OECD Environmental Performance Reviews

Waste Management and the Circular Economy in Selected OECD Countries

EVIDENCE FROM ENVIRONMENTAL PERFORMANCE REVIEWS

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BETTER POLICIES FOR BETTER LIVES

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Please cite this publication as:
OECD (2019), *Waste Management and the Circular Economy in Selected OECD Countries: Evidence from Environmental Performance Reviews*, OECD Environmental Performance Reviews, OECD Publishing, Paris, *https://doi.org/10.1787/9789264309395-en*.

ISBN 978-92-64-30938-8 (print)
ISBN 978-92-64-30939-5 (pdf)

OECD Environmental Performance Reviews
ISSN 1990-0104 (print)
ISSN 1990-0090 (online)

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Preface

Recent decades have witnessed an unprecedented growth in demand for natural resources and materials. Globally, the use of material resources grew from 27 billion tonnes in 1970 to 89 billion tonnes in 2017 and it is projected to increase further to 167 billion tonnes in 2060 (OECD Global Material Resources Outlook to 2060). The environmental consequences of material use will be magnified with the projected doubling of greenhouse gas emissions, pollution to the soil, water and air and damaging effects on ecosystems. Against this background, there is a growing imperative to transition to a more resource efficient and circular economy.

This report summarises key findings and lessons learned in the area of waste, materials management and the circular economy from OECD Environmental Performance Reviews conducted in 11 countries between 2010 and 2018: Japan (2010); Israel (2011); Norway (2011); Slovenia (2012); Colombia (2014); Netherlands (2015); Poland (2015); Korea (2017); Estonia (2017); Hungary (2018) and Czech Republic (2018).

Over this period, countries have become increasingly engaged in promoting policies that encourage greater resource efficiency. The report highlights that countries have improved their material productivity and waste management practices in the last two decades. Countries have also strengthened their policies with regulatory changes and economic instruments, mainly designed to drive waste away from landfills, increase recycling and reduce waste generation. However, the report stresses that more work need to be done. Many countries still lack effective institutional arrangements and accurate data to implement a coherent circular economy transition. Enforcement and compliance promotion remain important challenges, even in countries with advanced waste management practices.

The report builds on the wealth of policy analysis of Environmental Performance Reviews and Information. For some countries, information may be more recent than others. Still, the policy recommendations emerging from the reviews provide useful lessons for other jurisdictions. It is the result of a constructive dialogue of participating countries in the OECD Working Party of Environmental Performance. I am confident that this effort will be helpful to exchange on good practices and solutions to improve the transition to a resource efficient and circular economy.

Rodolfo Lacy

Director, OECD Environment Directorate

Foreword

The OECD Environmental Performance Review Programme has been supporting member and partner countries in developing effective environmental policies for nearly 30 years. The principal aim of the programme is to:

- support countries evaluate progress in achieving their environmental goals;
- promote continuous policy dialogue and peer learning; and
- stimulate greater accountability from governments towards each other and public opinion.

The thematic reports developed under the Environmental Performance Review Programme contribute to these objectives by summarising experience and lessons learned from country specific Environmental Performance Reviews.

This report provides a cross-country overview of waste, materials management and circular economy policies in selected OECD countries and Colombia, drawing on OECD's Environmental Performance Reviews during the period 2010-17. It presents the main achievements in the countries reviewed, along with common trends and policy challenges and provides insights into the effectiveness and efficiency of waste, materials management and circular economy policy frameworks. As the reviews were published over seven years, information on policies for some countries may be more recent than others and some information may be outdated. Nevertheless, the policy recommendations emerging from the reviews may provide useful lessons for other OECD and partner countries. The chapter on "Trends in materials consumption and waste generation" is based on data available up to April 2018 provided across all OECD countries where available.

The authors of the report are Tony Zamparutti, Alicia McNeill and Sarah O'Brien of Milieu Consulting. Nathalie Cliquot of the Environment Directorate co-ordinated its preparation. Nathalie Girouard, Head of the Environmental Performance and Information Division, OECD Environment Directorate provided oversight and guidance. The report benefited from contribution of Environment Directorate colleagues including Myriam Linster, Frederique Zegel and Peter Börkey. Sarah Miet provided statistical support and Annette Hardcastle and Natasha Cline-Thomas prepared the report for publication.

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Abbreviations and acronyms

DMC	Domestic material consumption
EPR	Extended producer responsibility
GDP	Gross domestic product
MBT	Mechanical biological treatment
MSW	Municipal solid waste
NGO	Non-governmental organisation
PRO	Producer responsibility organisations
SMC	Sound Material-Cycle
VBWF	Volume-based waste fee
WEEE	Waste electrical and electronic equipment

Glossary

Circular economy

While there is no single accepted definition of a circular economy, it is generally understood that the "transition to a circular economy" entails a reduced demand for natural resources, and the materials that are derived from them (McCarthy and al., 2018). For example, for the European Commission, the circular economy means maintaining the value of products, materials and resources in the economy for as long as possible and minimising waste. Three main mechanisms for reduced demand are often highlighted. *Creating material loops* involves the substitution of secondary materials (i.e. those that have been used already in production processes and are derived from the recycling of industrial or household waste) and second-hand, repaired, or remanufactured products for their virgin or new equivalents. *Slowing material flows* involves the emergence of products which remain in the economy for longer, usually due to more durable product design. *Narrowing material flows* involves the more efficient use of natural resources, materials, and products, either through the development and diffusion of new production technologies, the increased utilisation of existing assets, or shifts in consumption behaviour away from material intensive goods and services.

Decoupling

Decoupling refers to breaking the link between "environmental bads" and "economic goods." Decoupling occurs when the growth rate of an environmental pressure is less than that of its economic driving force over a given period. Decoupling can be either absolute or relative. Absolute decoupling is said to occur when the environmentally relevant variable is stable or decreasing while the variable reflecting the economic driving force is growing. Decoupling is said to be relative when the growth rate of the environmentally relevant variable is positive, but less than the growth rate of the variable reflecting the economic driving force.

Disposal

Disposal of waste refers to waste elimination techniques comprising for example landfills, containment, underground disposal, incineration without energy recovery.

Domestic Material Consumption (DMC)

DMC measures the mass (weight) of the materials that are physically used in the consumption activities of the domestic economic system (i.e. the direct apparent consumption of materials, excluding indirect flows).

Material productivity

Material productivity makes reference to the effectiveness with which an economy or a production process is using materials extracted from natural resources. The term also designates an indicator that reflects the output or value added generated per unit of materials used. This is typically a macro-economic concept that can be presented alongside

labour or capital productivity. It should be noted that the term “resource productivity” is often used to designate material productivity though the latter does not cover all resources (e.g. water is usually not included).

Materials or material resources

The term "materials" or "material resources" designates the usable materials or substances (raw materials, energy) produced from natural resources. These usable "materials" include energy carriers (gas, oil, coal), metal ores and metals, construction minerals and other minerals, soil and biomass.

Municipal solid waste

MSW (municipal solid waste) refers to waste collected by or on behalf of municipalities from households, commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings), and selected municipal services if managed as waste (e.g. waste from street cleaning, parks and garden maintenance). It includes waste from these sources collected door-to-door through traditional collection operations and fractions collected separately for recovery operations (door-to-door and/or voluntary deposits). MSW includes household and other similar waste, as well as bulky waste (e.g. old furniture, appliances), yard waste, leaves, grass clippings, street sweepings and the content of litter containers, if managed as waste.

Recycling

Recycling is defined as any reprocessing of material in a production process that diverts it from the waste stream, except use as fuel. It includes both reprocessing as the same type of product, i.e. of an identical nature, and reprocessing as products of similar nature but for different purposes.

Resource efficiency

There is no commonly agreed upon definition of resource efficiency. It is understood to refer to the economic efficiency and the environmental effectiveness with which an economy or a production process is using natural resources. It is also understood to contain both a quantitative dimension (e.g. the quantity of output produced with a given input of natural resources) and a qualitative dimension (e.g. the environmental impacts per unit of output produced with a given natural resource input).

Resource productivity

Resource productivity refers to the effectiveness with which an economy or a production process is using natural resources. It can be defined with respect to:

i. The economic-physical efficiency, i.e. the money value added of outputs per mass unit of resource inputs used. This is also the focus when the aim is to decouple value added and resource consumption.
ii. The physical or technical efficiency, i.e. the amount of resources input required to produce a unit of output, both expressed in physical terms (e.g. iron ore inputs for crude steel production or raw material inputs for the production of a computer, a car, batteries). The focus is on maximising the output with a given set of inputs and a given technology or on minimising the inputs for a given output.

iii. The economic efficiency, i.e. the money value of outputs relative to the money value of inputs. The focus is on minimising resource input costs.

The term also designates an indicator that reflects the output or value added generated per unit of resources used. This is typically a macro-economic concept that can be presented alongside labour or capital productivity. Resource productivity would ideally encompass all natural resources and ecosystem inputs that are used as factors of production in the economy. The term is however often used as a synonym for material productivity.

Waste

Waste refers to materials that are not prime products (i.e. products produced for the market) and for which the generator has no further use for his/her own purpose of production, transformation or consumption, and which he/she discards, intends to discard or is required to discard. Wastes may be generated during the extraction of raw materials during the processing of raw materials to intermediate and final products, during the consumption of final products, and during any other human activity. Waste does not include residuals directly recycled or reused at the place of generation (i.e. establishment) or waste materials that are directly discharged into ambient water or air.

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Executive summary

Trends in materials consumption and waste generation

The Environmental Performance Reviews of the 11 focus countries as well as recent OECD data show that most OECD countries have experienced improvements in material productivity. Among the focus countries, material productivity increased significantly in Slovenia, Czech Republic, Poland and Hungary between 2008 and 2015 and more moderately (close to 10%) in countries such as Japan, Korea and the Netherlands. The Environmental Performance Reviews do not provide a clear indication of the factors behind this trend: these may include rising economic productivity together with shifts in economic structure. Moreover, the level in material productivity varies greatly across OECD countries, as does their generation of total primary waste.

Most OECD countries have seen reductions in the amount of municipal solid waste (MSW) generated per capita, with many countries decoupling economic growth from the generation of MSW. MSW generation per capita decreased by 6% on average between 2000 and 2015 in the OECD. In some cases, the Environmental Performance Reviews of the focus countries attributed these shifts to specific policy actions (Korea, Netherlands). In parallel, many OECD countries have increased the level of MSW recycling and recovery. In 2015, several countries, including Japan, Netherlands, Norway and Estonia, had largely eliminated landfilling, replaced by incineration with energy recovery and recycling. In the OECD, 55% of MSW was recovered on average thanks to recycling and composting (35%) and incineration with energy recovery (20%). This trend appears to be linked to policy actions highlighted in the Environmental Performance Reviews such as promotion of investment in new facilities. For other key waste streams, however, a broad set of data are not available to show medium-term, cross-country trends.

Institutional and policy frameworks

Nearly all the focus countries reviewed had established a comprehensive legal framework for waste management, together with a process for the development of regular national waste plans that set out policy objectives and targets, identify actions to meet them and set out a process for monitoring implementation (some countries also developed waste plans at sub-national level).

