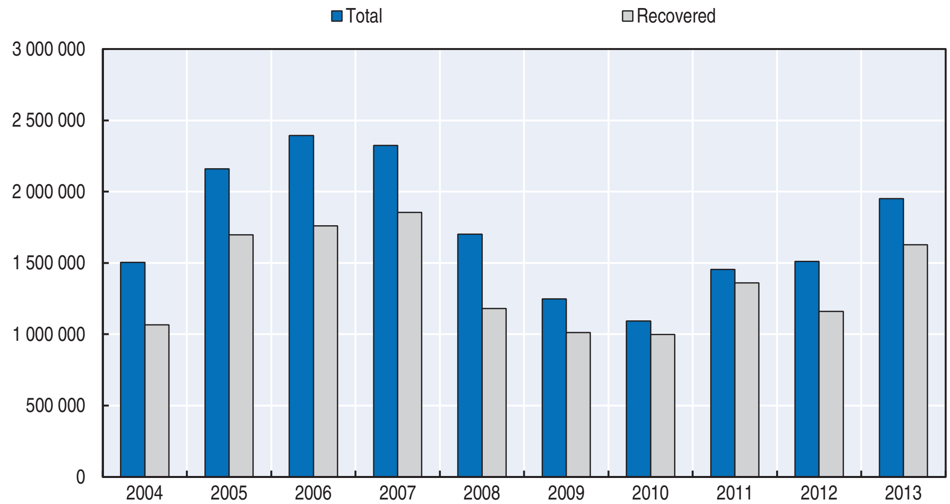
The generation of construction and demolition waste increased sharply from 2004 to 2006. After falling in 2008-10 in the wake of the economic crisis, it has since risen with the implementation of EU-funded construction projects (Figure 4.5). In 2013, Estonia recovered 87% of construction and demolition waste (compared to the EU target of 70% for 2020 and the national target of 75% for 2020), using it mainly in road construction.

3.3. Greenhouse gas emissions

In 2014, the waste sector accounted for less than 2% of all GHG emissions (ESTEA, 2014; MoE, 2016, 2015a). Emissions from the waste sector fell by more than 40% between 2000 and 2014 (see Figure 4.6).

Emissions from landfills account for the lion's share of the total sector emissions – 89% in 2014. Landfill GHG emissions have fallen since 2000, as Estonia has invested in methane recovery from landfills, while the share of waste going to landfills has fallen drastically.

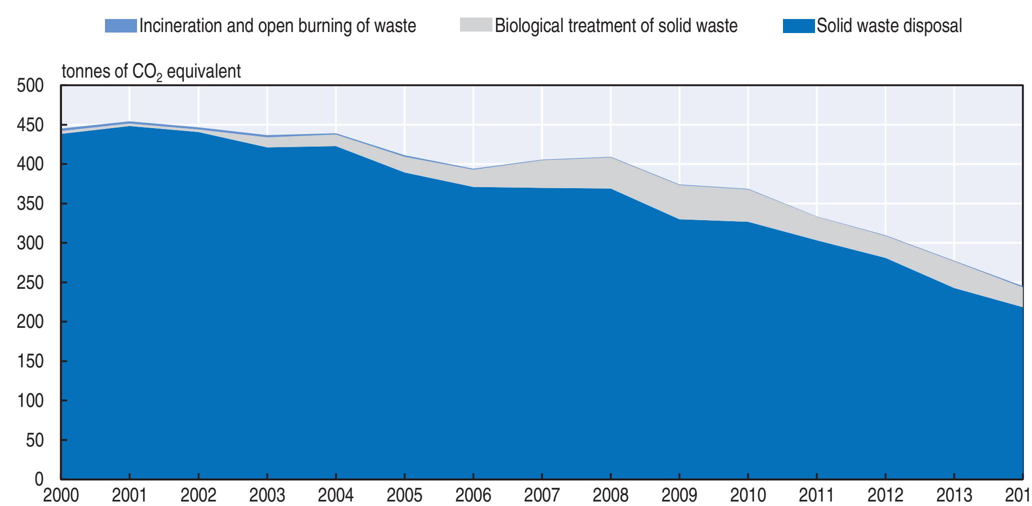
Figure 4.5. **A high share of construction and demolition waste is recovered**



Source: Country submission.

StatLink http://dx.doi.org/10.1787/888933448747

Figure 4.6. **Greenhouse gas emissions from the waste sector declined from 2000 to 2013**



Source: UNFCCC (2014), *GHG Data Interface* (database).

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Estonia has increased biological treatment of waste (i.e. composting), and related GHG emissions grew eight-fold between 2000 and 2014; nonetheless, biological treatment accounted for only 10% of GHG emissions from the waste sector in 2014. Emissions of greenhouse gases from incineration and open burning of waste fell by around 50% between 2000 and 2014, despite Estonia's increased incineration capacity: this appears to be due to the decline in open burning of waste. In 2014, incineration and open burning of waste accounted for only 1% of total GHG emissions from the waste sector. On the basis of current policies, the MoE projects that GHG emissions from the waste sector will fall by an additional 53% between 2013 and 2030 (MoE, 2015b).

4. Performance in managing municipal solid waste

Since 2005, Estonia has seen major changes in MSW management: collection has increased, while landfilling has been drastically reduced. As a result, Estonia has already met its 2020 target to reduce the level of biodegradable MSW going to landfills. EPR systems have supported MSW management. Estonia nonetheless faces major challenges to ensure more stable MSW collection, increase separate collection and recycling, and ensure that EPR systems work more effectively to support national and EU objectives.

4.1. MSW collection

Major progress

Under the system introduced in 2005, municipalities contract out waste collection and transport to private companies. At present, fees for households are relatively low: an average of EUR 4-6 per month. The frequency of collection can vary greatly: from more than once a week in large cities to a minimum of once every four weeks in small towns. In rural areas, collection can even be once every three months. Nonetheless, waste collection has clearly improved over the review period: the MoE estimates that waste was not collected from about 20% of households in the early years of this century; by 2015, this rate had fallen to under 5%.

In 2008, Estonia required municipalities to provide for separate collection of paper and cardboard, garden waste and hazardous waste from households and small businesses. Using EU funds, as well as domestic resources provided by the EIC, municipalities have built about 100 waste collection points across the country for recyclables, garden and park waste, household hazardous waste and large-volume recyclable municipal waste such as waste electrical and electronic equipment. The collection points are operated by local governments. Some include composting facilities for garden and park waste. As a result, separate collection has steadily increased, in particular in urban areas. Tallinn's scheme for recyclable waste has gone further, providing containers for recyclable waste near residential buildings. As a result, in 2012 Tallinn reached a separate collection rate of 53% of all MSW, the third highest among EU capital cities: 85% of glass and 74% of paper waste were collected (BiPRO, 2016).

A few municipalities have started separate collection of biodegradable waste. In Tallinn, this was done for apartment buildings and commercial establishments such as restaurants and food shops, which resulted in a third of such waste collected separately in 2012 (BiPRO, 2016). In some other parts of the country, there is separate collection for the commercial sector.

Improving management

The system has experienced several management issues that must be addressed for Estonia to meet key objectives such as the 2020 targets for recycling.

First, the legal and institutional framework has changed several times, in particular concerning the relationship between municipalities and private waste operators. The 2002 NWMP foresaw a strong municipal role in waste management. While private companies always played a role in MSW collection, the law was changed in 2011 so that municipalities could no longer organise waste collection "in-house" via municipal offices or municipally owned companies. Under the system in place in early 2016, municipalities organised tenders, while households paid waste companies directly.

The uncertainty continues. Waste companies have challenged municipalities that organise separate tenders for MSW collection and treatment. A 2015 court case established that municipalities "own" municipal solid waste and thus have a right to organise separate tenders; this ruling, moreover, indicates that municipalities have a "duty of care" for MSW as in many other OECD member countries. As a result of this ruling, the city of Tallinn has sought to receive household collection fees. However, the coalition programme of the current government, agreed in April 2015, calls for a further legal change: to eliminate tenders and instead require each household to contract directly with a waste collection company, largely eliminating municipalities' role in waste management. Experience in other OECD member countries has shown limitations of a "side-by-side" collection system, whereby multiple companies work in the same areas (Box 4.1).

Box 4.1. **Comparing costs of "side-by-side" and other MSW collection approaches**

Poland has recently ended a "side-by-side" system (referred to in Estonia as a "free market" system), where each household chose a waste collection company. It has instead put in place an arrangement whereby municipalities organise open tenders to choose a single collection company for each waste area. One reason for the change in Poland was that the old system did not ensure the collection of all MSW. Ireland continues to use a "side-by-side" system: here too, ensuring full coverage has been an issue, and further government enforcement efforts are planned to ensure full collection. In both Ireland and Poland, this system caused increased levels of traffic congestion, noise and air pollution, particularly in urban areas.

OECD analysis indicates that "side-by-side" systems typically lead to higher overall costs compared to a competitively chosen single supplier; they also require strong government oversight. At the same time, non-competitive systems, where a government-owned company has a monopoly to collect household waste, also lead to higher costs.

Source: EC (2016b); OECD (2015b, 2013, 2010).

A second problem is that market and legal factors hinder competition for municipal contracts. Legal disputes have often held up public contract awards (SEI, 2014). Notably, when a court challenge overturns a tender decision, no collection company is designated for the area (in contrast, in many other OECD member countries such as the Netherlands, the former contract holder would continue to perform its duties). As a result, losing bidders have an incentive to launch court challenges. Tallinn, for example, has seen a number of challenges to its tender awards in recent years: as a result, in early 2016, 5 of Tallinn's 13 districts did not have waste collection contracts in place. When no contract is in place due to court challenges, households and businesses must choose their own waste transport companies. While apartment buildings and large organisations need these services, individual homes and small enterprises could avoid their obligation to hire a waste collection service; reportedly, some mixed waste is disposed of in public bins to collect recyclable waste.

A third problem is that many municipalities (even some larger ones) lack the institutional capacity to organise tenders and oversee contracts, and – more generally – to manage MSW issues effectively. Many of Estonia's municipalities are quite small, with population spread over large rural areas: they lack financial resources and technical expertise (Chapter 2). In particular, municipalities do not receive a share of waste collection fees. Although municipalities receive a share of revenues from the waste disposal tax (see below), this revenue source has greatly fallen since less MSW is sent to landfills. In contrast, only three main companies bid for waste collection contracts (BiPro, 2013); they have greater technical and organisational capacity than most of the municipalities issuing the contracts.

Small municipalities can pool their resources and issue joint contracts: this is only done on a voluntary basis as common waste districts for rural areas have not been established (SEI, 2014). Co-operation among local authorities has not, however, developed as intended (EEA, 2013a).

The Waste Act limits service areas for waste collection and transport to 30 000 inhabitants. For the city of Tallinn, in particular, multiple areas are required. While the maximum limit can help maintain competition among Estonia's few private waste companies, it increases the administrative cost of tendering waste contracts. In contrast, many OECD member countries have created much larger waste management areas, which are commonly set in legislation (Box 4.2): these districts can ensure the capacity for the oversight of waste management lacking in small municipalities. Moreover, larger waste areas should reduce the costs of waste collection in small municipalities by providing economies of scale (Bel and Mur, 2009; OECD, 2013).[2] The creation of larger waste districts could be considered in Estonia's ongoing policy discussions on the reorganisation of local government, including the possible amalgamation of small municipalities.

Box 4.2. **Examples of large MSW management districts**

Several OECD member countries in Europe have created inter-municipal areas that pool administrative capacity for MSW management.

In Belgium, for example, the approximately 300 municipalities of the region of Flanders (population 6.4 million) are grouped into 27 inter-municipal associations that organise waste collection. In Finland, 39 inter-municipal associations have taken over waste management functions from local governments.

In Italy, waste planning is carried out by the regions, which are divided into waste areas that co-ordinate MSW collection and treatment plants. The Veneto region, for example, with a population of 4.9 million, has 12 waste areas. The administrative costs of the committees overseeing these areas are financed in part by the regional budget.

Source: EEA (2013b, 2013c); Interafval (2016); Eurostat (2016).

Local government needs adequate financing for waste management functions, including tendering, overseeing contracts and supporting enforcement. Some OECD member countries finance these functions mainly through general government revenues, as in the case of the Veneto region, noted in Box 4.2. In Poland's reform of MSW management, local governments now set and collect fees: the revenues are used both to pay contracted waste companies and oversee their work. This method, however, creates an initial risk that fees are set below costs for political reasons (OECD, 2015b). As an alternative mechanism, local waste authorities could receive a small charge per household on Estonia's existing system of local collection fees paid to private waste companies.