Many of the focus countries demonstrated commitment to circular economy objectives. However, the Environmental Performance Reviews found that appropriate institutional arrangements and supporting measures to support the transition to a circular economy were often missing and called for co-ordination among a broad range of government and private sector actors to ensure broad-based action across policy areas and stages of the life cycle.

The Environmental Performance Reviews reviewed the management of MSW. The Reviews found strong use of competitive tendering for MSW collection; growing use of kerbside collection to support objectives for greater recycling levels; and a need to ensure capacity in local government, which is often responsible for MSW management. Other

waste streams were considered in depth when prominent in the review country, and sufficient cases are not available to draw cross-country lessons.

Policy instruments

OECD countries have put in place a range of policy instruments for waste management. A key factor in their success is ensuring an effective mix appropriate to the policy challenges.

The focus countries have established regulatory instruments that set rules to govern priority waste streams, require authorisation for treatment facilities and set standards for their operation according to best available techniques. In addition, several countries have introduced landfills bans to promote recycling and recovery. The Environmental Performance Reviews show that OECD countries have used economic instruments such as landfill and incineration taxes, which can promote recycling and reduce landfilling. Full cost recovery for MSW services is in place in a few OECD countries but remains to be addressed in others.

All 11 focus countries have established extended producer responsibility (EPR) for key waste streams such as packaging waste, and the Environmental Performance Reviews highlight their successes in terms of strengthening recycling levels, but also noted challenges in their governance: the latter can include competition issues, achieving full cost recovery through producer fees, gaps in enforcement and in data, and free rider problems. These issues are addressed in OECD's 2016 guidance on EPR.

Several OECD countries have used green public purchasing to promote the use of recycled paper and other products; a further step is to employ this tool to support the circular economy, for example requiring durable goods to be repairable and recyclable. Public awareness supports waste management goals by changing behaviours; in several countries, non-governmental organisations (NGOs) have played an important role in organising clean-up campaigns.

Effective data systems are needed for policy development, implementation and evaluation: several Environmental Performance Reviews identified a need to collect more detailed and higher quality data to support waste policy. In some countries, these issues have concerned specific waste streams, such as construction and demolition waste. The Environmental Performance Reviews also highlighted that attaining circular economy objectives will require new data to track how materials are used in economies as well as their international flows. The OECD Council Recommendations on Material Flows and Resource Productivity (2004 and 2008) underline the importance of accurate data in these areas.

The Environmental Performance Reviews highlighted the need for better enforcement across the focus countries: key steps include ensuring co-ordination among enforcement bodies, establishing compliance promotion programmes and employing risk-based approaches to target inspections.

Investment and financing

The Environmental Performance Reviews found that OECD countries have mobilised both government and private financing for investment: for many of the focus countries, the level of investment in waste management has increased since 2000. The level of investments for waste management varies significantly across OECD countries– from under USD 50 per capita to over USD 200 per capita in focus countries like Estonia, Korea, Slovenia and Netherlands according to 2012 data. Public financing, including via dedicated

environmental funds, has played a key role in supporting waste investments in particular in EU countries. At the same time, several Environmental Performance Reviews found examples of overcapacity in areas such as incineration and mechanical biological treatment (MBT), or risks that investments could lead to overcapacity: they called on countries to calibrate their planning and policy mixes to avoid this outcome.

The Environmental Performance Reviews found that the clean-up of contaminated sites remains a common challenge in the focus countries. Legal frameworks establishing clear liability for past contamination are a necessary step, along with public funds for remediation of abandoned sites. Identifying contaminated sites and setting risk-based priorities for clean-up are among the good practices found.

International co-operation

The Environmental Performance Reviews show that many focus countries have extensive trade in both hazardous and non-hazardous waste streams. Nearly all OECD countries have ratified the Basel Convention, and many have subscribed to its Ban Amendment. Few, however, have signed and ratified its Liability Protocol. Another international dimension highlighted in the Reviews has been technical assistance to share knowledge on waste and circular economy policies with non-OECD countries such as Japan's support for the 3Rs approach in Asia.

Chapter 1. Main findings and conclusions

The last decades have witnessed unprecedented growth in demand for raw materials, driven by the rapid industrialisation of emerging economies and continued high levels of material consumption in developing countries. Current trends of population and economic growth create strong strain on the earth's natural resource and the environment. This has drawn increasing attention to issues relating to resource efficiency including to waste and material management policies as well as strategies promoting the circular economy. In June 2017, the resource efficiency dialogue was launched by G20 Heads of State and the "5-year Bologna Roadmap" was adopted in the G7 framework to advance common activities on resource efficiency.

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1.1. Introduction

The last decades have witnessed unprecedented growth in demand for raw materials, driven by the rapid industrialisation of emerging economies and continued high levels of material consumption in developing countries. Current trends of population and economic growth create strong strain on the earth's natural resource and the environment. This has drawn increasing attention to issues relating to resource efficiency including to waste and material management policies as well as strategies promoting the circular economy. In June 2017, the resource efficiency dialogue was launched by G20 Heads of State and the "5-year Bologna Roadmap" was adopted in the G7 framework to advance common activities on resource efficiency.

The OECD has reviewed waste and materials management policy frameworks in 11 countries in the framework of its Environmental Performance Reviews since 2010. The focus countries listed below by the dates of their review benefited from in-depth chapters on waste, materials management and more recently the circular economy.

- Japan (2010)
- Israel (2011)
- Norway (2011)
- Slovenia (2012)
- Colombia (2014)
- Netherlands (2015)
- Poland (2015)
- Korea (2017)
- Estonia (2017)
- Hungary (2018)
- Czech Republic (2018)

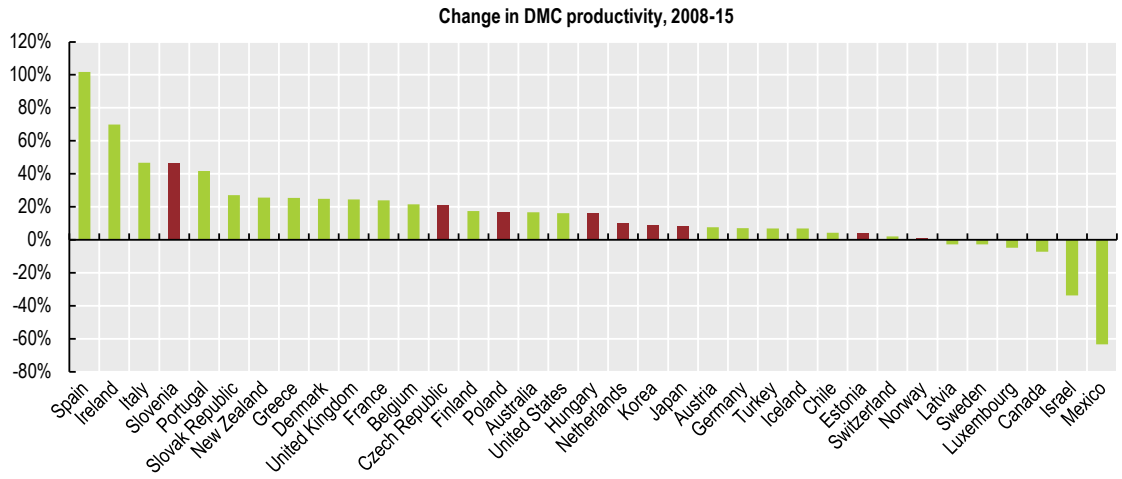
This report provides a cross-country review of waste and materials management policies in these focus countries, drawing on the evidence-based assessments of the OECD's Environmental Performance Reviews. It presents the main achievements along with policy challenges as well as common trends to provide insights into the effectiveness and efficiency of waste management and circular economy policy frameworks. As the reviews were published over seven years, information for some countries may be more recent than others and some information may be outdated. Nevertheless, the policy recommendations emerging from the reviews may provide useful lessons for other OECD and partner countries.

Unless otherwise indicated, all information comes from the Environmental Performance Reviews. The report also considers relevant evidence from the other 13 OECD countries[1] that have completed an Environmental Performance Review during the 2010-17 period. Moreover, recent data on waste and materials (and related indicators, such as gross domestic product [GDP]) are provided across all OECD countries where available.

1.2. Overall trends in materials consumption and waste generation

OECD-wide data show several positive trends in waste and materials management (these trends are presented in detail in Chapter 2 of this report). Since 2000, many OECD member countries have experienced improvements in material productivity (Figure 1.1). At the same time, levels of material productivity vary greatly across the OECD, due to differences in economic structures. Moreover, levels and trends in material productivity are influenced by a broad range of factors, including economic cycles, while the data are available for only a relatively short period of time: consequently, the improving trend is difficult to interpret.

Figure 1.1. Material productivity rose in most countries



Note: 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. 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: Eurostat (2016), Material flows and resource productivity (database); OECD (2016), "Material resources", OECD Environment Statistics (database).

StatLink https://doi.org/10.1787/888933976023

Many countries have seen a reduction in the level of municipal solid waste (MSW) generated per capita, and several focus countries decoupled economic growth from the generation of MSW. For a few countries, such as Korea, the Environmental Performance Reviews link these positive trends to specific policy actions. Overall, however, the generation of MSW is closely related to GDP; while a few of the focus countries appear to have decoupled the growth of MSW from that of GDP, it appears that challenges remain in this area.

Many OECD countries have increased the level of MSW recycling and recovery. The Environmental Performance have shown that most of the focus countries put in place policy objectives and instruments to raise their recycling and recovery levels.

1.3. Waste and materials management challenges in focus countries

The Environmental Performance Reviews covered countries with great differences in their economic, social and geographic conditions. These conditions can influence waste and materials management policy objectives, as well as legal and institutional frameworks, together with major policy trends. Box 1.1 below outlines challenges and issues for waste and resource efficiency policy found in the 11 focus countries.

Box 1.1. Waste and materials management challenges

Colombia

- Significant challenges arise in the management of hazardous waste from the oil and mining sectors.
- Lack of landfill capacity has been a problem, with landfills in some large cities reaching capacity. Plus, the environmental management of landfill sites was a concern: 30% of sites did not comply with standards.
- The informal sector plays an important role in waste management, with half of all waste separation for recycling carried out by the sector, creating challenges for government measures to improve recycling rates.
- Accession negotiations between the OECD and Colombia began in 2013, encouraging policy changes as OECD recommendations are taken-up.

Czech Republic

- During the period up to 2005, the Czech Republic made significant improvements in the legal and policy framework for waste management, aligning legislation with EU requirements and investing in waste treatment facilities. However, co-ordination challenges have hampered further implementation and inconsistent data collection have impeded policy monitoring and waste management planning.
- Waste generation rates (primary and municipal) in the Czech Republic are relatively low compared to other OECD countries, with the second lowest rate of MSW generation per capita in the OECD. Despite ongoing investments in recycling, landfilling retained a prominent role in waste treatment.
- Construction materials and fossil fuels feature heavily in domestic material consumption (DMC), with construction waste representing around 40% of total waste. While use of fossil fuels, in particular coal, has fallen in recent years, construction material consumption and waste has rebounded since the recession.

Estonia

- Accession to the European Union in 2004 has driven policy changes in waste management. Availability of EU funding led to increase in construction and demolition waste. Investments in incineration and mechanical biological treatment (MBT) have led to overcapacity in these waste treatment options.
- The prominence of oil shale in Estonia's energy supply creates significant challenges in terms of material consumption and waste management. Estonia's material consumption has increased significantly since 2000, and continued reliance on oil shale would make improvements in material productivity challenging.
- Most waste is generated by the mining (36.3%) and energy production (32.6%) sectors. 98% of hazardous waste is from oil shale.

Hungary

- As in other new European Union Member States, accession to the European Union has led to reforms in waste management policy. Increased investments in

infrastructure, particularly in motorways, led to increased consumption of construction materials.

- Despite significant decreases in landfilling over the last decade, Hungary has a high rate of landfilling of waste, compared to other OECD EU countries, with 54% of MSW going to landfill in 2015.
- Recent changes to the regulatory and institutional frameworks for municipal waste management have created challenges, particularly for municipalities as they seek to adjust to their changing roles in municipal waste management.
- Recent industrial accidents and contaminated land discoveries, including the 2010 toxic sludge spill at Kolontár, have drawn public attention to compliance issues in waste management.

Israel

- Israel faces significant waste management and resource efficiency challenges. Israel's per capita waste generation rate is very high compared to the OECD average, and 82% of waste is landfilled. Hazardous waste generation has also grown in recent years.
- Landfills are increasingly reaching maximum capacity, and there are challenges in securing new landfill sites due to potential impacts on water resources and local opposition.
- There has been significant progress in preventing illegal dumping since the 1980s and 1990s, but remediation of a large number of contaminated sites remains a challenge.

Japan

- Despite investments in waste treatment, landfill capacity for non-municipal waste remains a challenge.
- These landfill capacity issues initially led to an emphasis on recycling and reducing final disposal, rather than waste prevention (reduction and reuse). However, the policy focus has shifted: reliance on imports of natural resources has brought attention to sustainable material consumption and circular economy goals.
- Concerns about dioxin emissions has led to improvements in incineration technologies and past experiences of pollution problems have led to the adoption of a comprehensive legal framework for polychlorinated biphenyls (PCB).
- The earthquake and tsunami of 2011 created significant challenges in the management of solid waste, with resulting waste exceeding existing treatment and disposal capacity, particularly for radioactive contaminated waste. Large-scale efforts continue to be taken to decontaminate affected sites.

Korea

- Korea has enjoyed rapid economic development over the last two decades, leading to growing household consumption and waste generation.
- Its ICT and electronics sectors are reliant on external markets for energy and mineral resources. As the OECD's most densely populated country, securing landfill space is challenging due to local opposition. These factors led to a focus on waste reduction and resource recovery in policy making.

Netherlands

- There is an emphasis on incineration with energy recovery in the Netherlands' waste management portfolio, with overcapacity in incineration.
- Limited space in households can discourage waste separation, with lower rates in major cities.
- Waste generation and economic growth were reported to be decoupled, based on national data. However, OECD data suggests that waste generation is still very much linked to economic growth. In addition, the 2008 economic crisis may have contributed to success in meeting targets. It may be difficult for the Netherlands to maintain progress during the recovery.

Norway

- In the period to 2008, Norway saw considerable growth in household waste generation, due in part to a rising population but also to greater household materials consumption.
- Other waste streams also grew in this period, including from some industries (e.g. food processing) as well as construction. Hazardous waste generation also grew, though this was due in part to changes in classification to include, among others, treated wood and asbestos fibre cement waste.

Poland

- Recent major reforms to waste policy have been driven, at least in part, by Poland's accession to the European Union.
- Due to its relatively large mining and industrial sectors, Poland has relatively high materials consumption levels. Improvements were observed during 2000-10, but threaten to be undermined by new construction activities in more recent years
- Poland had the lowest per capita municipal waste generation in the OECD in 2014. Reforms to the management of MSW introduced in 2013 have improved service coverage and separate collection, however, provision of MSW services remains a challenge due to implementation challenges during the reform transition.

Slovenia

- As in other new EU Member States, accession to the European Union has been the major driver in reforming the waste sector, which was previously poorly regulated. Prior to accession, almost all waste was landfilled or disposed of illegally.
- Slovenia was in the process of putting in place the measures needed to support the implementation of EU waste legislation, including data collection systems for material flows and waste.

1.4. Institutional and policy frameworks

The drivers of waste and materials policies have varied across OECD countries. For many European countries, accession to the European Union or the influence of EU policy developments has played an important role. Several OECD countries put in place new

measures to tackle problems with illegal waste disposal and shipments, as in Estonia and Spain. The Environmental Performance Reviews have highlighted limits to landfill capacity in countries with high population densities that have stimulated policy action: in Israel, for better waste regulation, in Japan for the circular economy.

Nearly all the countries reviewed had established a comprehensive legal structure for the management of solid waste, together with a process for the development of national waste plans that set out policy objectives and targets, identify actions to meet them and set out a process for monitoring implementation (some countries also developed waste plans at sub-national level).

Many countries demonstrated commitment to circular economy objectives, often expressed in a circular economy policy statement or as part of a broader environmental strategy. OECD countries have used various terms, including resource productivity and sustainable materials management, to refer to circular economy objectives. However, the supporting measures to support the transition to a circular economy have been missing in many cases. Environmental Policy Reviews have identified a wide range of policy instruments that can translate circular economy objectives into concrete action – including economic instruments, green public purchasing, public information and awareness-raising measures, and private sector initiatives, such as voluntary agreements. However, often these instruments are not implemented with circular economy objectives in mind. For example, the Environmental Performance Reviews found that resource taxes can be used to promote greater resource efficiency but are in some countries viewed as a revenue instrument potentially resulting in limitations in how the instrument is designed and implemented.

A key barrier to the implementation of a comprehensive and coherent circular economy policy mix can be the absence of an effective institutional framework. In order to develop and implement policies that support the move to a circular economy, OECD countries should seek to build broad government support and inter-ministerial co-ordination for effective policies that address all stages of the materials life-cycle. This will address the challenge that action in this sphere goes beyond the remit of environment ministries: several Environmental Performance Reviews called for circular economy strategies or policies to be supported by institutional arrangements co-ordinating the activities of all relevant players, including ministries for economic development, and ensuring that circular economy objectives are integrated across all relevant policy areas. The OECD policy guidance on resource efficiency underlines that where these institutional arrangements are in place, the shift to a circular economy can be treated as a broader economic policy challenge and integrated across sectoral policies.

Only one country reviewed involved the private sector directly in waste management planning, the Netherlands. The extent of private sector involvement in planning and policy stages likely depends on overall public/private relations within a country. Several countries, however, have enlisted private sector co-operation to boost recycling, and a private sector role is likely to increase in the transition to a circular economy.

Most of the review countries use competitive tendering for MSW collection. A key need, seen in many countries, is to ensure adequate government capacity to manage tenders as well as waste management more generally: countries including Poland had programmes to strengthen capacity, notably at municipal level. Where local government have roles in overseeing MSW collection and management, OECD countries should ensure they have the adequate capacity to perform this role. Enabling inter-municipal co-operation can also assist in addressing capacity issues in local governments and help to ensure an efficient scale of management. A growing number of OECD countries have put in place kerbside

collection of recyclable waste, and the Environmental Performance Reviews recommended others to do so.

1.5. Policy instruments

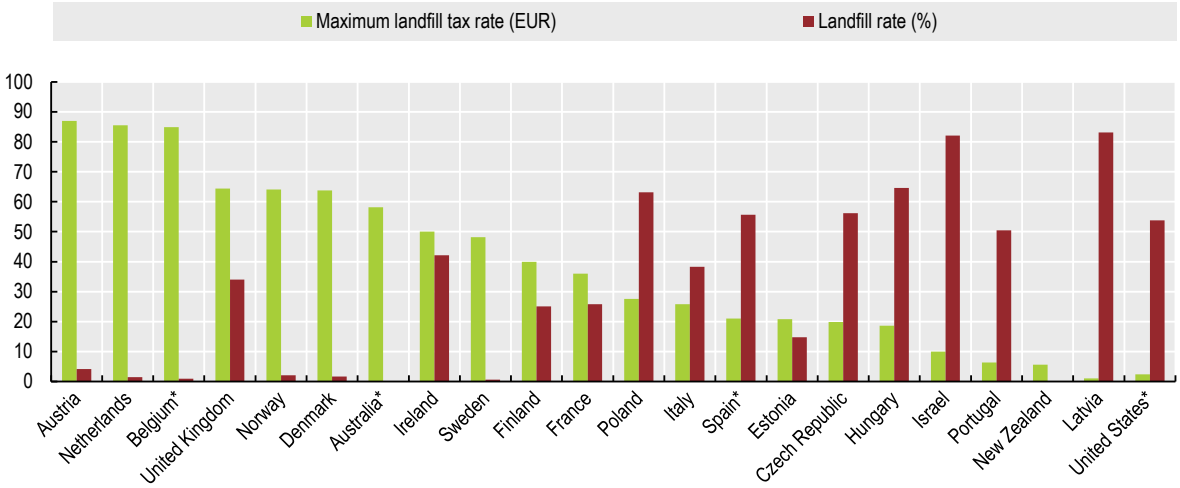
OECD countries have put in place a range of policy instruments for waste management. A key factor in their success is ensuring an effective mix appropriate to the policy challenges. For example, Korea addressed food waste, a policy priority, via a landfill ban, a volume-based waste fee for MSW not going to recycling or composting, voluntary agreements with key sectors such as restaurants and hotels as well as public-private initiatives for awareness raising.

Most of the focus countries have established a comprehensive legal framework for waste management. These frameworks include regulatory instruments that set rules to govern priority waste streams, require authorisation for treatment facilities and standards for their operation according to best available techniques. Landfills bans have been a key regulatory instrument to promote recycling: the EU has established bans for specific waste streams, such as end-of-life tyres and batteries; countries such as the Netherlands have gone further, setting broad-based bans on landfilling.

OECD countries have used economic instruments such as landfill and incineration taxes, which have been a key instrument to promote recycling. Ensuring full cost recovery for MSW services remains a challenge in many OECD countries, though this is in place in countries such as Estonia and the Netherlands. A few countries – including the Czech Republic, Korea and the Netherlands – have introduced volume-based pricing for households in at least part of their territories: public acceptance is needed to ensure its effective implementation. Economic instruments are likely to play a growing role in waste management policy in OECD countries. Tariffs should ensure cost recovery for waste management services. The growing use of pay-as-you-throw (or volume-based) pricing for MSW and other waste streams will also be an important element. Taxes on landfilling (Figure 1.2) and incineration can implement the polluter pays principle and encourage greater recycling, but care is needed in designing these taxes to ensure unintended consequences, such as overcapacity in certain treatment methods and weakened incentives for waste reduction are avoided.

Figure 1.2. Countries with high landfill taxes tend to have lower landfill rates

Municipal waste landfilling and tax rates 2013



Note: *tax rates refer to Flanders for Belgium, to New South Wales for Australia, to Catalonia for Spain, and to New Jersey, North Carolina, Mississippi and Indiana for the United States.
Source: OECD (2016b), "Municipal waste", OECD Environment Statistics (database); OECD (2017a), "Environmental policy instruments", OECD Environment Statistics (database).