Stronger public management of waste issues is also needed for co-ordination with EPR schemes, as well as to provide effective information to the public on waste management and to strengthen awareness of waste requirements and of recycling methods (Section 4.3).

A further issue concerns minimum collection levels. The Waste Act allows local governments to pick up waste in high-density areas only once every 4 weeks – and only once every 12 weeks where composting of biological waste is in place. While infrequent pick-up could reduce collection costs for households, the minimum collection period should be reviewed: OECD Europe countries typically have at least weekly pick-up of solid waste, and some have daily pick-up in urban areas (Hogg et al., 2012).

Finally, while the quality of waste data has improved significantly over the review period, further efforts will be needed to support current policy goals. For example, further work is needed to identify the amount of MSW not collected, estimated by independent studies at close to 5%. Better data are also needed on the composition of MSW going to MBT plants. The MBT facility at Tallinn's municipal landfill only assesses waste composition once a year: more frequent analyses will be required to properly estimate the amount of packaging waste in mixed waste streams.

4.2. Investments in waste treatment

Since 2005, MSW treatment has been transformed. In 2005, about three-quarters of MSW was sent to about 150 small landfills that did not meet EU standards. By 2015, the last 17 old landfills had been closed to meet one of the key objectives of the NWMP 2014-20. Five new landfills meeting EU requirements have been built: these are publicly owned (except for one, in Uikala, which has combined municipal and private ownership).

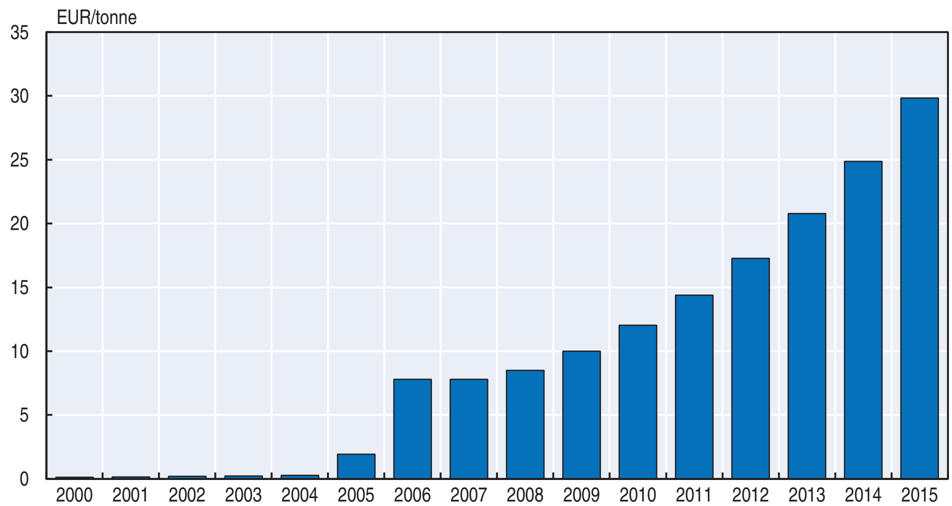
Treatment facilities providing an alternative to landfilling have been built without government support. Private waste companies provided most of the EUR 130 million to build Estonia's five MBT facilities. These plants produce refuse-derived fuel (RDF), which is burned in a cement plant in Kunda. The small share of residual waste is sent to landfills. Although these plants could also separate materials such as paper and plastic for recycling, in early 2016 they had little incentive to do so.

In 2013, Eesti Energia, the state-owned power company, opened a municipal waste incinerator at Iru, near Tallinn. About half of the construction cost of this facility, which produces both heat and power, was financed by a EUR 50 million loan from the European Investment Bank, with the company providing the remainder (EIB, 2015).

The role of the waste disposal tax

An important policy measure, the waste disposal tax (also referred to as the landfill tax), made alternative forms of treatment competitive with landfilling. This tax is part of the broader pollution tax system governed by the Environmental Charges Act[3] (Chapter 3) and is imposed on waste disposed in landfills. The waste disposal tax is paid together with landfill operators' gate (service) fee for non-hazardous waste. In 2005, Estonia's government started to increase the national waste disposal tax, which previously had been at very low levels. In 2006, the tax for MSW was set at EUR 7.30 per tonne and rose to reach almost EUR 30 per tonne in 2015 (Figure 4.7). Municipalities receive 75% of the revenues from the waste disposal tax; in the past, this provided a key source of funding for waste collection and management. The tax provided an incentive for investments in MBT plants and incineration, which meant the amount of waste sent to landfills decreased by 95% over 2000-14. This has led to a shortfall in municipal budgets for waste management.

Figure 4.7. **Waste disposal taxes for MSW have risen steadily**



Source: Country submission.

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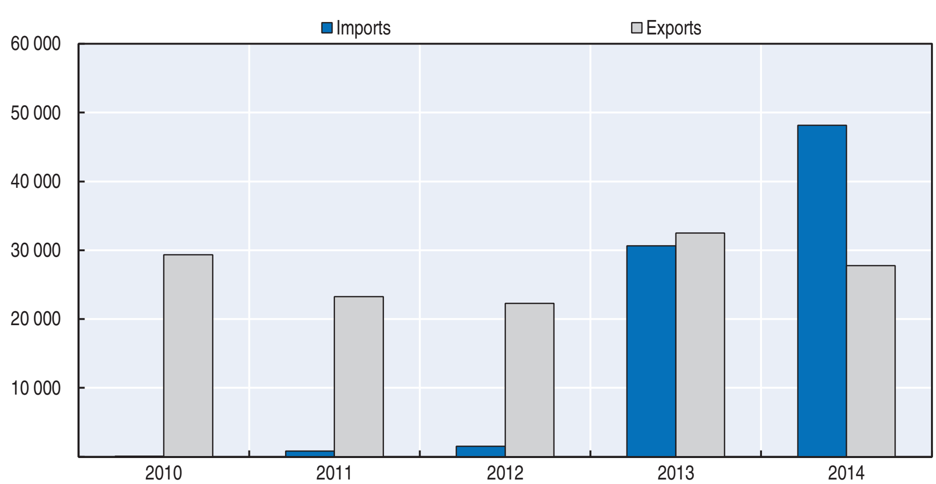
Overcapacity

Investment decisions since 2005 have created an overcapacity in MSW treatment facilities. Other factors have also contributed to overcapacity: notably, total MSW generation, once projected to rise, has decreased since 2000 and in particular since the start of the economic crisis in 2008. As a result, the MBT facilities and the incineration plant compete for a declining quantity of domestic mixed waste. Since 2010, Estonia's imports of MSW have increased steadily, particularly those of mixed waste from Ireland and Finland for incineration (Figure 4.8). With the low level of MSW going to landfills, not all are needed: in 2016, one of the five landfills is expected to close. Estonia exports some types of MSW, as seen in Figure 4.8, in particular paper and cardboard for recycling. Indeed, while the use of recycling capacity in neighbouring countries may be an efficient solution,

Figure 4.8. **Estonia's imports of municipal solid waste have increased sharply**



Source: Country submission.

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Estonia should consider whether further domestic capacity is needed in coming years to meet recycling targets.

Estonia's treatment overcapacity, the high level of incineration (including both the incinerator and the cement plant that burns RDF produced by the MBT facilities) and the low levels of separate collection mean that Estonia will face a great challenge in achieving the 2020 recycling targets. These targets, set in EU legislation, are also transposed into the national legislation and included in the NWMP 2014-20.

In the longer term, the European Commission has proposed higher targets in its circular economy package: 60% of MSW recycled in 2025 and 65% in 2030 (EC, 2015). Moreover, Estonia's waste prevention plan seeks to reduce the generation of MSW; the country's ageing population may also contribute to lower MSW levels.

The government and the waste industry thus need to identify instruments and strategies to increase recycling, while addressing capacity issues. One option would be a tax on domestic mixed waste sent to incineration and to MBT plants, which would encourage separate collection and recycling (Hogg et al., 2014). A portion of the tax on MBT plants could be reduced based on how much they separate recyclable material. In addition, EPR schemes could be given incentives to purchase packaging material in mixed waste that is separated by MBT plants (Section 4.3). Estonia should also assess its MSW overcapacity issues in discussion with actors and governments in neighbouring countries. For example, Latvia, Lithuania and Poland have recently invested EU funds in MBT and other MSW facilities (EC, 2016a): there is a risk that overcapacity will be an issue for the entire Baltic Sea region.

4.3. Extended producer responsibility

In EPR systems, "a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle" (OECD, 2001), and thus to its end-of-life environmental impact. To meet EPR requirements set out in several pieces of EU and Estonian legislation, producers often join producer responsibility organisations (PROs), which collect, recover and recycle their waste.

Packaging waste

Producers, who became responsible for packaging waste in 2002, can join one of three PROs that focus on general packaging: Green Dot Estonia, Estonian PackCycling or TVO. Companies that do not join one of these PROs must pay a charge for their packaging (as do PRO members when packaging targets are not met). The three PROs have greatly increased the collection and recycling of packaging waste (they export collected packaging for recycling due to lack of national capacity). All three PROs reportedly recovered 78% of the packaging waste put on the market and sent 58% for recycling: they thus met targets set in the EU and national legislation (Table 4.4).

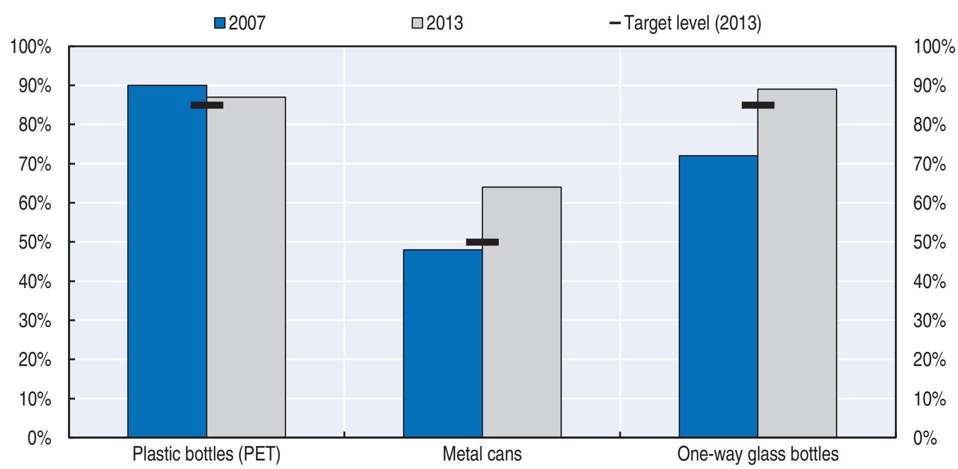
A key issue for these three PROs, particularly in terms of meeting future packaging waste targets, is to increase their collection of "primary" (i.e. post-consumer) packaging waste. Based on samples taken in 2012-13, packaging waste constituted 28.5% of mixed municipal waste (SEI, 2013), a high share that indicates separate collection could be further improved.

Collecting higher levels of primary packaging waste will require closer co-operation with municipalities. PROs collaborate with municipalities by providing collection containers for municipal civic amenity sites, supermarkets and other retail locations. The national government does not, however, set specific requirements for PRO agreements with municipalities. As a result, these agreements vary in their approach (BiPro, 2013). Moreover, smaller municipalities in particular lack capacity to negotiate effectively with PROs and to oversee their work (NAO, 2010).

In 2005, Estonia established a deposit-refund system for glass, metal and plastic beverage containers (both refillable and non-refillable). Eesti Pandipakend (Estonian Deposit Packaging) was established to run this system as an EPR scheme. All customers pay a deposit of EUR 0.10 on containers (regardless of size); retailers collect used containers and refund their deposit (R4R, 2014).

In 2013, 330 million beverage containers covered by the deposit-refund system were placed on the market. The return rates for both PET and glass bottles were close to 90% in 2013, while for metal cans they were 64%: the system thus met its 2013 targets (Figure 4.9). Eesti Pandipakend works efficiently, with high collection and recycling rates; the reuse of glass containers is close to 40% (R4R, 2014).

Figure 4.9. **The deposit-refund system met its 2013 targets**



Source: R4R, 2014.