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All the focus countries had established extended producer responsibility (EPR), which has been a key mechanism to promote recycling and waste reduction. In the focus countries EPR is particularly used for packaging waste, waste electrical and electronic equipment, and end-of-life batteries, tyres and vehicles. The Environmental Performance Reviews have highlighted the success of these schemes. Challenges in their governance have also been noted in several Environmental Performance Reviews, such as Estonia and Poland. These can include competition issues, achieving full cost recovery through producer fees, gaps in enforcement and in data, and free rider problems: OECD's 2016 guidance on EPR addressed many of these problems. Where appropriate, OECD countries should consider opportunities for extending this instrument to further waste streams. Countries should also ensure that EPR schemes and producer responsibility organisations (PROs) work effectively and efficiently, by following OECD Guidance as well as the good practices and lessons learned identified in Environmental Performance Reviews.

Several OECD countries – including Korea, Netherlands and Norway – have used green public purchasing as an instrument to promote the use of recycled paper and other products. A further step is to introduce circular procurement, promoting repairable products that can be easily broken down into recyclable components.

Public awareness and support are key factors in changing behaviour and thus can be crucial for the success of waste policies. Communication campaigns need to use high-quality communication methods. In several countries including Colombia and Estonia, non-governmental organisation (NGOs) have played an important role in organising clean-up campaigns.

Accurate data is needed to improve the policy base for policy development, implementation and evaluation: several Environmental Performance Reviews identified a need for better data collection and quality assurance. In many countries, data sets are not complete. Inconsistencies in definitions and data collection methods make comparison across

countries difficult. Often, data are not consistently recorded over time, with gaps in some years, making it difficult to monitor progress over time. In other cases, data are not available for all relevant indicators. In some countries, these issues have concerned specific sectors, as construction and demolition waste. Korea and Japan have led in the introduction of advanced IT systems for waste tracking. Where necessary, countries should address data gaps for specific waste streams, such as construction and demolition waste, as well as broader data needs.

The move towards the circular economy requires a stronger information base for the circular economy. Policy development is creating new data needs on material flows, to understand how materials are used within a country. Policy implementation needs to be supported by indicators, with material flow information systems in place to monitor progress. Environmental Performance Reviews for the focus countries have highlighted progress in the area: for example, the Netherlands has worked to develop statistics on materials embedded in imports. However, significant gaps remain, particularly in data on international material flows as well as materials consumption embedded in imports and exports. OECD countries should address these gaps by implementing the OECD Council Recommendations on Material Flows and Resource Productivity (2004 and 2008).

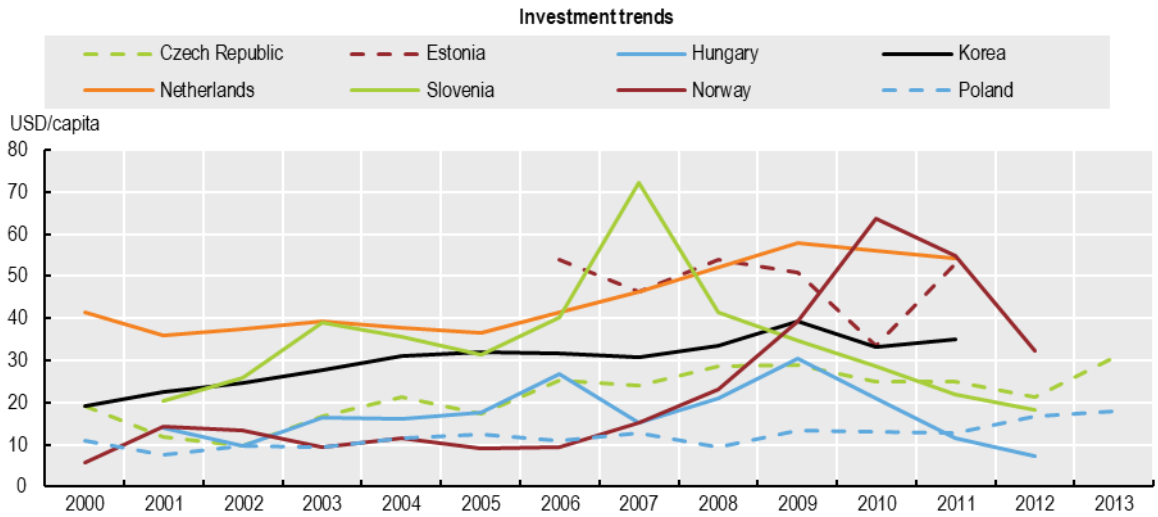
The reviews also show that enforcement and compliance promotion remain important challenges, even in OECD countries with advanced waste management. In many of the focus countries, multiple government bodies have roles for enforcement: several Environmental Performance Reviews identified a need for better co-ordination among enforcement bodies. Ensuring adequate capacity is another key step: dedicated bodies for enforcement, investigation and prosecution can play a key role – Norway's Økokrim unit provides an example of a unit focused on environmental crime prosecution. Several OECD countries, including Korea, Norway and Poland, have established risk-based approaches to focus inspections on the most important facilities and activities. Compliance promotion, to ensure that economic actors are aware of requirements, is also an element in enforcement. Among OECD countries seeking to improve enforcement, key areas for attention include: better co-ordination among enforcement bodies, including police and customs; compliance promotion among key economic actors; the development of risk-based approaches to use enforcement resources efficiently; and adequate capacity to inspect, investigate and prosecute waste-related crimes.

1.6. Investment and financing

The Environmental Performance Reviews found that OECD countries have mobilised both government and private financing for investment: for many of the focus countries, the level of investment in waste management has increased since 2000 (Figure 1.3). Public financing, including via dedicated environmental funds, has played a key role in supporting waste investments in particular in EU countries such as Hungary and Poland. At the same time, several countries have experienced overcapacity in either incineration or MBT facilities or are at risk of overcapacity in the future. A number of factors may have contributed to these situations, including the promotion of separate collection and recycling, reducing the need for waste incineration and pre-treatment, and infrastructure planning failing to take into account waste treatment facilities in neighbouring countries. New EU Member States have had access to European grant financing, which can create incentives for over-investment, in particular in large facilities. These issues highlight the need for effective waste management planning that establishes appropriate policy mixes. Neighbouring countries, notably in the OECD Europe area, may need to co-ordinate their

policies for waste management investments. Countries should follow OECD's 2006 Council Recommendation on Good Practices for Public Environmental Expenditure Management.

Figure 1.3. Investment in waste management has increased since 2000



Source: OECD (2017), "Environmental protection expenditure and revenues", OECD Environment Statistics (database).

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The clean-up of contaminated sites is a challenge in many OECD countries. Clear rules establishing strict liability for the clean-up of past problems are needed. Environmental Performance Reviews identified gaps in the legal frameworks of some focus countries. Another challenge occurs when a liable party goes bankrupt or cannot be identified; some OECD countries have overcome this challenge by establishing a public fund for remediation of contaminated sites. Understanding the nature and extent of contaminated site challenges is valuable in guiding remediation activities; several OECD countries have established a register of contaminated sites to plan remediation investments. Where a country faces a large number of legacy polluted sites, it can be important to prioritise remediation activities based on risk assessment: Norway, for example, identified priority sites for clean-up. Other countries facing a large number of legacy polluted sites should prioritise remediation activities based on health and environmental risks.

1.7. International co-operation

With regard to international instruments on transboundary waste movements, nearly all OECD countries have ratified the Basel Convention, and many have subscribed to its Ban Amendment; however, as yet few have signed or ratified the Liability Protocol. Moreover, as of mid-2017, only four of the 11 focus countries had designated "pre-consented recovery facilities" under the OECD Council Decision concerning the Control of Transboundary Movements of Wastes Destined for Recovery Operations (C(2001)107/FINAL). OECD countries should consider further attention to the ratification and implementation of international instruments.

Several Environmental Performance Reviews found extensive transboundary trade in hazardous and non-hazardous waste streams in the focus countries: trade allows specialised recovery; at the same time, it can arise when domestic waste policy creates inefficiencies, as seen in Estonia's MSW imports for incineration, where capacity exceeds domestic needs. Countries need to address the dimension of international waste shipments, and the development of waste treatment and disposal sites in trading partners, in their waste management planning. Enforcement efforts need to be adequate to address the risks of illegal shipments.

The Environmental Performance Reviews highlighted initiatives to share knowledge and promote stronger waste and circular economy policies, undertaken for example by Japan and Korea. Countries should consider ways to expand international co-operation for the dissemination of policies and good practices for a circular economy.

Notes

[1] The other 13 countries, in addition to the 11 whose Environmental Performance Reviews had an in-depth chapter on waste and materials, are: Portugal and the Slovak Republic (2011); Germany (2012); Mexico, Italy and Austria (2013); Iceland and Sweden (2014); Spain (2015); France and Chile (2016); Canada, New Zealand and Switzerland (2017).

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Chapter 2. Trends in materials consumption and waste generation

This chapter provides an overview of key trends across OECD countries, with some further details on the 11 focus countries. The chapter presents the most recent cross-country statistics available. It should be noted that data limitations create a challenge in comparing cross-country data on material consumption and waste.

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

This chapter provides an overview of key trends across OECD countries, with some further details on the 11 focus countries. The chapter presents the most recent cross-country statistics available. It should be noted that data limitations create a challenge in comparing cross-country data on material consumption and waste (OECD, 2008a).

2.1. Economic and social context

Income levels play a role in terms of the levels of material consumption and waste generation and the approach to waste treatment. In general, as economies industrialise and incomes rise, material consumption and waste disposal (OECD, 2008b) levels tend to rise. Other key determinants include economic structure – in service-based economies, levels of mining and industrial waste will be relatively low – as well as demographic factors. An increase (or decrease) in population will drive higher waste levels. So will factors such as the number of single-person households, which has risen in many OECD countries: private material consumption and waste generation are likely to increase alongside. However, when income levels reach certain threshold levels, there is evidence to suggest a positive impact on behaviours related to material consumption and waste generation, particularly when effective policy measures are in place. Notably, per capita consumption has been observed to stabilise when incomes reach a certain level as economies move to less material-intensive, more service-based profiles.

When measured at purchasing power parties, the income per capita in OECD countries ranged from about USD 20 000 to over USD 100 000. The 11 focus countries include four countries with per capita incomes below USD 30 000: Colombia, whose accession to OECD is under discussion; Estonia; Hungary, and Poland. Two other countries, Netherlands and Norway, had a per capita income over USD 50 000 (Table 2.1).

Population levels and density may also affect waste management approaches. For example, densely populated countries, such as the Netherlands or Japan, will have less space for landfill sites as well as other waste treatment facilities and may face greater obstacles due to local concerns about siting decisions. At the same time, recycling of municipal waste may also be more challenging in crowded urban areas, if households do not have sufficient space for the separation of waste. In areas where population density is low, it may be challenging to ensure wide coverage of waste collection services at an acceptable cost. In 2016, the population of the 11 focus countries varied from 1.3 million in Estonia to 127.5 million in Japan (Table 2.1). Population density also varied: Estonia and Norway are the most sparsely populated, while Israel, Japan, Korea and the Netherlands had more than 350 persons per square kilometre.

The overall economic structure also varies significantly across the focus countries (Box 2.1). For example, Colombia, Estonia, Norway and Poland have large extractive sectors that will lead to higher levels of mining waste. In contrast, the economies of Japan and the Netherlands are focused on services rather than industry, and have low levels of mining and industrial waste generation.