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Other EPR systems

In addition to packaging waste, Estonia has required EPR for five other types of "products of concern" (as defined in the Waste Act, Article 26): waste electrical and electronic equipment (WEEE), used end-of-life vehicles and their parts, used tyres, waste agricultural plastic, and batteries and accumulators. PROs have been set up for three of these product types. Table 4.4 provides an overview of these schemes and their main quantitative targets, set in Estonian policy and legislation and in EU legislation. They have played a key role in terms of increasing the recovery and recycling of key waste streams. As for packaging waste, most appear to have met recent targets.

While at least seven other European countries have some form of collection scheme for agricultural plastic (APE Europe, 2016), Estonia is one of the few to have an EPR system for it since 2013. About 10 000 t of plastic are used per year, including plastic film for hay rolls and temporary greenhouses. One reason for creating an EPR scheme for this waste

Table 4.4. **Estonia has six extended producer responsibility systems**

Waste stream	Number of PROs	Targets in national policy or legislation (EE) and EU legislation (EU)	Achievement
Packaging waste	Three for general packaging waste and one for deposit-refund beverage containers	2013: 60% recovery and 55% recycling levels (EU) 2020: 60% recycling (EU)	2013: 77.6% recovery and 58% recycling
Batteries and accumulators	Two	Minimum collection rate for portable batteries and accumulators (EU): 2012: 25% 2016: 45% Minimum collection rate for motor vehicle batteries and accumulators (EE): 2012: 75% 2016: 90% Minimum recycling rate, from 2011 (EU): 75% for nickel-cadmium batteries and accumulators 65% for lead-acid batteries and accumulators 50% for other batteries and accumulators End landfilling and incineration of industrial and automotive batteries and accumulators	2013 collection rates for batteries and accumulators: Portable: 40% Motor vehicle: 380%[b] 2013 recycling levels for batteries and accumulators: Lead-acid: 94% Nickel-cadmium: 80% Others: 51%
Waste electrical and electronic equipment	Three	Minimum WEEE collection amounts (EU): 2011: 4 kg/end-user/year collection rate for WEEE from households 2014: 5 kg/end-user/year collection rate for WEEE from households Minimum WEEE collection rates (compared to the average weight of EEE placed on the market in the previous three years) (EU and EE[a]): 2016: 45% 2017: 52% 2018: 59% 2019: 65%	2013 collection rate: 3.5 kg/person 28% of weight placed on the market in the previous three years
End-of-life vehicles	No PRO: vehicle importers subject to EPR	2006: 85% minimal recovery and 80% recycling of the mass of end-of-life vehicles admitted to dismantling stations (EU) 2015: 95% recovery and 85% recycling (EU)	2013 reuse and recovery rate: 86%
End-of-life tyres	Two	Recycled or recover (EU) all waste tyres	2011-13: 39% recycled/recovered
Plastic used in agriculture	No PRO: companies subject to EPR	Collect at least 70% of the volume placed on the market in the previous year; 50% of collected plastic should be recycled; non-recycled plastic should be recovered (including energy recovery via incineration) (EE)	n/a

Notes: EU = targets set under EU legislation; EE = targets set under national legislation or policy documents.

a) For minimum WEEE collection rates: 2016 and 2019 rates set under EU legislation; 2017 and 2018 rates set in Estonian legislation (Government Regulation No 65 of 20.04.2009).

b) The collection rate is measured against sales for the previous year.

Source: ESTEA (2015).

stream was to reduce burning of plastic waste. In addition, PROs for packaging waste sometimes gathered this waste: this activity distorted data on packaging waste and created a legal question whether farmers should be subject to EPR requirements.

No PRO has been created for this waste stream. In early 2016, about 10 suppliers of plastic for agriculture were active in the country: each contracted with a waste management company to collect plastic waste. In some cases, the plastic is collected directly from farms (whose size has been growing due to consolidation of land since collective farms were privatised to pre-Soviet owners). Households and other small users of plastic for agriculture have been able to take their waste to municipal civic amenity sites. As of early 2016, results of this EPR system were not available.

Strengthening EPR systems

Estonia's EPR systems face several organisational issues to ensure that future waste targets are met and to guarantee the long-term viability of the systems themselves. For many systems, the accuracy of reported data is an ongoing concern, an issue exacerbated by competition among multiple PROs. An agreed mechanism to balance the level of waste produced and waste collected among PROs is not in place, leading to disputes and court cases. Several EPR schemes face "waste leakage", where valuable waste products escape the system. A share of durable goods such as refrigerators, which should be covered by the PROs for WEEE, is recycled by scrap metal dealers. The issue of free riders has also been reported, for example, for end-of-life tyres: small importers selling via the Internet do not contribute to either PRO for this sector.

Another problem is the difficulty in setting appropriate fee rates when PROs compete for members or when disposal options change. For example, shredded end-of-life tyres were, until recently, used in the closure of MSW landfills to create a layer for collection of methane and other waste gases (this use was classified as recovery, as the EU prohibits disposal of end-of-life tyres in landfills). Now that the landfill closure work has been largely completed, this option is no longer viable; most alternatives, such as incineration, are more expensive. As a result, end-of-life tyres have accumulated in large storage sites awaiting disposal, thus posing an environmental risk.

Problems such as data accuracy, waste leakage, free riders and PRO fee rates are common challenges for EPR systems (OECD, 2014). In Estonia, government oversight and enforcement have not been sufficiently strong to address these problems. Several initiatives could strengthen EPR systems to ensure their better functioning and the achievement of national and EU waste targets:

- **Audit requirements.** In 2014, to improve data quality, the MoE required independent audits of companies participating in packaging waste PROs. Auditing is expected to improve data accuracy and could be extended to PROs in other waste streams. In 2015, the MoE raised the minimum level of packaging put on the market that would trigger an audit to reduce excessive compliance costs for small and medium-sized enterprises.
- **Activity licence.** The MoE issues an activity licence to packaging waste PROs. This requirement could be extended to other EPR schemes to ensure they are carrying out their roles effectively as representative bodies for waste producers and as agents supporting the achievement of national targets.
- **Clearer definition of PRO roles in relation to municipalities and other government bodies.** This is needed particularly to strengthen collection for streams such as packaging waste, including via further efforts to raise public awareness on recycling (Box 4.3).
- **A clearinghouse mechanism to ensure a level playing field among competing PROs.** Such a mechanism would address potential issues among the organisations: for example, balancing the fees paid by members against the level of waste collected. In some OECD member countries, the government takes this role. Estonia already has an independent clearinghouse mechanism, created as part of the Register of Products of Concern. However, it needs evaluation and further development with stronger enforcement. Estonia could benefit from best practices in other OECD member countries, such as Denmark, where an independent clearinghouse was created (Box 4.4). The Chamber of Commerce could also undertake this role. Specific functions of a clearinghouse can vary. They may include maintaining a common register of producers; overseeing data reporting to ensure

quality; balancing material and financial flows among PROs; verifying compliance with requirements and identifying free riders; and ensuring a level playing field among PROs operating for the same waste stream.

- **Mechanisms to ensure financial sustainability.** The experience of tyre PROs, whose treatment costs have increased, underlines the need to ensure the long-term financial sustainability of these systems. One approach could be to require PROs to purchase insurance against future costs, as in Sweden (BIO Intelligence Service, 2014).
- **Economic instruments to reduce generation of packaging waste and strengthen its collection.** Estonia could consider a tax on all packaging not covered by the deposit-refund system to encourage waste reduction (Hogg et al., 2014). In addition, PROs for packaging waste could be required to count packaging material going to MBTs towards their quotas and to purchase packaging material separated by these facilities.

Box 4.3. **Projects and programmes to raise public awareness**

Estonia has taken several actions at both the national and local levels to raise public awareness on waste issues, including separate collection. Estonia's Environmental Board promotes environmental education programmes in schools: waste management is one of the topics. An independently organised annual day of community group activities, "Let's do it! My Estonia", includes actions to clean up litter and illegal waste. Municipalities and the MoE have worked with PROs to provide public information to promote recycling. As a result, public awareness has reportedly improved, and illegal dumping and littering have decreased in recent years.

Further initiatives are being prepared. For example, the Waste Prevention Programme foresees public awareness activities as a mechanism to reduce waste and encourage recycling and reuse.

Nonetheless, public awareness still appears to be insufficient: for example, waste separation is low in some areas, and separated waste can contain high shares of misplaced and non-recyclable items. Estonia needs to devote greater efforts to campaigns related to waste issues. In particular, further efforts are needed to reach current policy goals for recycling, as well as for waste prevention. In several European OECD member countries, including the Netherlands, PROs play an important role in helping raise public awareness on separate collection and recycling. Avenues to strengthen their role in Estonia should be explored.

Source: BiPro (2013); EB (2015); Teemeära (2015).

Box 4.4. **Denmark: An independent clearinghouse for EPR systems**

In Denmark, DPA-system is an independent, non-profit organisation that provides a clearinghouse for three EPR systems: for WEEE, end-of-life batteries and end-of-life vehicles. The members of its board are appointed by the Minister of Environment from the main PROs and industrial sectors concerned. The organisation maintains a common register of producers, sets fees and receives reports.

Source: BIO Intelligence Service (2014); DPA-system (2015).

5. Performance in managing mining and industrial waste

The mining, combustion and processing of oil shale account for the great majority of total waste generation in Estonia and for about 98% of hazardous waste. Since the beginning of the oil shale industry, over 400 million t of waste have been dumped into landfills and waste storage facilities. Waste management areas occupy over 27 km^2 in Ida-Viru county alone. Since 2005, the volume of waste streams related to oil shale has increased. Government policies and investments have sought to increase recovery of these types of waste and to address the legacy of poorly managed waste sites. Further initiatives are needed to improve the management of oil shale waste, as well as other types of hazardous waste. Oil shale mining and processing waste is further discussed in Chapter 5.

5.1. *Hazardous waste outside the oil shale sector*

As mentioned in Section 3.2, the largest share of hazardous waste generated outside oil shale use comes from the service sector. This includes asbestos in cement, called Eternit, removed from public buildings. In accordance with EU rules, this waste is sent to municipal and other non-hazardous landfills. The government has maintained the waste disposal tax for asbestos at low levels (under EUR 1 per tonne in 2015) to encourage its disposal.

Hazardous waste generated by the waste sector includes ash from the combustion of RDF and hazardous waste in the Kunda cement plant: the ash is disposed in a company landfill. Ash from the Iru incinerator, which is also classified as hazardous, is sent to Finland for disposal. Slag from the recycling of lead-acid batteries is sent to hazardous waste landfills.

Although the government has spent about EUR 10 million on the establishment and operation of three hazardous waste collection centres, only the centre in Tartu has managed to guarantee adequate treatment over the years. Only 25-35% of the actual capacity of the Vaivara and Tallinn centres has been used. The Tartu and Tallinn centres have now been sold to private operators.

Estonia has one landfill at Vaivara for hazardous waste other than from oil shale. This landfill reopened in April 2016 after being closed for four years due to delays with establishing a contract with a private operator. It has been equipped with a new leachate treatment plant.

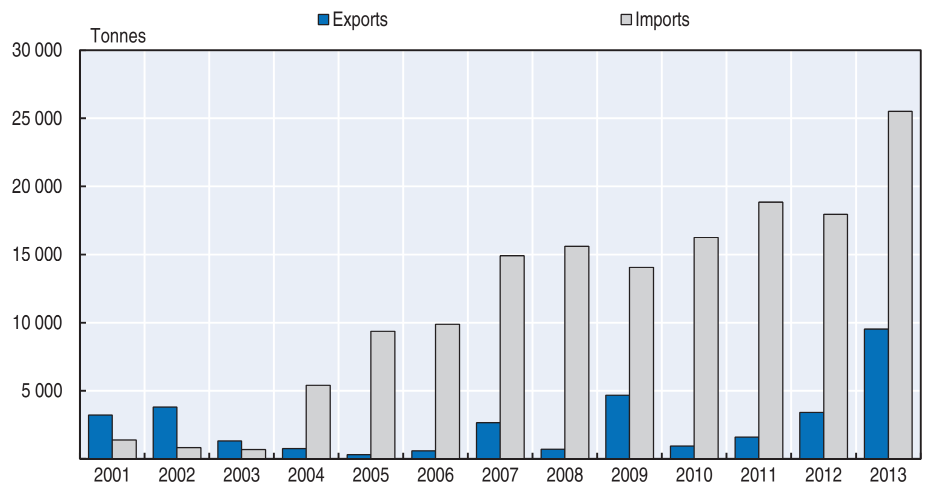
The privately owned cement plant in Kunda incinerates several types of hazardous waste in addition to RDF. In 2000, when the plant opened, the MoE reached a voluntary agreement with its operator, supporting its role in waste management, in particular for the incineration of hazardous waste. In March 2015, this voluntary agreement was renewed: the MoE declared it would help the cement plant find opportunities for the recovery of clinker dust and that CO_2 from waste incineration would not be taxed; the plant agreed to continue hazardous waste incineration. In early 2015, however, the Eastern Baltic region had an overcapacity in cement production facilities, due to the economic downturn. As the plant has played a key role in hazardous waste treatment, it would be valuable for the government to work with hazardous waste generators on contingency planning in case of its closure.