Table 2.1. Countries vary in population size, density and income levels

	Population 2016 (thousands)	Total area (km^2)	Population density 2016 (persons per km^2)	GDP per capita 2016 (USD, constant prices, 2010 PPPs)
Colombia	48 653.4	1 138 910	43.9	12 833.4
Czech Republic	10 610.9	78 867	137.4	30 643.3
Estonia	1 312.4	45 228	31.0	26 726.2
Hungary	9 753.3	93 028	107.7	24 716.0
Israel	8 191.8	20 770	378.6	31 833.4
Japan	127 748.5	377 915	350.4	37 504.1
Korea	50 791.9	99 720	522.4	35 014.2
Netherlands	16 987.3	41 543	503.8	46 295.3
Norway	5 254.7	323 802	14.4	59 745.8
Poland	38 224.4	312 685	124.8	24 920.8
Slovenia	2 077.9	20 273	103.2	29 011.8

Source: OECD Statistics, UN Population Division, www.worldatlas.com/.

Box 2.1. Economic and social context

Colombia saw strong economic growth in the first decade of the century, driven by a commodity price boom, significant economic policy reform, and improved security. Yet extractive industries, livestock grazing, urbanisation and increased transport are creating increasing pressures on the environment.

Czech Republic saw strong economic growth over the last decade and a half. The country's energy mix has been reliant on domestic coal resources, but energy from waste is now becoming more prominent in the energy mix. The economy is export-oriented and characterised by intensive industrial and agricultural activities.

Estonia has a small population, extensive forests, and significant water resources. Domestic oil shale is the main energy source, creating high resource use.

Hungary has relatively few raw materials and relies on energy and materials imports, with an economy less resource-intensive than other OECD countries. It is the largest electronics producer in Central and Eastern Europe.

Israel is a small, water-scarce, densely populated and highly urbanised territory. It has seen economic and population growth since 2000, which has intensified already significant pressures on the environment.

Japan is the second largest OECD economy and one of the OECD's most efficient countries in terms of energy and domestic materials consumption, although since the 1990s it has been characterised by sluggish economic growth. With limited natural mineral resources, its strong manufacturing sector is heavily reliant on imports.

Korea has one of the fastest-growing economies in the OECD, driven by the large export-oriented manufacturing sector. This has led to high pollution and resource consumption, especially with coal a core part of the energy sector.

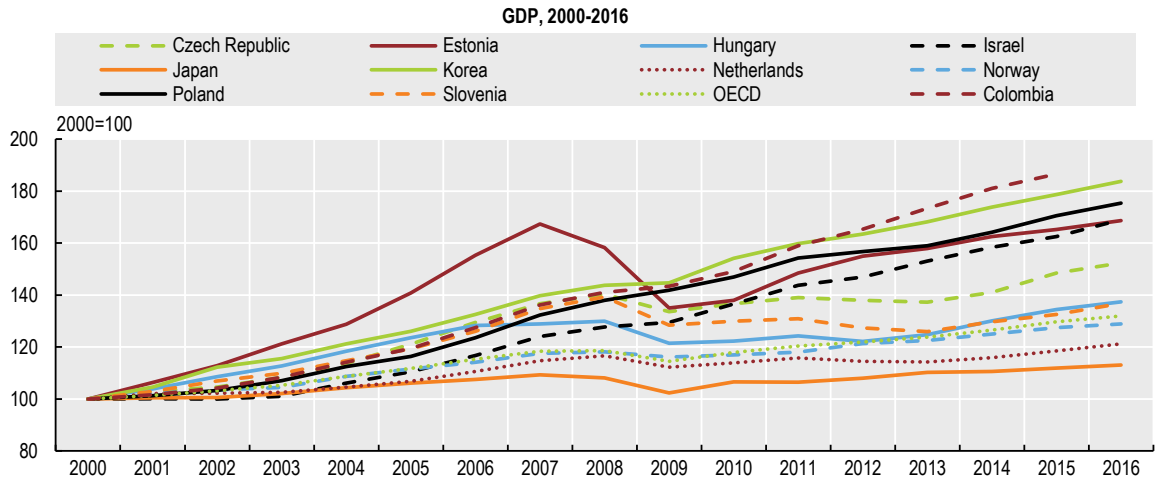
Norway has experienced relatively high economic growth, with oil and gas exploitation accounting for more than 20% of gross domestic product (GDP): the energy sector has intensified environmental pressures.

Poland saw steady economic growth since 2000 but it remains heavily reliant on coal, making it one of the more resource-intensive countries in the OECD.

Slovenia has experienced strong economic growth since its independence in 1991, which has put pressure on its rich environmental resources, with over 60% of the country covered by forests.

The **Netherlands** is a small, densely populated country with an open, resource-efficient economy focused on services.

Figure 2.1. All focus countries have experienced economic growth since the 2008 economic crisis



Note: GDP at 2010 prices and purchasing power parities.
Source: OECD (2017), "Aggregate National Accounts, SNA 2008 (or SNA 1993): Gross domestic product", OECD National Accounts Statistics (database), http://dx.doi.org/10.1787/data-00001-en.

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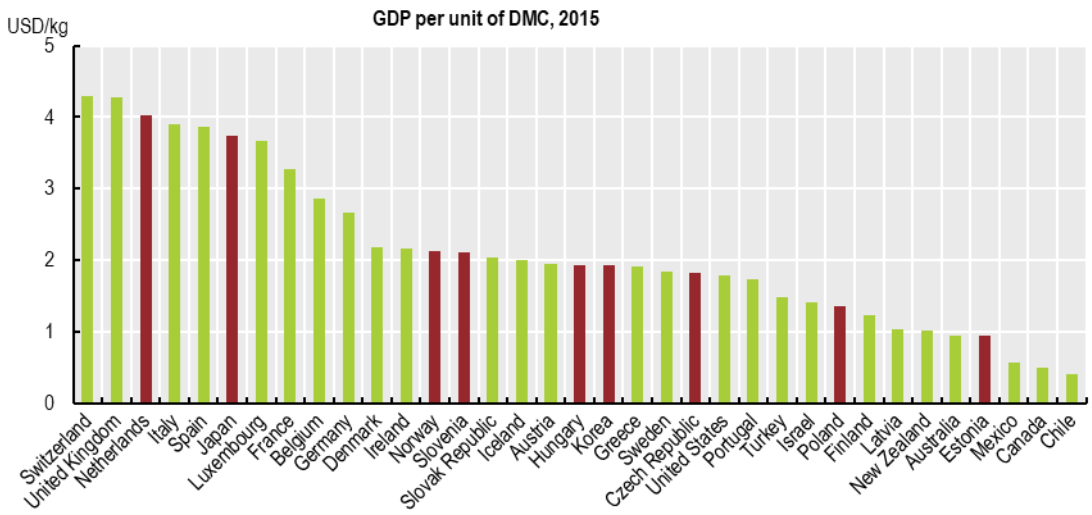
Between 2000 and 2016, economic growth in the 11 focus countries varied significantly (Figure 2.1). The global financial crisis and recession affected all countries, with Estonia and Slovenia among those experiencing the sharpest falls in GDP. Despite the crisis, Colombia, Estonia, Israel, Korea and Poland all saw increases in GDP (at constant purchasing power parities) greater than 60% over this period, while the Czech Republic saw increases of just over 50%. Total growth in GDP was below 40% for the other five countries. The crisis affected materials consumption and productivity, as well as waste generation, though its influence varied across the countries, as described in Sections 2.2 and 2.3.

2.2. Material consumption and productivity

Resource productivity refers to the effectiveness with which an economy or a production process is using natural resources. Material resources include energy carriers (gas, oil, coal), metal ores and metals, construction minerals and other minerals, soil and biomass. Material productivity makes reference to the effectiveness with which an economy or a production process is using materials extracted from natural resources: this can be presented as an indicator that reflects the output or value added per unit of materials used. This section presents domestic material consumption (DMC), an indicator assessed in the Environmental Performance Reviews, which measures the mass of materials physically used in the domestic economic system; it does not include materials used in other economies to produce imported goods.

Figure 2.2. Material productivity varies across OECD countries



Note: 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. 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: Eurostat (2016), Material flows and resource productivity (database); OECD (2016), "Material resources", OECD Environment Statistics (database).

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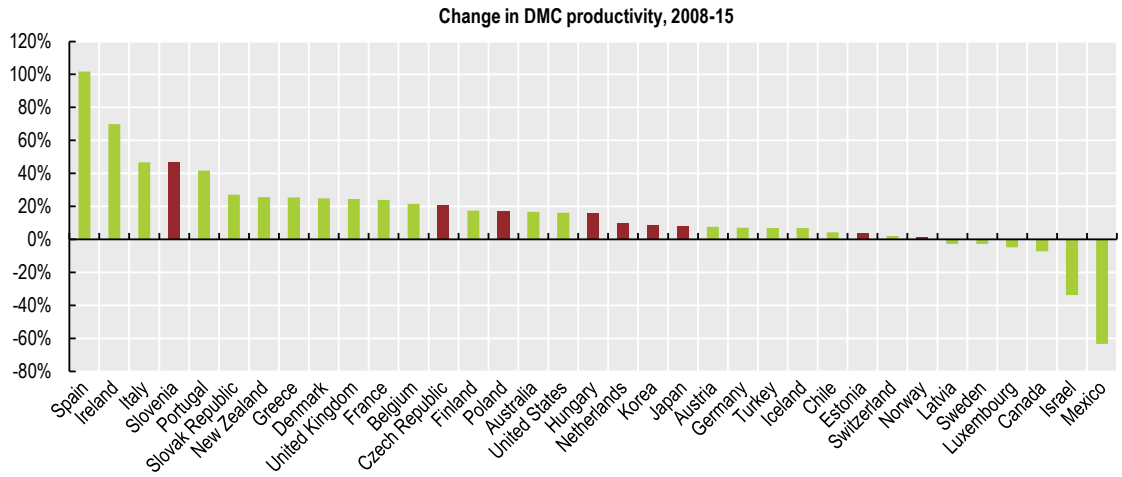
OECD countries with highest material productivity tend to be those whose economies are focused on services and high-value products, as seen for Japan and the Netherlands among the focus countries (Figure 2.2). Countries with economies more reliant on extracting material resources tend to have lower material productivity levels: among the focus countries, Estonia and Poland mine domestic fossil fuels, an important factor in their low material productivity levels; although data are not available for Colombia, this country also mines coal, which is an important export.

Most OECD countries saw an increase in material productivity, as measured by DMC productivity, between 2008 and 2015 (Figure 2.3). This period covers the global economic crisis and recovery (data are not available for many countries before 2008). The increase in material productivity suggests that the economic recovery has not been based on increased material consumption in most countries. This may indicate that, during the recovery, growth has been stronger in service-based sectors than in resource-intensive sectors such as construction and manufacturing. It should be underlined that data are available only for a relatively short period; moreover, material productivity is influenced by a broad range of factors, including economic cycles. Consequently, these trends can be difficult to interpret.

Figure 2.3. And material productivity rose in most countries



Note: 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. 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: Eurostat (2016), Material flows and resource productivity (database); OECD (2016), "Material resources", OECD Environment Statistics (database).

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Among the focus countries, material productivity increased by more than 40% between 2008 and 2015 in Slovenia. Productivity growth was also reasonably strong in the Czech Republic, Poland and Hungary during this period, while for Japan, Korea and the Netherlands, the growth was close to 10%. In Poland, for example, extraction of metal

ores and fossil fuels grew more slowly in the review period (2000 to 2012) than the country's fast-rising GDP, and it appears that this trend has continued in the period from 2008 to 2015, when material productivity rose by 17%. On the other hand, extraction of construction minerals grew more quickly than GDP, as investment in private buildings and public infrastructure rose. In several other focus countries, including Estonia and Korea, the consumption of construction minerals for buildings and infrastructure has grown. In Spain, on the other hand, a period of intense construction ended with the economic crisis. Decreases in material productivity were observed in only six OECD countries during the period. Israel, for example, experienced a 36% reduction in material productivity, due in part to rising domestic fossil fuels extraction.

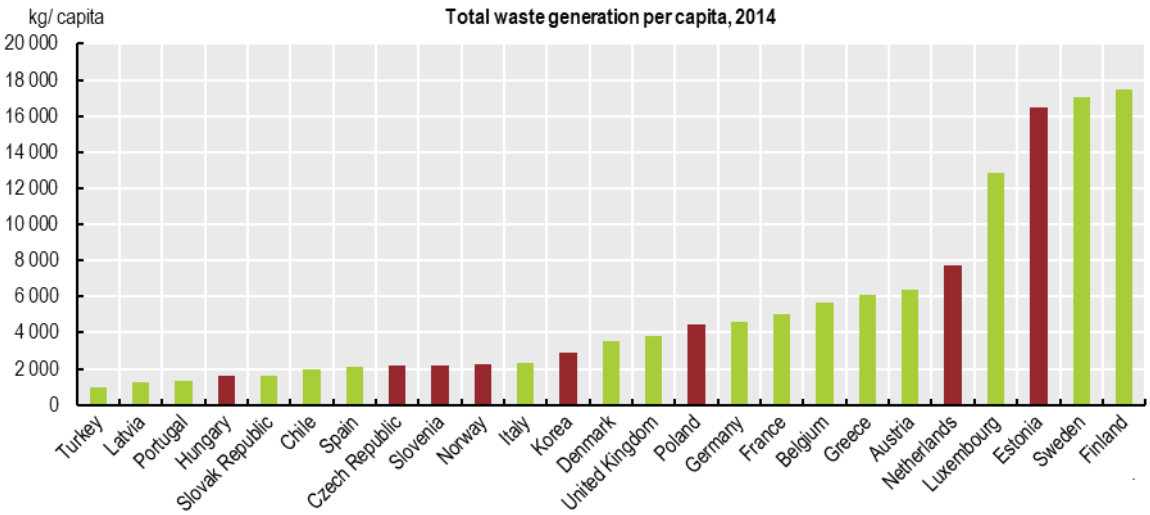
2.3. Waste generation and treatment[1]

This section provides an overview of data from the Environmental Performance Reviews on waste generation and treatment in OECD countries, with a focus on the 11 focus countries. Data is presented on primary waste generation, municipal solid waste (MSW) generation, and treatment of MSW. Data on the generation or treatment of other waste streams, such as industrial, construction or hazardous waste, are not presented here due to the absence of comprehensive time series data across countries.

2.3.1. Total primary waste generation

The generation of total primary waste also varies markedly across OECD countries (Figure 2.4), and this can be linked to several factors, including domestic materials consumption, GDP levels, and differing waste accounting methodologies. The levels of total primary waste generation per capita are high in Estonia, where large amounts of mining and industrial waste arise from the processing of oil shale, a low-grade solid fossil fuel. In Luxembourg, the highest per capita income OECD country, large amounts of waste arise in particular from construction activities (moreover, a high share of Luxembourg's work force is made of cross-border commuters, so per capita statistics do not provide a good comparison with other countries). Other factors may play a role: in the Netherlands, an important share of total primary waste generation arises from dredging activities.

Figure 2.4. Waste generation varies significantly across OECD countries



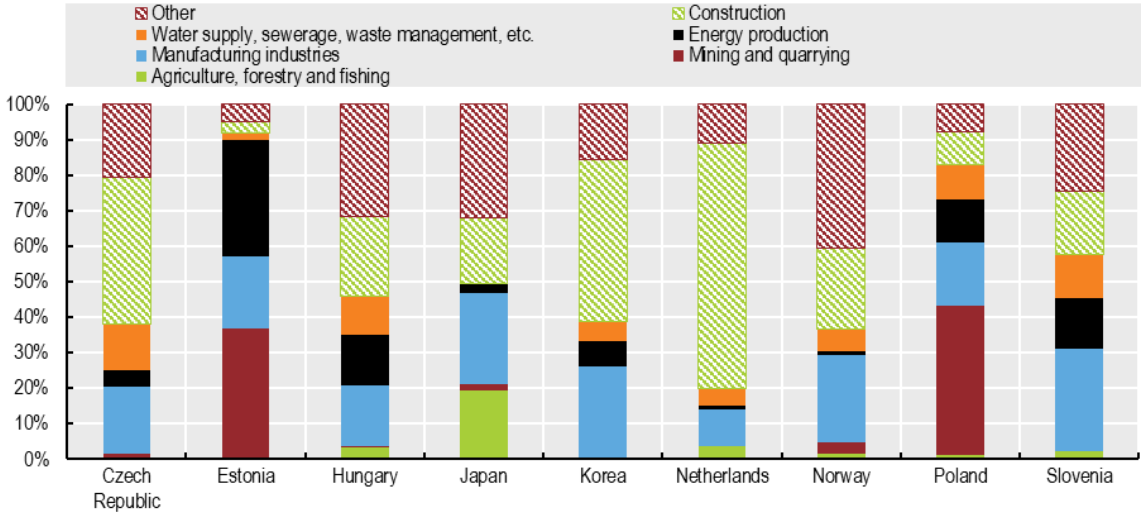
Note: Total waste exclude secondary waste (e.g. residues from treatment operations).
Source: OECD (2017), "Waste: Waste generation by sector", OECD Environment Statistics (database). http://dx.doi.org/10.1787/data-00674-en.

StatLink https://doi.org/10.1787/888933976118

The composition of total primary waste generation varies in the focus countries (Figure 2.5). Mining and quarrying waste make up about 40% primary waste in Estonia and Poland, driven largely by the mining of domestic solid fuel. Mining and quarrying waste is also a major factor in in Colombia, whose coal exports doubled in the review period; moreover, oil and mining are seen as a key economic driver (data are not available for all waste streams in Colombia, however). In contrast, high proportions of construction waste were a feature in Korea and the Netherlands. Manufacturing generated about 25% or more of total primary waste in Korea, Norway and Slovenia. It should be noted that not all countries report waste generation by all economic sectors: these can affect the comparative levels of total primary waste generation (Figure 2.4).

A comparison of primary waste and GDP (Figure 2.6) shows a rather weak correlation. While several high-income countries such as Luxembourg, Finland and Sweden have high primary waste generation per capita levels, other high-income countries (for example, Norway) have relatively low waste generation levels and some low-income countries (Estonia, Turkey) have high waste generation levels. The structure of key sectors, particularly the prominence of the construction and mining sectors in the economy, appear to be a more important factor. As noted for the other figures on total primary waste generation, some countries have not reported for all economic sectors, reducing the comparability of data available.

Figure 2.5. Composition of waste by sector in the focus countries, 2014



Note: Total waste exclude secondary waste (e.g. residues from treatment operations). Japan: 2013 data.
Source: OECD (2017), "Waste: Waste generation by sector", OECD Environment Statistics (database). http://dx.doi.org/10.1787/data-00674-en.

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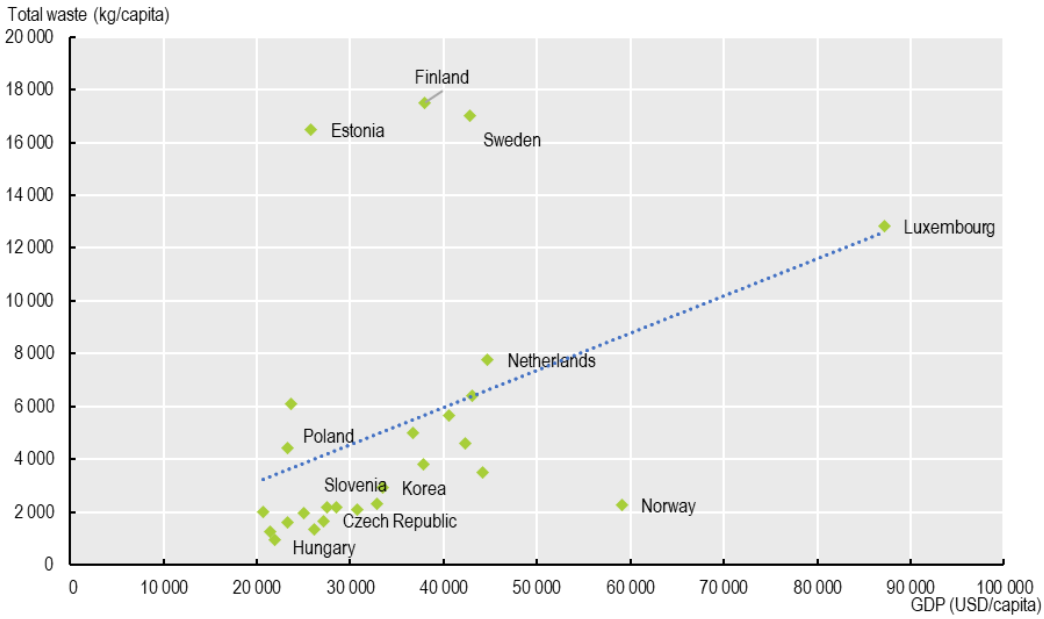
Figure 2.6. There is a weak correlation between total waste generation and GDP per capita, 2014



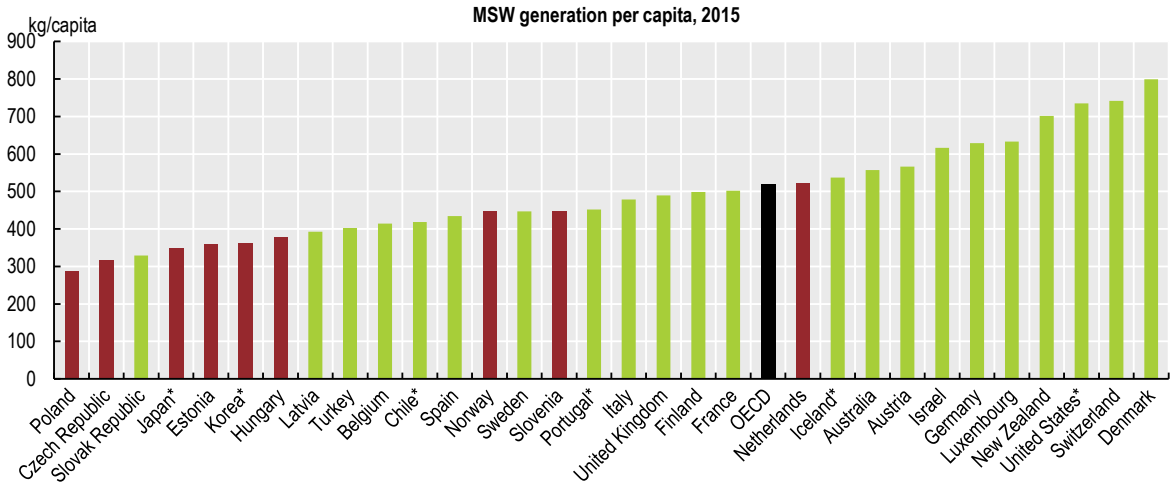
Note: Total waste exclude secondary waste (e.g. residues from treatment operations). GDP at constant prices and 2010 purchasing power parities. Correlation coefficient = 0.28.
Source: OECD (2017), "Waste: Waste generation by sector", OECD Environment Statistics (database), http://dx.doi.org/10.1787/data-00674-en. OECD (2017), "GDP per capita and productivity levels", OECD Productivity Statistics (database), http://dx.doi.org/10.1787/data-00686-en.