The National Audit Office (NAO, 2015b) highlighted several shortcomings regarding government oversight of hazardous waste permits and reporting. Data quality is an important concern: reporting on hazardous waste contains "significant amounts of incorrect data": for example, balances of waste stockpiles did not match from one year to another. Moreover, information systems for waste permits and reporting are not integrated, hindering checks of data accuracy.

5.2. Shipments of hazardous waste

Since 2001, Estonia's imports of hazardous waste have grown steadily (Figure 4.10): about 90% of imports have been lead-acid batteries, arriving in particular from Finland, Latvia and Lithuania for treatment at a facility in Sillamäe. Among other shipments, Estonia has also received waste oils from these nearby countries, as well as WEEE from Finland and Norway.

Figure 4.10. **Estonia's imports of hazardous waste have grown since 2001**



Source: Eurostat (2016), *Transboundary Shipments of Waste by Partner, Hazardousness and Waste Operations* (database).

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Estonia's exports of hazardous waste have varied over the years. The largest exports by volume have been shipments of treated wood, such as railroad sleepers, sent to Sweden for disposal. Other exports have included WEEE containing hazardous materials, such as refrigerators and fluorescent lamps: these have been sent to Baltic countries, including Finland, Latvia, Lithuania and Sweden.

Estonia has strengthened its inspections of hazardous waste shipments over the review period. Notably, the *Probo Koala* case prompted greater attention to enforcement in this area (Box 4.5).

Box 4.5. **The *Probo Koala* case raised awareness of waste shipment enforcement in Estonia**

The 2006 *Probo Koala* case, which highlighted gaps in the enforcement of hazardous waste shipment rules in the Netherlands, was also a prominent case in Estonia. The *Probo Koala,* a tanker operated by a Dutch company, Trafigura, delivered waste sludge to a local company in Côte d'Ivoire. The sludge was dumped at night in public areas in Abidjan, creating respiratory illnesses and reportedly causing several deaths.

The ship stopped in Paldiski, Estonia, on both its outbound voyage to West Africa (to pick up oil products for delivery to Nigeria) and on its return to Europe, by which time it had become prominent in global news. At Paldiski, Estonian authorities temporarily held the ship. Before it was allowed to leave Estonia, hazardous substances were pumped out of the

Box 4.5. **The *Probo Koala* case raised awareness of waste shipment enforcement in Estonia** *(cont.)*

ship at the port of Sillamäe, and hazardous waste was taken to the Vaivara waste management centre, where the oil and sediments were separated from water. The oil waste was taken to the Kunda cement plant for incineration.

Source: OECD (2015a); Trafigura (2015).

Recommendations on waste and materials management

- Establish a stable, long-term institutional framework that can ensure the achievement of European requirements and targets for MSW management, including by strengthening the institutional role and financial and technical capacities of local authorities to oversee MSW management more effectively; consider establishing inter-municipal entities for this purpose.
- Consider the introduction of economic instruments such as a tax on domestic mixed waste and possibly an incineration tax to better support recycling targets, which would create incentives for separate collection at source, for mechanical-biological treatment facilities to separate materials for recycling, and for waste companies to send all recyclable waste to recycling facilities.
- Strengthen the role of PROs in supporting the achievement of waste management goals, including those for recycling, by establishing a stronger framework for co-operation between PROs and government bodies responsible for MSW management; encourage PROs to raise public awareness of benefits of separate collection and recycling, and ensure sufficient infrastructure for the separate collection of recyclable waste at the local level.
- Take steps to implement an independent clearinghouse mechanism to oversee the multiple PROs to help ensure their long-term viability, as well as the accuracy and transparency of their reporting; extend government accreditation and auditing requirements, now in place for packaging waste PROs, to the other EPR schemes.
- Further strengthen data gathering and information systems for waste management in such key areas as packaging waste, hazardous waste and the monitoring of potential impacts of existing and former waste sites.
- Continue to explore options to improve material productivity, including by enhanced research and development on oil shale use and its waste products, drawing on EU initiatives for a circular economy; ensure the effective use and monitoring of planned investments of EU funds in resource efficiency.

Notes

1. Amounts treated reflect waste actually treated that year, and do not match amounts generated because of temporary storage.
2. Research in OECD member countries suggests that economies of scale are achieved when waste collection areas reach 10 000 inhabitants; some studies indicate this occurs at 50 000 inhabitants (OECD, 2013).
3. Estonia's Environmental Charges Act refers to pollution taxes as "charges", but the OECD defines them as taxes, and they are referred to as such in this report.

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PART II

Chapter 5

Mining and the environment

Oil shale mining and use are the dominant source of environmental impact in Estonia. While pollution releases from the sector have declined over the last decade, major challenges remain with respect to waste management, air and water quality, particularly in north-eastern Estonia. This chapter provides an overview of trends in the extraction and use of oil shale and other mineral resources, highlights the related environmental impacts and analyses the effectiveness of policy instruments Estonia applies to address them.

1. Introduction

Estonia has abundant deposits of oil shale, construction minerals and peat. Construction minerals such as sand, gravel, clay and limestone account for half of all mineral deposits by volume, while combustible minerals represent the other half and include oil shale and peat (Valgma, 2012).

The oil shale deposit is the most commercially exploited in the world, accounting for about 80% of its global extraction (Box 5.1). Oil shale is Estonia's most important energy-rich mineral resource: it provided around 70% of the country's total primary energy supply and 83% of electricity in 2015 (IEA, 2016a; Chapter 1), making Estonia one of the most energy-independent countries of Europe. Still, oil shale mining and use account for only 4% of gross domestic product (GDP) (IEA, 2013) and 1.5% of employment (Rell and Kupts, 2014). Estonia has to balance the domestic economic and security benefits of oil shale exploitation with its environmental costs: oil shale mining and use cause the country's most important environmental impacts (Section 4).

Box 5.1. **Oil shale and shale oil**

Oil shale, one of the most prolific hydrocarbon resources on Earth, is a sedimentary rock containing up to 50% kerogen, a solid mixture of organic chemical compounds. Massive deposits are found in a number of countries around the globe, including Australia, Brazil, the People's Republic of China (hereafter China), Estonia, Israel, Jordan and the United States, but most are too deep or too costly to be exploited. Today, only China and Estonia produce oil shale commercially.

Once extracted from the ground, the rock can be used in thermal power plants to produce electricity or heat. It can also be processed by applying heat to produce crude oil and valuable chemicals, such as phenols. Crude oil produced from oil shale is called shale oil (a type of synthetic oil extracted from shale by pyrolysis), and can be refined into diesel, jet fuel, motor gasoline and natural gas liquids. In Estonia, over 80% of the mined oil shale is used to produce electricity and heat; the rest is used to produce shale oil and chemicals.

Source: Batkhuyag and Yondongombo (2012); IEA (2013).

Estonia also has considerable peat resources: over 1 million hectares (ha) of its territory is covered by peatlands, constituting 22.5% of the total land area. Highly decomposed peat is mainly used as heating material. The Rakvere phosphate rock deposit is the largest in Europe. For technological reasons, it is not being mined and is, therefore, not covered in this chapter.

2. Policy framework for minerals management

National development plans guide the management of mineral resources. Their main purpose is to ensure the long-term availability of the resources and to prevent and mitigate environmental impacts. The process for preparing a national Earth's Crust Strategy was launched in early 2015 and should be completed by the end of 2017. The Estonian Environmental Strategy 2030 (adopted in 2007) introduced the objective of environmentally sustainable mining without stipulating specific measures.

The main elements of the regulatory framework for the mining and use of mineral resources are the Earth's Crust Act (2004, last amended in 2015) and the Mining Act (2003). A draft new Earth's Crust Act was sent to Parliament in April 2016 as part of the environmental law codification effort (Chapter 2). The use of oil shale in combustion plants and shale oil production is also regulated by certain provisions of the Ambient Air Protection Act (1998), the Waste Act (2004) and the Industrial Emissions Act (2016).

2.1. Oil shale

The National Development Plan (NDP) for Oil Shale Use for 2008-15 had three strategic goals: to guarantee oil shale supply to ensure the country's energy independence; to increase the efficiency of oil shale mining and use; and to reduce the environmental impact of oil shale (MoE, 2008). The energy independence goal, which favoured electricity generation based on oil shale over export-oriented shale oil production, has lost its relevance since Estonia became a member of the Nord Pool open electricity market (Chapter 1). Energy security can now be guaranteed through a combination of self-reliance and increased diversity of energy suppliers. The Oil Shale NDP for 2016-30 adopted by Parliament in March 2016 no longer presents oil shale as a stake in the country's energy independence (MoE, 2015a).

The other two goals of the NDP 2008-15 (increased efficiency and reduced environmental impact) had not been achieved by 2015 (NAO, 2014) and were included again in the NDP 2016-30. The new NDP defines a number of indicators and respective 2020 targets[1] with respect to efficiency and environmental impact of oil shale mining and use. However, these targets are not ambitious and commonly call for maintaining 2013 performance levels. Without a comprehensive assessment of the environmental, health and socio-economic consequences of oil shale production and use, the new NDP is unlikely to address the sector's actual negative impacts (NAO, 2014). Importantly, neither the previous nor the current NDP describes specific activities to reduce oil shale waste generation. At the same time, the NDP 2016-30 also assigns priority to applied research and development (R&D) in the oil shale sector, but proposes to raise it from approximately EUR 520 000 to just EUR 600 000 in 2020 (MoE, 2015a). As the sector's technological know-how advances, more ambitious targets for 2025 and 2030 would need to be formulated and accompanied by specific implementation measures.

Other NDPs that affect the use of oil shale are the recently adopted National Development Plan of the Energy Sector until 2030 and the Development Plan of the Electricity Sector until 2018. The energy and electricity plans aim primarily at determining how much oil shale is required by the economy. The Energy Development Plan ensures consistency throughout all the plans related to energy by including targets and measures from other development plans (NAO, 2014). The General Principles of the Climate Policy until 2050 envisages a shift from combustion to more extensive processing of oil shale into higher value-added products, thereby reducing greenhouse gas (GHG) emissions.

Despite the broad policy coverage of the oil shale sector, the coherence of separate strategies and action plans, especially in terms of inter-ministerial co-ordination, remains a challenge. For example, the Estonian Environmental Strategy envisaged in 2007 a reduction of annual oil shale extraction compared to the 2005 baseline of 11 million tonnes (t), which did not happen; the NDP 2008-15 and the Earth's Crust Act stipulated an annual limit of 20 million t (Section 5.1).

2.2. Peat

The main principles of peatland protection and sustainable use are stated in the draft concept paper "Protection of Estonian Peatlands and Principles of Sustainable Use" (MoE, 2010). The concept paper emphasised the importance of balancing the economic benefits and environmental effects of peat use. It advocated the concentration of peat mining in existing peat production areas, as well as the reuse or restoration of abandoned peat production areas.

There were plans to use this paper as a basis for a proposal for a peatland protection and sustainable use plan. The concept paper has never been formally adopted, but its objectives will be integrated into the Earth's Crust Strategy that is being developed.

2.3. Construction minerals

The National Development Plan for Mineral Resources Used in the Construction Industry for 2010-20 set priorities for mining and use of construction minerals. Its strategic objectives include increasing the efficiency of construction mineral mining and use, expanding the use of alternative construction materials and reducing the sector's environmental impacts. The National Development Plan identifies waste rock from oil shale mining as an important resource for construction and encourages its wider use.

There is no extraction limit for construction minerals. As 92% of the mined construction minerals are used within Estonia, the government considered that setting such a limit could constrain construction activities, including infrastructure projects of national importance. However, NAO (2009) believed that issuing extraction permits based on national annual mining rates would make the extraction of minerals considerably more efficient.

3. Extraction and use of mineral resources

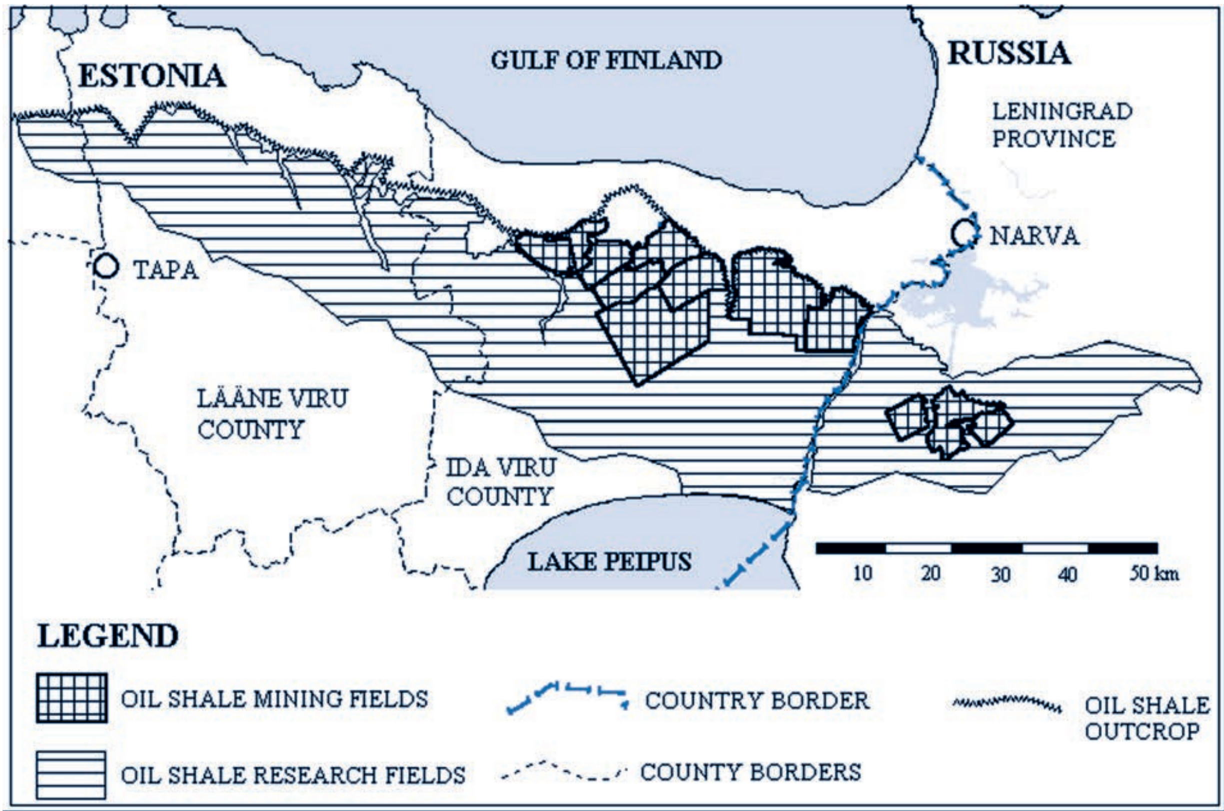
3.1. Oil shale

The oil shale deposits lie in an area of about 2 000 km^2 in the north-eastern part of the country (Figure 5.1). The best reserves in terms of their calorific value are found in the central and eastern part of the deposit and will be exhausted over the next decade. Therefore, mining activities will move towards the western and southern parts of the deposit, which contain lower quality reserves (EASAC, 2007).

The deposits amount to nearly 4.7 Giga-tonnes, including about 1.3 Giga-tonnes of active (extractable) reserves (NAO, 2014). At the extraction rate of 20 million t per year and considering substantial mining losses, the active consumable (sufficiently investigated) reserves would last for about 50 years (MoE, 2014). The 2014 extraction rate was almost 15 million t (Statistics Estonia, 2016).[2]

Since 2009, more than half of Estonia's mined oil shale has come from underground mines (Gaškov et al., 2012). Based on the World Energy Council's forecasts (All, 2014), underground mines are expected to constitute 80% of all mines by 2020. The extraction technology is more complex for underground mining than for open-cast mining due to the deeper bedding of oil shale deposits. The process leads to greater losses: almost one-third of resources are left behind in pillars and/or unmined areas. In 2013, mining losses accounted for 8% of the total production in open-cast quarries and for 29% in underground mines (NAO, 2014).

Figure 5.1. **Estonian oil shale deposit area**



Source: Valgma, I. (2001), Map of the Baltic Oil Shale Area, *www.ene.ttu.ee/maeinstituut/poster/rez.html*.

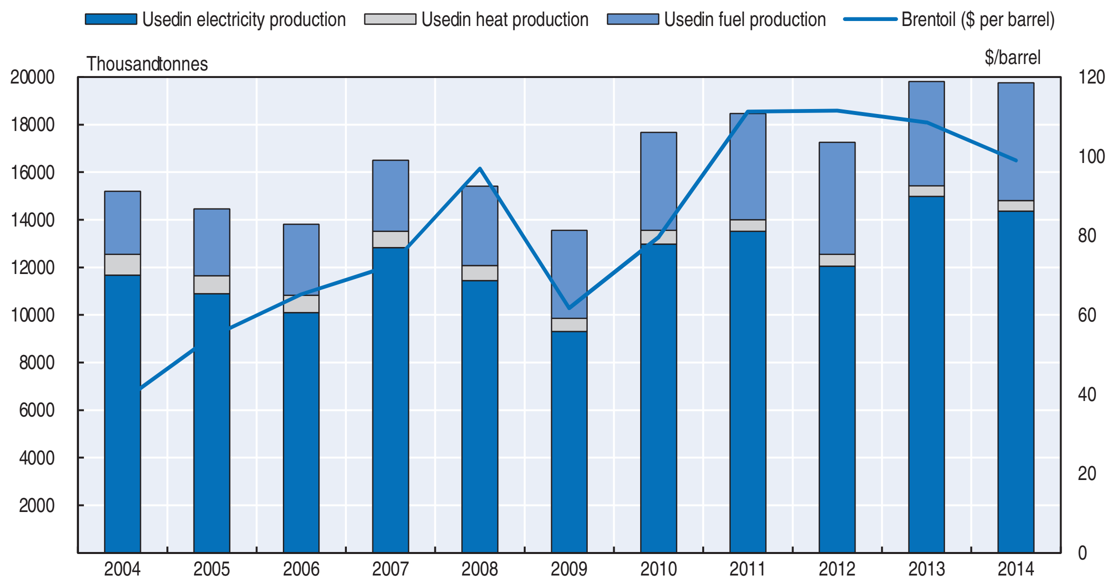
Both the shift to underground mining and the exploration of lower-quality reserves are expected to reduce the profitability of oil shale mining. The NDP for Oil Shale Use for 2008-15 did not indicate the optimal level of efficiency improvements needed to maintain the sector's economic viability, or put forward any measure for reducing mining losses. The NDP 2016-30 sets a target of maintaining losses in underground mines below the 2013 base, but does not contain measures to reduce them further (MoE, 2015a).

Four oil shale mining companies hold excavation permits: the state-owned Eesti Energia Kaevandused (part of the Eesti Energia Group) and three private firms. The extraction is heavily concentrated. In 2012, Eesti Energia mined around 13 million t of oil shale, accounting for 88% of the total extracted in Estonia and making it the largest oil shale processing company in the world (NAO, 2014).

Compared to other solid fuels, oil shale does not have a high export potential (All, 2014). However, products of oil shale – shale oil, chemicals and electricity – can be profitably exported. Export demand for electricity and shale oil (coming primarily from Latvia and Lithuania) drove increased extraction of oil shale in the last decade (Figure 5.3). High global oil prices in 2009-14 increased the profitability of using oil shale for fuel production and motivated oil shale companies to actively invest in additional shale oil production capacities (Figure 5.2).

The drop of global oil prices over 2014-15 has heavily reduced the profitability of shale oil production: Eesti Energia's net profit fell by 66% during the period (Eesti Energia, 2016).

Figure 5.2. **Oil shale use correlates with oil price dynamics**



Source: Statisticsof Estonia (2015); Federal Reserve Bank of St Louis (2016).

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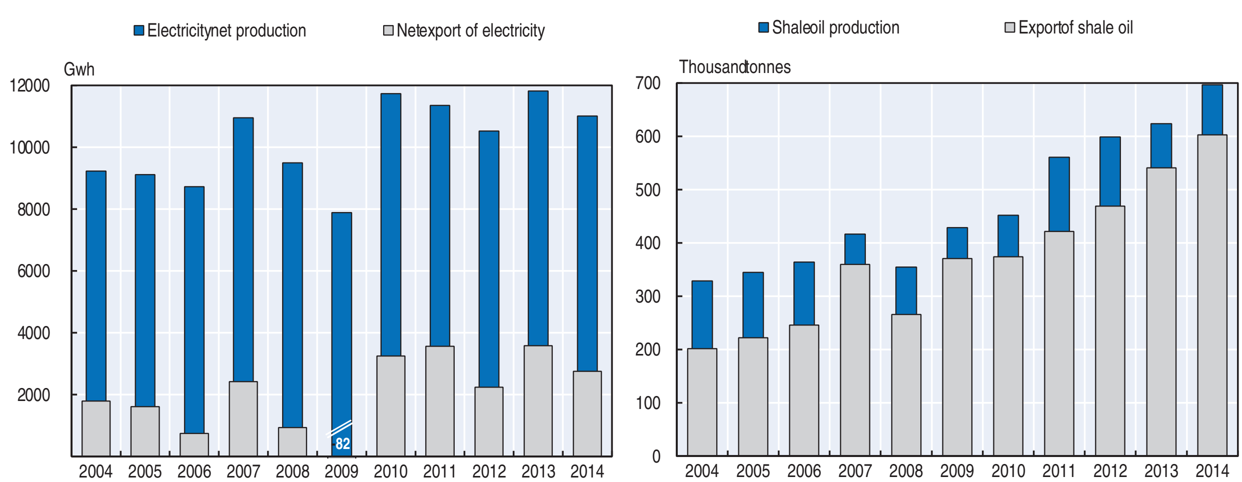
Figure 5.3. **Exports of electricity and shale oil boost oil shale production**



Source: Statisticsof Estonia (2015).

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This has forced companies to freeze production, lay off workers and put their long-term investment plans on hold. A recent study estimated that approximately 75% of the oil shale processing equipment will reach the end of its economic life by 2025. The same study estimated that an increase of CO_2 prices to EUR 100 per tonne by 2035 instead of EUR 20 per tonne (in real terms) could decrease the cash flow per tonne of oil of the sector's companies by about 30% (Ernst and Young, 2014).

Oil shale combustion for electricity generation is expected to stabilise in the coming years before declining due to increased competition for electricity exports in the Nord Pool market and limited replacement by renewables (most Estonian boilers designed for oil shale combustion can accommodate partial or complete fuel switching to biomass). Oil shale use for heat will continue to decline as current policies favour its replacement with biomass in combined heat and power plants; only 13% of heat supply now comes from oil shale. Shale oil production prospects are uncertain in light of low global oil prices (Kearns, 2015). The same is true for Estonia's longer-term plans to capture semi-coke gas, a by-product of shale oil production, and use it as a fuel for electricity and heat generation.

To ensure the sector's viability, Estonia should invest to improve efficiency of oil shale extraction, power generation and shale oil production. Some investments have been made: new shale oil production units and new fluidised bed combustion units in power plants are more efficient than old ones. In 2011, the oil shale sector accounted for a quarter of the total R&D expenditures. However, this share went down to 17% in 2014 (IEA, 2016b). According to NAO (2015), the government had not achieved its goal, set in the NDP 2008-15, of raising the efficiency of mining and using oil shale.

More investments are needed to develop new mining and processing technologies, although this may be difficult under currently unfavourable market conditions. Research continues into loss-reducing mining technologies, some of them including backfilling with waste rock to allow more extraction of oil shale without risking land subsidence (Karu et al., 2008; Tohver, 2011). In addition to the reference document on best available techniques (BAT) for shale oil production developed in Estonia in 2013, the NDP for Oil Shale Use for 2016-30 envisages a BAT reference document on the use of oil shale for energy generation[3] by mid-2017 (MoE, 2015a). An EU BAT reference document on mining waste management is also under preparation.

More generally, the government needs to take concrete action towards diversification of the energy supply by ensuring a more even distribution of energy sources (IEA, 2013). As a member of the Nordic Electric Exchange since 2009, Estonia is a participant in an open electricity market. Thus it does not have to rely on domestic sources for power supply.