StatLink https://doi.org/10.1787/888933976156

2.3.2. Municipal solid waste generation

The generation of MSW also varies across OECD countries (Figure 2.7). Poland has the lowest per capita generation of MSW among OECD countries, under 300 kg. Colombia – not yet an OECD member country – appears to have even lower per capita waste generation rates of around 200 kg per person, based on the most recent available data. Japan, Estonia, Hungary, the Czech Republic and Korea also had relatively low municipal waste generation rates in 2015, under 400 kg.

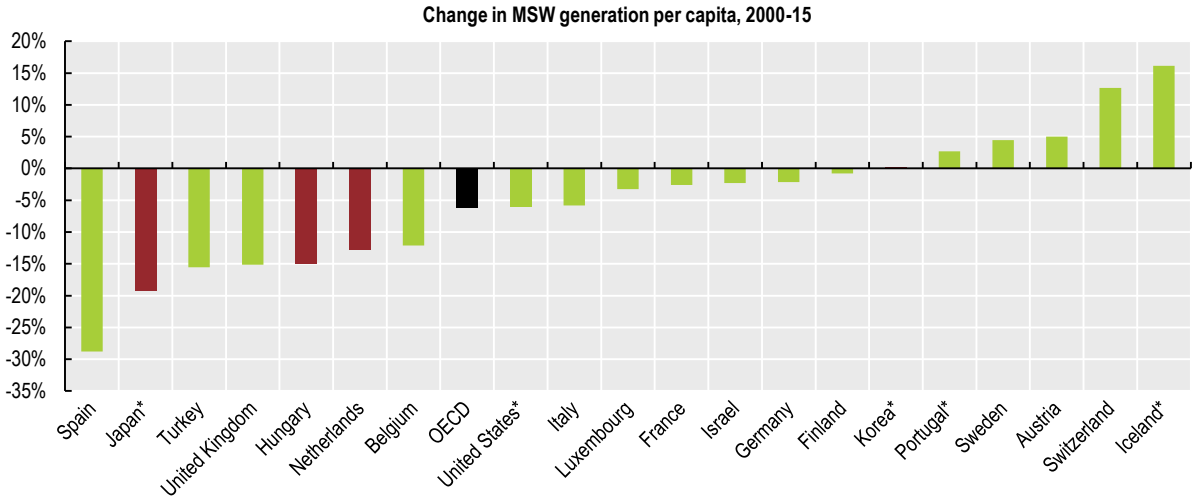
Figure 2.7. The generation of municipal solid waste varies from under 300 kg/capita to over 700 kg/capita



Note: * 2014 data. Data 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.
Source: OECD (2017), "Waste: Municipal waste", OECD Environment Statistics (database). OECD (2017), Environmental Performance Reviews: Korea, http://dx.doi.org/10.1787/data-00601-en.

StatLink https://doi.org/10.1787/888933976175

Figure 2.8. … And has fallen in many OECD countries



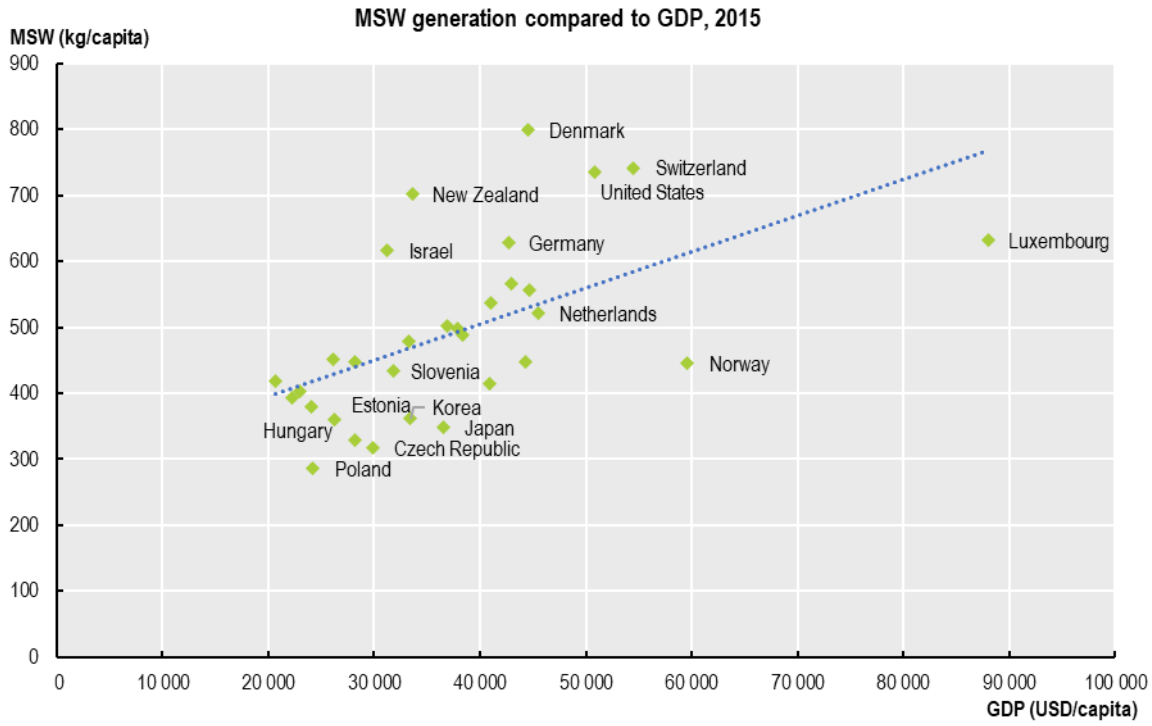
Note: * 2014 data. Data may include provisional figures and estimates. Household and similar waste collected by or for municipalities, originating mainly from households and small businesses. Includes bulky waste and separate collection.
Source: OECD (2017), "Waste: Municipal waste", OECD Environment Statistics (database). OECD (2017), Environmental Performance Reviews: Korea, http://dx.doi.org/10.1787/data-00601-en.

StatLink https://doi.org/10.1787/888933976194

Most OECD countries (14 of the 20 for which data was available) reduced the amount of municipal waste generated per capita between 2000 and 2015 (Figure 2.8). While often the Environmental Performance Reviews did not comment on the factors behind these decreases, insights were provided for some countries. In some cases, these decreases may be attributed in part to changes or uncertainties in the reporting of data (for example, Estonia, Poland). In other cases, decreases in MSW generation may be a result of policy measures. For example, the decrease observed in MSW generation were attributed to the introduction of volume-based pricing in Korea and broader waste reduction policies in the Netherlands. At least ten OECD countries experienced an increase in MSW generation per capita: among the focus countries, Norway saw an increase of almost 20% over this period, which was attributed to increased consumption in that country. Of the 11 focus countries, Israel has the highest per capita waste generation and experienced only a moderate reduction (-2%) during the 2000-15 period.

While several factors can influence MSWgeneration (including differences in definitions and measurement among countries), economic activity, particularly the level of private final consumption, has been a key element (Figure 2.9). This is not a rigid relationship: as described below, some OECD countries have decoupled GDP growth from increases in municipal waste generation.

Figure 2.9. The generation of municipal solid waste is closely related to GDP



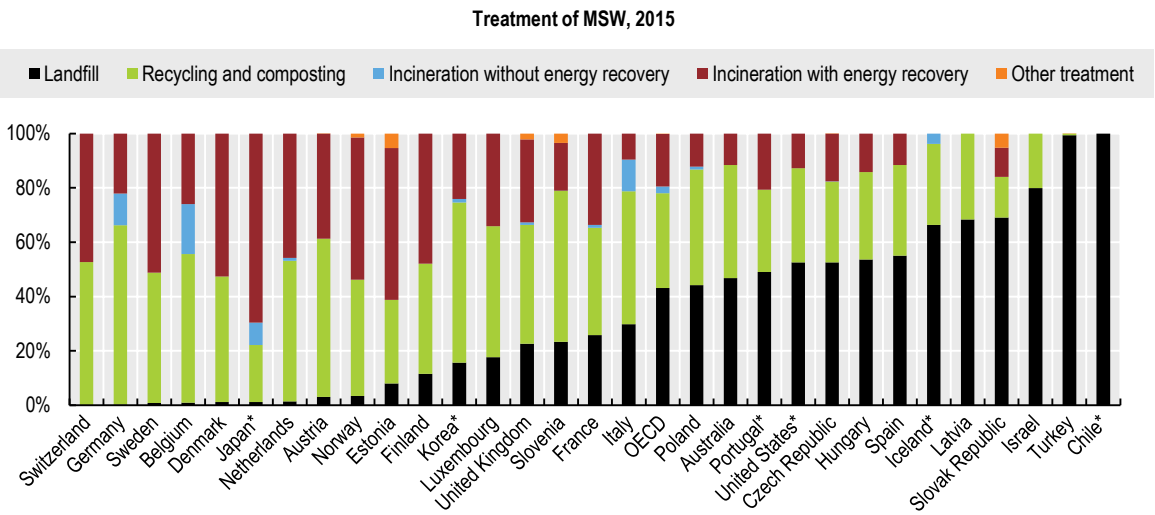
Note: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Household and similar waste collected by or for municipalities, originating mainly from households and small businesses. Includes bulky waste and separate collection. GDP at constant prices and 2010 purchasing power parities.
Source: OECD (2017), "Waste: Municipal waste", OECD Environment Statistics (database), http://dx.doi.org/10.1787/data-00601-en. OECD (2017), "GDP per capita and productivity levels", OECD Productivity Statistics (database), http://dx.doi.org/10.1787/data-00686-en.

StatLink https://doi.org/10.1787/888933976213

2.3.3. Treatment of municipal solid waste

In 2015, a few of the focus countries still send the majority of MSW to landfills: Colombia (86% in 2015), Israel (80% in 2015), Hungary (54% in 2015) and Czech Republic (53% in 2015) (Figure 2.10). Several other countries – including Japan, Netherlands, Norway and Estonia – had largely eliminated landfilling, replaced by incineration and recycling. In Norway and the Netherlands, over 40% of MSW went to recycling; in contrast, recycling rates were lower in Estonia and Japan.