The diversification of the energy supply and the consequent decline in demand for oil shale would entail the need to offer social guarantees to the oil shale sector's mostly Russian-speaking work force in north-eastern Estonia. Estonia recently submitted an application for support from the Globalisation Adjustment Fund to mitigate the impact of job cuts in Ida-Viru county. The experience of Germany's Ruhr region may provide insight into the transition from an economy based on natural resources to a knowledge-based economy (Galgóczi, 2014). Based on Germany's experience, a socially responsible downsizing process may include labour market transition of dismissed workers through employment promotion and retraining managed by specialised agencies, as well as early retirement. Although the transition would mostly affect men, job creation for female employees should also be an important priority. Finally, active collaboration between the central government, municipalities, employers and trade unions is essential for a successful and just transformation.

3.2. Peat

Estonia's peat areas cover 1.2 million ha, or 22.5% of the territory. As of the end of 2014, the active reserves of peat suitable for mining were about 198 million t. Currently, there are 208 registered peat mining areas, of which 62 were in active use in 2014 (MoE, 2006-14). Around 65% of peat production is exported. Around 60% of the peat consumed domestically is used to make gardening products, while the rest is burned for household heating (Eesti Turbaliit, 2016).

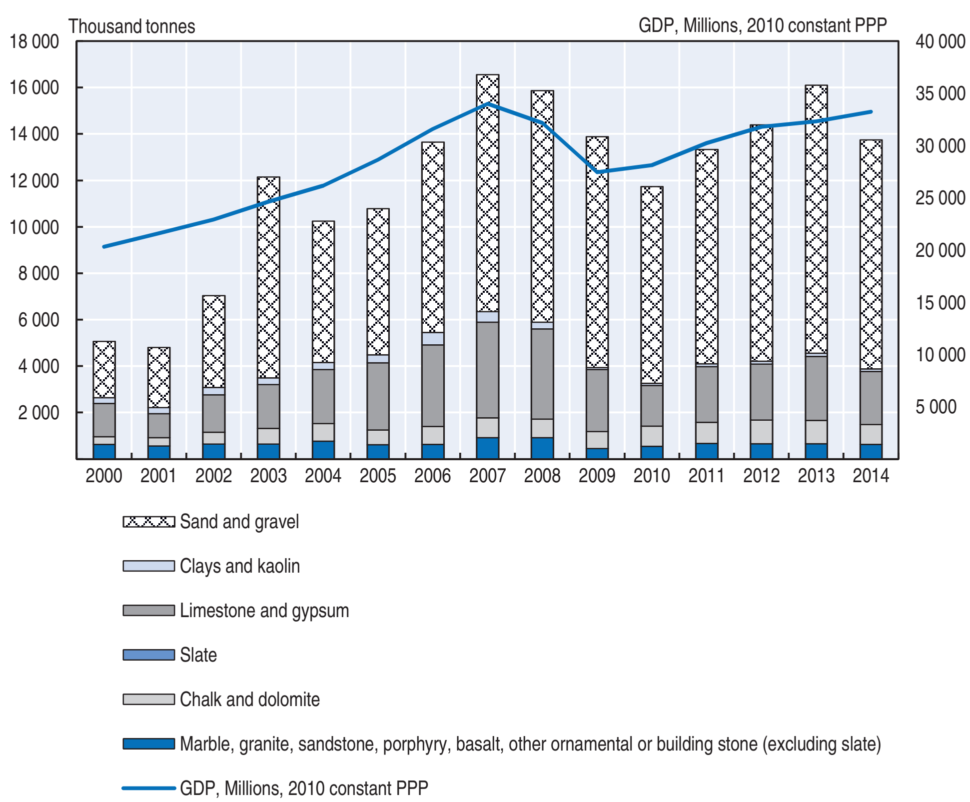
In 2006, a government regulation established an annual peat extraction quota of 2.6 million tonnes. The limit is divided between counties to guarantee an even distribution of production sites. During the last decade, the peat extraction volumes have fluctuated between 0.6 and 1.2 million t per year depending on weather conditions. The government plans to decree where extraction of peat deposits is acceptable from economic and environmental perspectives.

3.3. Construction minerals

Sand, gravel and limestone are the most widely used construction minerals in Estonia. Sand and gravel are used in the building materials industry to make concrete and other mixes, as well as in road construction. Limestone is used in the construction of buildings and roads. Dolomite rock is used in the production of crushed stone, masonry stones, pavement slabs, stairs, etc.

More than 200 small companies mine construction minerals in open quarries. Since 2007, the extraction of sand and gravel accounted for about 65-70% of all extracted construction minerals (Figure 5.4). Over the last ten years, the demand for construction materials was largely driven by investments of EU structural funds into road infrastructure. During the rapid economic growth of 2006-07, road construction materials – limestone and gravel – were most in demand. The economic crisis in 2008 resulted in less mining of all minerals; since 2011, mineral volumes have started to gradually increase, but have not reached pre-crisis levels.

Figure 5.4. **Domestic extraction of construction materials in relation to GDP**



Source: EUROSTAT (2016) *Material Flows and Resource Productivity* (database); OECD (2016) *National Accounts* (database).

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4. Environmental impacts and main mitigation measures

Oil shale is the country's largest source of hazardous and non-hazardous industrial waste. Approximately half the material extracted in oil shale mining becomes waste rock, consisting of limestone and oil shale residue; this accounts for 70% of the country's non-hazardous waste generation (Chapter 4). Oil shale processing generates up to 98% of the country's hazardous waste (Eurostat, 2015). This includes ash from oil shale combustion, as well as semi-coke and retorting waste from its conversion to shale oil.

Oil shale mining has harmful environmental impacts on water abstraction and the quality of both surface water and groundwater (NAO, 2014). Air pollution from the oil shale sector comprises more than 70% of all Estonia's air emissions (NAO, 2014). The industry (including state-owned Eesti Energia) spent EUR 366 million in 2011-14 alone to reduce pollution caused by oil shale mining and processing (Statistics Estonia, 2015), but major challenges remain.

Other environmental impacts of oil shale mining are related to noise, vibration, sinkholes and floods. These factors reduce the value of properties and land, damage landscapes and buildings, and negatively affect the social fabric of local communities. None of these aspects has yet been analysed in detail, making it difficult to design mechanisms to address them (NAO, 2014).

Peat mining has considerable impacts on ecosystem and hydrological balance. The restoration of dehydrated peat lands and protection of existing wetlands are important challenges in Estonia. Special focus is needed for abandoned production fields. If these areas are not re-vegetated, they constitute an important source of CO_2 emissions (Karofeld, 2004).

Mining of other minerals also causes problems of waste disposal, but of a lesser scale. Mining of construction minerals generates waste in the form of siftings and dust. Siftings are used as a filling material in construction activities or for backfilling of mines. In addition, NAO (2009) noted the extraction of minerals in Estonia does not usually involve environmental mitigation and that old quarries are usually not reconditioned.

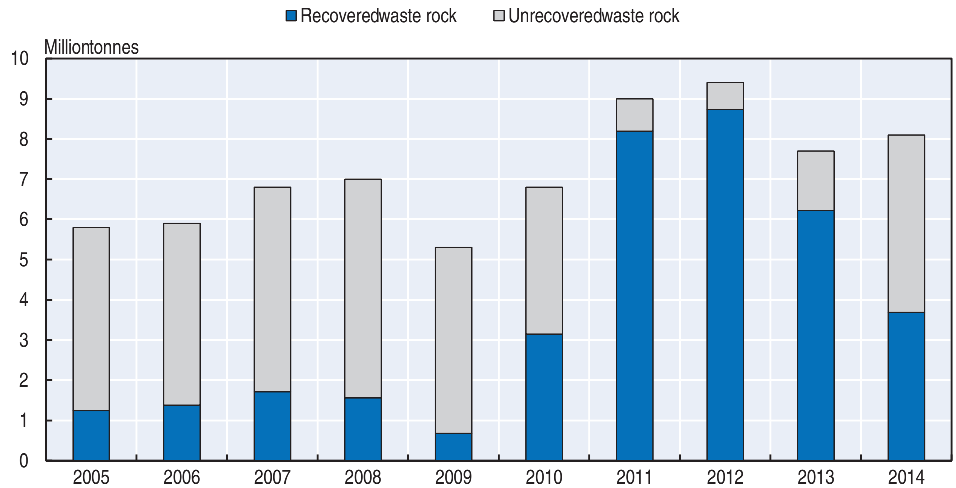
4.1. Non-hazardous mining waste

Mining waste generation has increased by about 40% since 2005 due to growth in total extraction volume (Figure 5.5). According to NAO (2014), this increase is caused by extraction of oil shale of increasingly lower quality. In addition, mining waste generated by the Narva quarries was not reported until 2011; this suggests the increase in mining waste is, at least partly, related to changes in waste reporting (NAO, 2014).

The amount of waste rock depends on the mining technology: underground mining generates up to half a tonne of mining waste for every tonne of extracted oil shale, which is significantly more than open-cast mines. In the foreseeable future, mining waste amounts are likely to increase due to more extensive underground mining and exploitation of lower quality reserves (Section 3.1).

Waste rock is usually sorted into low-quality gravel (for road construction or backfilling) and oil shale residues. Oil shale residues are deposited in landfills because it is not economically feasible to reuse them. One study estimates that all waste deposited in landfills contains more oil shale than what is annually extracted (Gaškov et al., 2012). The risk of self-ignition and leaching, with consequent negative impacts on air quality and groundwater, is particularly high in Soviet-era landfills, where the oil shale content in waste is very high.

Figure 5.5. **Oil shale mining waste recovery rose until 2012, but has since declined**



*Source:*Statistics Estonia (2015).

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Between 2005 and 2012, the share of recovered waste rock went from 20-25% to more than 90%, before declining to 45% in 2014 (Figure 5.5). Using gravel made from waste rock as ground filler for building a local moto-centre, as well as in several large-scale road construction projects, explains the high reuse percentage of 2011-12 (Gaškov et al., 2012). However, the NDP 2016-30 sets the waste rock reuse target for 2020 below levels that have already been achieved, at just 40% (MoE, 2015).

Eesti Energia, the main mining company, has invested in crushed stone production facilities. Due to the low value of waste rock (and the low quality of gravel produced from it) and the comparatively high transportation costs, reuse opportunities depend on local construction. Indeed, the fall in the reuse of mining waste over 2012-14 appears to be linked to the completion of local construction projects. The demand for waste rock is partly sustained by the fact that several big limestone quarries in Harju county are on the verge of depletion; plans to open up new quarries have not been well received by local communities. In coming years, a share of waste rock from oil shale mining could be used as construction material for the upcoming Rail Baltica project (Box 5.2); however, the economic costs and environmental impacts will need to be carefully assessed.

Box 5.2. **The Rail Baltica Project**

In the coming years, Estonia together with Latvia and Lithuania plan to construct Rail Baltica, a transport link to other parts of Europe financed in part with EU support. For much of this line, new tracks will be built, with work indicated (as of early 2016) to begin in 2017. The Estonian government has commissioned a feasibility study on the use of limestone waste from oil shale mining for the construction. While the quality of the rock is not appropriate for the track ballast, it could be used for complementary works. However, its transport from oil shale mining areas in north-eastern Estonia would result in both direct costs and environmental impacts.

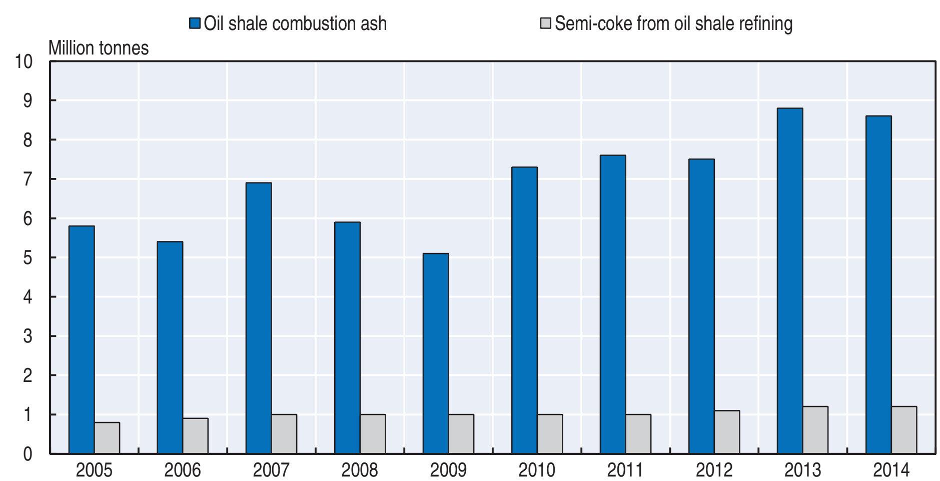
Source: Rail Baltica (2016).

Old quarries are also commonly used to plant forests for commercial logging. In addition, the academic community has proposed to use quarries to build wind farms, turning waste hills into ski slopes or observation points, but in practice only a few have been transformed (Virkus, 2014). The government foresees greater use of underground mines and introduction of backfilling of mining waste into galleries after extraction. This recovery method should reduce surface movements and improve mine safety and mining operations, but it will entail higher costs.

4.2. Hazardous waste from oil shale combustion and refining

The quantity of hazardous waste generated in 2014 was about 9 million t of oil shale ash and 1 million t of semi-coke. This is 48% more than in 2005 (Figure 5.6) due to more oil shale combustion and refining (Figure 5.2) and insufficient improvements in the respective technologies.

Figure 5.6. **Generation of hazardous ash and semi-coke rose since 2005**



Source: Statistics Estonia (2016).

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Ash

Oil shale is burned in power plants, as well as in combined heat and power plants, near the main oil shale mining area; this produces fly ash and bottom ash, both of which are classified as hazardous waste due to their high alkalinity (they also contain heavy metals). About 45% of the oil shale used in combustion ends up as ash (Gavrilova, 2005). Estonia has introduced fluidised bed combustion in power plants, increasing their efficiency. Despite this effort, levels of ash have increased in recent years (Figure 5.6) due to higher levels of power generation.

The ash has been deposited in landfills that cover about 2 000 ha. The leachate from these ash fields has contaminated soils and groundwater (Gavrilova, 2005). Oil shale ash is used in building materials and in agriculture to reduce the acidity of soils, as well as for the production of mineral fertilisers. Between 2005 and 2014, the oil shale ash recovery grew from 3.3% to 4.8% (MoE, 2015b). While Eesti Energia has researched methods to recycle oil shale ash for road building and in other construction areas (Osamat, 2015), the government is setting only a modest target of 4.5% ash recovery for 2020 in its oil shale NDP (MoE, 2015a).

Semi-coke and other wastes

Three existing refineries located near the oil shale mines generate oil products and gas. Approximately 3 t of hydrocarbon-containing waste, mainly solid semi-coke (containing polycyclic aromatic hydrocarbons) and viscous pitch, are generated for each tonne of shale oil produced. According to the MoE, new filtering methods have reduced the amount of waste pitch produced.

Significant amounts of semi-coke could be used in cement production, thereby replacing natural limestone and oil shale and saving these resources (SEI, 2007), but so far these techniques have not been used. Thus, this waste has also been landfilled, which has led to groundwater contamination in the area (Gavrilova, 2005). Old landfills present a particularly serious pollution legacy. The process of closing and cleaning up the semi-coke landfills of Kohtla-Järve (Box 5.3) and Kiviõli has been almost completed with support from EU structural funds. However, an audit discovered that the quality of preparation of these projects was poor; it resulted in significantly higher costs compared to initial offers submitted by contractors (NAO, 2015). Monitoring of air and water pollution at these and other landfill sites should be continued and improved.

Box 5.3. **Clean-up issues at the Kohtla-Järve landfill**

The large landfill at Kohtla-Järve has received waste from the production of oil products since 1938, including ash and semi-coke. The landfill now contains over 80 million t of semi-coke. It has created air pollution, including volatile organic compounds, as well as groundwater pollution. In 1997, ditches were dug around the site to extract leachate, which was sent to a wastewater treatment plant. Nonetheless, significant groundwater contamination from many years of leaching remains.

To meet EU requirements, the Ministry of the Environment decided to close a large section of the landfill. The work, which started in 2010, included reconstructing the drainage ditches and putting a waterproof cap on the closed area. It was financed largely by EU funds. The work was delayed, however, when a large portion of the closed landfill self-ignited. Although the project was largely completed by 2015, independent experts contend that the landfill still emits pollutants to the air and that groundwater contamination continues.

Source: Vallner et al. (2015).

According to NAO (2015), the quality of reported data for hazardous ash and semi-coke arising from oil shale use needs to be improved. The companies in these sectors estimate waste levels, but they use different methods. The MoE should review these methods and establish a common approach.

4.3. ***Impact on water bodies***

The oil shale sector is the largest water consumer of the country. Ida-Viru county, where oil shale deposits are located, accounted for about 95% of all abstracted water in Estonia over the last eight years (Statistics Estonia, 2016). The sector's water abstraction includes large volumes of surface water used for cooling in oil shale-fired power plants, as well as water pumped out of mines and quarries; the amount depends largely on rainfall (Pihor et al., 2013). The NDP for Oil Shale Use for 2016-30 sets a 2020 target of 14 m^3 of groundwater pumped out per tonne of oil shale extracted, which is only slightly below the 2013 average level of 15 m^3 (MoE, 2015a).

Mining operations have a considerable impact on the hydrological regime of the Ida-Viru oil shale basin, influence groundwater infiltration and affect river run-off and flow feed, causing land subsidence. In addition, water discharges from mines affect the chemical composition of surface water and groundwater. High sulphate concentrations in the mine water and its acidity (high pH) have been particularly problematic. Studies also indicate a change in river water temperature and ice conditions due to discharges of warmer mining water (Vaht, 2014).

Due to the impossibility of reaching the good status water quality targets of the Water Framework Directive by 2025, Estonia requested an exemption. It cited the region's socio-economic conditions – the need to continue mining at present levels – that make it difficult to reduce water pollution (EC, 2012). However, an action plan would be necessary to prevent further deterioration and to protect adjacent groundwater bodies, which are considered at risk (NAO, 2014).

The poor quality of groundwater in the oil shale mining area also has a direct impact on public water supply. Due to exploitation of the upper groundwater levels during mining activities, the bore wells need to access deeper groundwater levels. This implies higher costs of water supply (Gaškov et al., 2012). In addition, a survey by the NAO among local authorities revealed that mining strongly affects the availability and quality of water in wells. These issues are considered problematic even in 55% of the areas where mining has been suspended or mines have been closed. About 70% of local authorities in affected areas reported that some drinking water wells had dried up due to oil shale extraction, and 43% of local authorities signalled the low water quality in some wells (NAO, 2014).

Peat extraction also disrupts water bodies. Estonia has more than 6 000 ha of wetlands with a damaged water ecosystem as a result of peat harvesting during Soviet times. To achieve a good status of water bodies, the natural hydro-morphological water regime must be restored in these areas, thereby creating habitat conditions necessary for recovery of species.

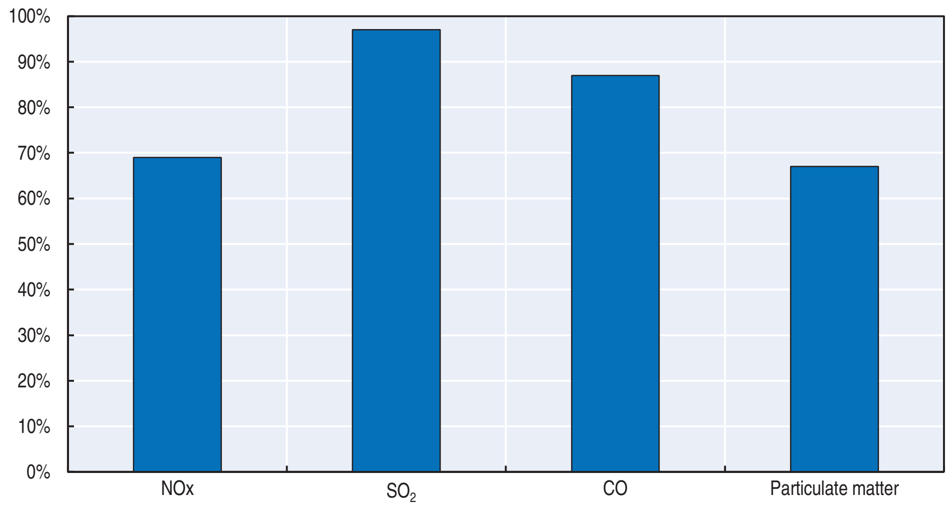
4.4. Impact on air quality

The impact of mining itself on air quality is relatively small. However, air quality issues (SO_2, NO_x, particulate matter and CO_2) associated with oil shale-based electricity and heat production, shale oil production and landfilling of hazardous waste from these processes are significant, particularly in Ida-Viru county (Figure 5.7).

Oil shale combustion to produce electricity or heat, and its heat transformation into shale oil is carbon-intensive. Estonia has the sixth highest level of GHG emissions per capita among OECD member countries (Chapter 1). According to NAO (2014), the amount of CO_2 emissions generated per unit of oil shale energy and heat production increased by 11% between 2007 and 2012.

As part of the EU accession requirements, Estonia agreed that emissions from oil shale power plants would not exceed 25 000 tonnes after 2012. Desulphurisation equipment installed at the oil shale-fired Narva power plant in 2012 significantly contributed to the decrease of SO_2 emissions (Chapter 1). As a result, Estonia complied with interim emission limit values for SO_2 and particulate matter from large combustion plants; the EU had granted these interim limits for a transitional period that ended on 31 December 2015. However, Estonian power plants can comply with the emission limit values imposed by the EU Industrial Emissions Directive (2010/75/EU) as of 1 January 2016 only by curtailing their operations; significant technology investments would be required to reduce unit emissions.

Figure 5.7. **Ida-Viru accounts for the lion's share of Estonia's air pollution**



Source: ESTEA (2016).

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4.5. *Health implications of mining*

The health implications of mining have not been thoroughly investigated in Estonia. The first study on the health impacts of the oil shale sector was conducted in 2014 by the Estonian Health Board in co-operation with different departments of Tartu University and the Estonian Environmental Research Centre (Orru et al., 2015).

The study indicates the health status of residents of Ida-Viru county is worse in many respects than elsewhere in Estonia, principally due to environmental pollution originating from the oil shale sector. However, this region is characterised by complex problems (such as other forms of industrial pollution, old contaminated sites, a difficult socio-economic situation), which also have an impact on the health of residents (Box 5.4). Further health impact studies are planned under the Oil Shale NDP for 2016-30.

Box 5.4. **Health impacts of the oil shale sector in Ida-Viru county**

Although the state of the environment has improved significantly over the years, the life expectancy of a child born in Ida-Viru county is still nearly five years shorter than of a child born in southern Estonia or in Tallinn. Most health problems in Ida-Viru are related to air quality. The rates of respiratory system disorders diagnosed in children and the mortality from cardiovascular disorders are also higher in Ida-Viru county than elsewhere in Estonia. In addition, the study showed that the proportion of children with potential risk of asthma is higher in Ida-Viru county than in Lääne-Viru and Tartu counties.

Apart from the living environment, the work environment also affects morbidity levels. People who have worked in the oil shale sector have much more frequently reported symptoms of respiratory diseases, hypertension, stroke, heart diseases and diabetes than those who have not.

Source: Orru et al. (2015).

5. Policy instruments and their effectiveness

Extraction permits and issue-specific environmental permits are the main instruments for regulating environmental impacts of mining activities. The sector's main regulatory issues are setting of, and monitoring and enforcing compliance with, conditions of such permits, including land restoration requirements.

Environmental taxes are the main economic instrument affecting the mining sector. They are regulated by the Environmental Charges Act (2006)[4] and include extraction taxes, air and water pollution taxes, waste disposal taxes, water abstraction taxes, etc. Environmental taxes account for a significant share of operating expenses in the mining and energy sector – 5% in 2011 (Statistics Estonia, 2016). However, they appear to be too low to encourage innovation and investment in cleaner technologies.

5.1. Permits

Beginning in 2008, the Earth's Crust Act set a maximum limit of oil shale excavation of 20 million t per year to ensure sustainable use of oil shale resources. All four companies with permits have to comply with their share of this total extraction limit. So far, none has exceeded its respective limit.

In 2015, the Earth's Crust Act was amended to allow holders of extraction permits to extract additional amounts of oil shale as compensation for the years 2009-14 when they did not exceed the established extraction limit. In this way, it intended to give more flexibility to smaller mining companies and reduce Eesti Energia's monopoly. As the limit was set significantly above actual excavation amounts, such a step would inevitably lead to an increase of the sector's environmental impacts. At the same time, allowing more competition for oil shale extraction permits may open opportunities for more effective oil shale use. NAO (2015) suggested that the government promote a public debate on the negative impacts of mining and use of oil shale and the future of the oil shale sector. It recommended postponing decisions on new extraction limits and deployment of new excavation areas until such debate has taken place.

The MoE issues permits for the exploration and extraction of mineral resources of national importance (mostly oil shale), although this responsibility is expected to be transferred to the Environmental Board by the new Earth's Crust Act. The Environmental Board issues exploration and extraction permits for deposits of local importance (construction minerals and peat). In practice, with respect to construction minerals, the issuance of a geological exploration permit often establishes new quarries before assessment of the environmental impact caused by extraction (NAO, 2009).

Oil shale combustion and processing are subject to integrated pollution prevention and control or issue-specific environmental permits for air and water pollution releases and waste management, issued by the Environmental Board (Chapter 2). According to NAO (2015), the Environmental Board has not set sufficiently detailed and comprehensible conditions in environmental permits to regulate how a company should monitor and mitigate the environmental impact of its activities. The Environmental Board has not been using the conditions of environmental permits to influence companies to reduce dumping of oil shale waste and increase waste reuse. Moreover, extraction permits do not include any financial requirements and guarantees to conduct remediation. This might lead to problems in case of bankruptcy of the permit holder when the obligations are transferred to the land owner who is not able to take up the recovery.

The Environmental Board is supposed to collect information about the environmental impact of exploration and mining of natural resources. It should periodically verify whether the company's claims of extraction volumes correspond to the actual situation and to permit provisions, and whether the company is mining the deposit as required. If serious problems arise in the course of mining operations or if the company fails to meet the requirements, the Environmental Board has a right to review, amend or withdraw its permit.

However, NAO (2015) stated that there is inadequate compliance monitoring of waste management in oil shale mining and processing, and company-reported data are not sufficiently checked either by the Environmental Board or by the Environmental Inspectorate. The NAO has identified several errors in waste reporting that a reporting control system could easily have identified. The same report (NAO, 2015) alleges that the MoE has failed to consolidate all the relevant environment monitoring data, including those collected by companies, into an integrated information system. This makes it difficult to analyse and use data on the sector's environmental impact.

5.2. Land restoration requirements

The Earth's Crust Act and the subsequent 2005 regulation of the Ministry of the Environment require restoration of land affected by mining sites. According to this regulation, the extraction permit holder is required to remediate land used for mining of mineral resources through a restoration project. The project should describe technical and environmental aspects of land restoration and must be approved by the Environmental Board.

Remediating mined areas into useable land depends on the mining technology and the type of mined resource. In the case of open-cast mining, a major concern is restoring the productivity of the land; conversely, underground mining may lead to land subsidence and requires restoration of the groundwater regime. Soviet-era areas of land subsidence have been investigated and refilling has been done where needed. However, the risk of further subsidence remains. Old site plans and reports are incomplete and sometimes misleading, which may result in unexpected land subsidence in old mining areas (Baltic Countries Mineral Industry Handbook, 2015).

Landscapes disturbed through mining must be remediated so that they blend in with the surrounding area and are fit for reuse. This way, for example, an old open-cast mine can be afforested or transformed into a field or lake, or redeveloped entirely as a residential or recreational area. Research has shown that if land reclamation activities are planned skilfully, mining areas could be turned into valuable forests, commercial zones or even agricultural land (Kaar and Kiviste, 2010).

According to mining permit holders' reports, the extent of restored areas of oil shale mines reached about 13 000 ha in 2012 (Pihor et al., 2013). The Ahtme and Kohtla mines are excellent examples of effective remediation of open-cast waste deposits into multipurpose recreational areas. These projects, supported with EU funds, have contributed to the tourism potential of north-eastern Estonia.

There are concerns with the restoration of construction mineral quarry sites. The law stipulates the quarry must be reconditioned by the time the extraction permit expires, but these requirements are usually not followed. Extractors commonly apply to extend their extraction permits and expand the quarries before their permits expire; once permits have been extended, the deadline for reconditioning is postponed (NAO, 2009).

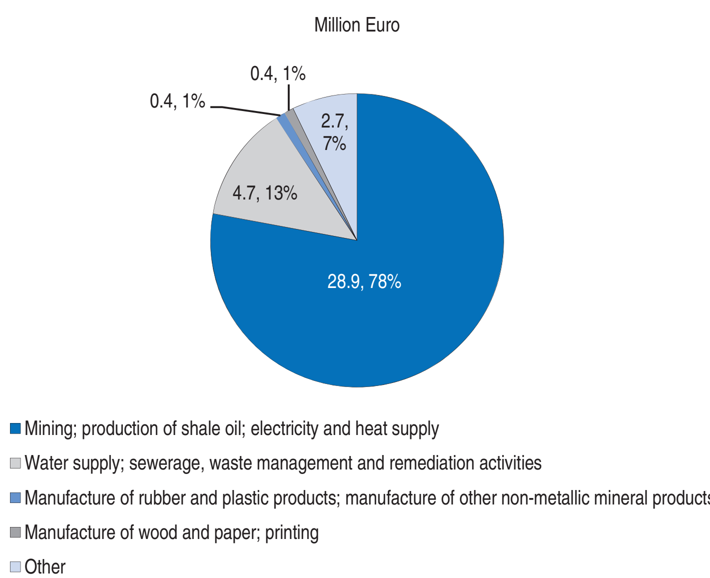
5.3. *Economic instruments*

Extraction permit holders pay the mineral resource extraction tax for extraction and use of mineral resources belonging to the Estonian state. These taxes have grown significantly since 2005 (e.g. about three-fold for oil shale), but are not set in relation to the value of the resource (Chapter 3).

Amendments to the Environmental Charges Act (adopted in June 2016) tie extraction taxes for oil shale to the oil price retroactively from July 2015. There is a fixed minimum extraction tax of EUR 0.275 per tonne that corresponds to "compensation for environmental distress in the area"; revenues from the tax revert to the local government. Above this fixed amount, the variable tax depends on the oil price. In 2016, the extraction tax is set at its minimum until the end of 2017 (when a new extraction tax calculation methodology is expected to be approved); this effectively cuts the rate by more than 5.7 times. The government is reducing the tax burden on the oil shale industry to increase the profitability of investment in shale oil production in the context of low global oil prices. However, this tax break deprives the government of significant environmental tax revenues and runs contrary to its green tax reform agenda.

There are also taxes on air and water pollution, as well as waste disposal (Chapter 3). The largest share (almost 80%) of pollution taxes is paid by enterprises active in mining, production of shale oil, electricity and heat supply (Figure 5.8).

Figure 5.8. **The oil shale sector is the biggest payer of pollution taxes, 2013**

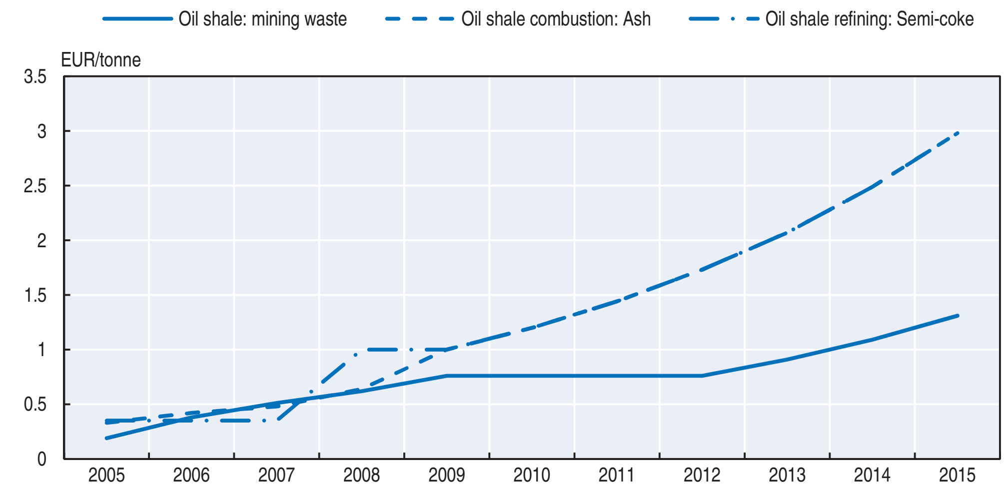


Source: Statistics Estonia (2016).

StatLink http://dx.doi.org/10.1787/888933448866

Environmental taxes increased steadily between 2005 and 2015 (Chapter 3). For example, waste disposal taxes rose seven-fold for non-hazardous mining waste and more than eight-fold for oil shale ash and semi-coke (Figure 5.9). However, a study concluded the impact of these taxes on the volume of pollution releases is unclear (Lahtvee et al., 2013). Air emissions and wastewater discharges have been reduced, but more due to investments made to comply with stricter EU environmental standards than in response to an economic

Figure 5.9. **The tax rates for waste disposal from oil shale mining, combustion and refining have risen**



Source: Country submission.

StatLink http://dx.doi.org/10.1787/888933448876

incentive. Waste disposal charges may have affected waste recovery practices: Eesti Energia Kaevandused has constructed several crushed stone production plants and recovered as much as 70% of its non-hazardous mining waste in 2010-11, compared to 20% in previous years (ESTEA, 2014). Still, this remarkable increase in the waste recovery rates could be attributed primarily to strong commercial demand for construction materials in those years.

The taxes' environmental effectiveness appears to be further compromised by lack of enforcement of their payment. While the Environmental Board is supposed to monitor payment of environmental taxes, it recently reported to the NAO that it had not carried out such supervision since 2011. As a result, it is unclear whether the state received the right amount of tax revenue (NAO, 2014).

In general, businesses perceive environmental taxes as a source of revenues for the government rather than as an incentive to reduce environmental impacts (NAO, 2014). For environmental taxes to stimulate introduction of cleaner technologies, tax rates should be increased for priority pollutants and landfill disposal of mining waste (Chapter 3), and their collection closely monitored.

This would require overcoming the industry's significant resistance to environmental tax rate increases. Eesti Energia and the sector's other companies evoke financial difficulties caused by low world oil prices. In response to this pressure, in the first half of 2016, the MoE proposed amendments to the Environmental Charges Act to reschedule payment of taxes on landfill disposal of oil shale mining, combustion and processing waste. Like the above-mentioned proposal to lower extraction taxes, this action would undermine both the environmental incentive and revenue-raising effect of economic instruments in the oil shale sector and amount to an environmentally harmful subsidy (Chapter 3).

Recommendations on mining and the environment

- Align the policy of oil shale extraction limits with the sector's overall efficiency and environmental goals stated in relevant strategic documents; make the NDP's efficiency and environmental targets for 2025 and 2030 more ambitious in view of reducing the share of oil shale in the energy mix, and plan measures for achieving them; strengthen the information base on the sector's environmental and health impacts, including through establishing standard monitoring and reporting procedures and more diligent verification of companies' self-reporting data by the Environmental Inspectorate.
- Encourage deployment of more efficient oil shale mining and processing technologies; develop partnerships between government and industry to facilitate cost-effective transition to cleaner and more efficient oil shale extraction and use; develop a reference document on best available techniques in energy generation and oil production and rational use of extracted resources.
- Consider additional actions towards the diversification of the Ida-Viru region's economy away from oil shale mining and use, envisaging measures to mitigate the potential social impacts (e.g. improving labour mobility and training) through active collaboration between the central government, municipalities, employers and trade unions.
- Reinforce efforts to increase the recovery of mining waste, including ash and semi-coke from oil shale processing, by investing in research and development in collaboration between the government, research institutions and enterprises; consider increasing landfill disposal taxes for oil shale mining and processing waste; improve the monitoring of air and water pollution in mining areas.
- Strengthen the permitting regime for the mining industry by ensuring that extraction and environmental permits contain clear conditions for waste minimisation and post-operation land remediation; better enforce land restoration requirements, particularly for construction minerals mining sites; provide financial support for innovative land restoration projects.

Notes

1. The targets for 2025 and 2030 are either the same as for 2020 or remain to be specified.
2. Statistics Estonia reports both the extraction of pure oil shale (15 million tonnes in 2014) and the consumption of "trade oil shale" (containing limestone and other impurities, which increase the volume), which is shown in Figure 5.2.
3. In the absence of a BAT reference document for oil shale processing, Estonian power plants have to comply with emission limit values for lignite-based power generation under the EU Industrial Emissions Directive.
4. Estonia's Environmental Charges Act refers to resource and pollution taxes as "charges", but the OECD defines them as taxes, and they are referred to as such in this report.

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