Figure 2.10. For many OECD countries, incineration and recycling have largely replaced landfilling of MSW



Note: * 2014 data. Data 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.
Source: OECD (2017), "Waste: Municipal waste", OECD Environment Statistics (database), http://dx.doi.org/10.1787/data-00601-en.

StatLink https://doi.org/10.1787/888933976232

The decline of landfilling of MSW has been a broad trend across many countries, with the rise of waste recycling and recovery. The Performance Reviews found an increase in waste recycling in most countries. Many OECD countries saw a rise in MSW incineration with energy recovery (and a decline in incineration without energy recovery). These trends were particularly dramatic in Estonia, where nearly all MSW was sent to landfills in 2000, but only 8% in 2015, due to a shift to incineration mainly and recycling. Slovenia achieved a steady increase in the recovery and recycling of MSW since 2002, and a corresponding fall in landfilling. The landfilling of MSW in Japan fell from 19% in 2000 to 13% in 2007, with a corresponding increase in recycling; Norway also saw a steady decline in landfilling and an increase in recycling.

A broad range of policies – including landfill bans, landfill taxes and extended producer responsibility(EPR) – have supported the shift away from landfilling (see Chapter 4 on policy instruments); so have investments, which in several countries were supported by government financing (see Chapter 5).

2.3.4. Evidence of decoupling between waste generation and GDP

The Performance Reviews identified some progress in decoupling primary waste levels and GDP. For example, primary waste generation remained stable in Poland during the 2000-12 period, while GDP grew by 50%. In Japan, primary waste generation grew more slowly than GDP between 1997 and 2007, with a decline in particular in mining waste; however, waste from the energy production and manufacturing sectors grew faster than GDP. The Environmental Performance Reviews do not provide a comprehensive overview of the factors behind this trend. This relative decoupling may be linked to the nature of the

economic recovery in these countries, with a potential shift away from production and consumption that generates high levels of waste. It may also point to the impact of policy developments in these countries, with Poland acceding to the EU environmental acquis during this period, and Japan adopting its Fundamental Plan for Establishing a Sound Material-Cycle (SMC) Society, which sets out targets for waste generation and material productivity.

Other countries did not achieve a decoupling in waste generation from economic growth. In Korea, waste generation appears to be closely linked with economic growth. Between 2000 and 2014, primary waste generation increased by 71%, in line with economic growth (+74%). Norway has been unable to meet its objective of decoupling waste generation from economic growth, with annual waste generation growing at a disproportionately higher rate (+17%) than GDP (+9%) during the period from 2004 to 2011.

For the period 2006-12, where data are available across most of the review countries, only two saw a clear decoupling trend: Poland and Slovenia. It should be noted that this is a relatively short time period for an assessment of decoupling. Moreover, there may be differences in statistical methods over time and across countries. Consequently, these results provide only an initial overview of trends.

The Environmental Performance Reviews reported a decoupling trend between the generation of MSW and economic growth in some focus countries. The Environmental Performance Reviews of Japan and the Netherlands highlighted these countries' policy actions, including waste disposal charges, as a factor in reductions in municipal waste generation. Some countries, such as Israel and Hungary, saw a relative decoupling: MSW generation grew over their review periods, but at a slower rate than GDP. Here too, differences in statistical methods limit the data availability across countries.

Notes

[1] The term "treatment" is understood in its broad sense and designates disposal and recovery operations as well as pre-treatment of waste prior to recovery or disposal.

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Chapter 3. Institutional and policy framework

This chapter reviews key results from the Environmental Performance Reviews on the legal and policy frameworks for waste management and the circular economy in the 11 focus countries. It then discusses institutional frameworks and the role of the private sector, highlighting key challenges, lessons and good practices.

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

This chapter reviews key results from the Environmental Performance Reviews on the legal and policy frameworks for waste management and the circular economy in the 11 focus countries. It then discusses institutional frameworks and the role of the private sector, highlighting key challenges, lessons and good practices (Box 3.1). The focus is on the management of MSW, as this has been addressed across the 11 countries.

Box 3.1. Examples of good practices for institutional and policy frameworks

Legislation, strategies and planning for waste management

- Comprehensive legal frameworks covering all aspects of waste management (seen in most focus countries).
- Waste management plans that include clear, quantitative targets, realistic actions for their financing and implementation and a process for monitoring and review (seen in most focus countries).
- Co-ordination between national and sub-national planning (e.g. Poland).

Policy frameworks for the circular economy

- Policy and legal frameworks for the circular economy, as adopted in Japan, Korea and the Netherlands.
- Integration and mainstreaming of circular economy approaches in existing policy and legal frameworks (Norway, EU), particularly economic policy as recommended in the OECD Policy Guidance on Resource Efficiency.
- Building a greater emphasis on waste prevention in waste policy, for example through waste prevention plans (Czech Republic, Poland and other EU countries).

Institutional frameworks

- Management of at least some aspects of waste services at the local level to ensure waste management arrangements reflect local conditions (most OECD countries).
- Institutional platform or structure to support the horizontal co-ordination of waste policy across relevant sectors (Czech Republic).

Organising municipal solid waste services

- Competitive tendering, where appropriate, to support efficient MSW services (a growing number of OECD countries).
- Building institutional capacity for local governments to manage tendering and oversee waste management effectively (Poland).
- Inter-municipality co-operation to achieve economies of scale in MSW management areas (Japan, Norway and Poland), in particular for small municipalities.
- Separate, kerb-side collection of recyclable municipal waste (many OECD countries), to encourage separation of waste and overall recycling levels.
- Where the informal sector plays a role, engagement strategies based on dialogue and financial incentives can integrate the sector in formal waste management

(Colombia), ensuring positive contributions to recycling efforts, while limiting negative impacts, such as illegal dumping and waste leakage.

Role of the private sector

- Public/private co-operation on waste management planning (Japan, Netherlands).
- Public/private co-operation to boost recycling (Colombia, Israel and other countries).

3.1. OECD policy framework for waste and materials management

OECD has supported environmentally sound waste and materials management in member countries through the publication of reports and working papers. Based on this work, the OECD's governing body, the Council, has adopted OECD Acts – Decisions and Recommendations – in these and related fields. Key Acts include the following:

- **Recommendation of the Council on Resource Productivity [C(2008)40]**

  This document sets out recommendations for Member Countries on policies for the improvement of resource productivity. It encourages member countries to strengthen their capacity for analysing material flows and related environmental impacts. The Recommendation moreover calls for further actions to improve resource productivity, including the use of information in policy development, the promotion of life-cycle approaches, and the promotion of new technologies and the greater use of economic instruments. The Recommendation builds on the 2004 Recommendation on Material Flows and Resource Productivity [C(2004)79].

- **Recommendation of the Council on the Environmentally Sound Management of Waste [C(2004)100]**

  The Recommendation calls on member countries to elaborate and implement policies and programmes to ensure that waste be managed in an environmentally sound and economically efficient manner, including an adequate regulatory and enforcement infrastructure. It moreover sets out core performance elements (CPEs) for waste management facilities.

- **Recommendation of the Council on the Use of Economic Instruments in Environmental Policy [C(90)177]**

  This document recommends that member countries make use of economic instruments as a complement or a substitute to other policy instruments such as regulations, taking into account national socio-economic conditions. In waste and circular economy policy, this may involve making use of pay-as-you-throw arrangements for municipal waste to encourage waste reduction, waste disposal taxes to discourage the use of environmentally harmful waste treatment or disposal methods, or resource taxes to encourage the more efficient use and re-use of scarce resources.

- **Decision of the Council concerning the Control of Transboundary Movements of Wastes Destined for Recovery Operations [C(2001)107]**

This decision builds on previous OECD Acts on the transboundary movements of waste, setting out requirements and procedures for transboundary movements of wastes destined for recovery within the OECD area.

Two OECD Recommendations on public spending are relevant for waste policy:

- **Recommendation of the Council on Good Practices for Public Environmental Expenditure Management [C(2006)84]**

  This recommendation calls on member countries to take effective measures to ensure that public environmental expenditure programmes are environmentally effective, economically efficient and managed in accordance with sound principles of public expenditure management. In the case of waste management, this may involve ensuring the long-term planning of investments in waste treatment based on an identification of future needs and ensuring that investments do not result in unintended, environmentally harmful consequences.

- **OECD Council Recommendation on Improving the Environmental Performance of Public Procurement [C(2002)3]**

  This recommendation provides policy frameworks that can be used by governments in improving the environmental performance of public procurement, including procedures for identifying environmentally sound products, training and technical assistance for implementation, and indicators for monitoring and evaluation.

3.2. Legislation, strategies and planning for waste management

3.2.1. Legal frameworks

In general, OECD countries have legislation in place ensuring that the main aspects of waste management – classification, collection, transport and treatment of municipal, industrial and hazardous waste – are regulated.

Comprehensive "umbrella" legislation, providing a framework for all regulation relevant to waste management, can also be useful in ensuring that waste legislation is coherent and consistent and that no gaps exist. This approach exists in many of the focus countries reviewed. In Korea and Japan, relevant legislation and supporting regulations are brought together under framework legislation focused on sustainable resource use. In the Netherlands and Norway, both countries took a comprehensive approach to waste management relatively early, with waste regulated under the framework of the general environmental protection legislation (the Environmental Management Act of 2002 in the Netherlands, and the 1982 Pollution Control Act and 2004 Waste Regulations in Norway). In Estonia, Poland, Hungary, Czech Republic and Slovenia, accession to the European Union prompted the reform of waste legislation: EU legislation, including the Waste Framework Directive, provides a comprehensive legal framework for these five countries and other EU member states.

Contrastingly, the regulation of waste management in Colombia and Israel is characterised by numerous pieces of legislation, creating the potential for gaps or inconsistencies. In Colombia, waste legislation has evolved over recent decades and most aspects of waste management are covered, with recent improvements in the regulation of hazardous waste. Nonetheless, some gaps remain for construction, non-hazardous mining waste and agriculture. Similarly, while there has been significant regulatory development in Israel, a comprehensive legal framework drawing together all relevant legislation is lacking. At the

time of Environmental Performance Review, a significant gap in Israeli waste law remained regarding the liability for contaminated sites; however, regulations addressing this gap were awaiting approval.

3.2.2. Policies and plans

The legal frameworks for all reviewed countries set out requirements for regular waste management planning processes (the exception, Norway, has an environmental White Paper process that incorporates national waste planning)

Typically, national waste management plans:

- set out policy objectives;
- set targets (usually quantitative) in line with the policy objectives;
- identify actions that will be taken to meet the objectives and targets;
- outline a process for monitoring implementation of the plan, often setting out the indicators that will be used to assess implementation.

In all countries except Colombia,[1] the national waste planning process covered all waste sectors. In Colombia, separate policy planning processes were in place for municipal waste and hazardous waste. In some cases, the national waste management planning process was part of national environmental planning processes (for example, Norway). All EU OECD countries are required under the Waste Framework Directive to ensure the preparation of waste management plans that set out, among other things, the current waste management situation, the measures to be taken to improve waste management and an evaluation of how the measures support the objectives of the Directive. The waste management plans for all countries included quantitative targets of some kind. These targets are often related to the recycling and recovery of waste, but in some cases also addressed waste reduction and resource efficiency.

In many of the focus countries, waste management plans address recycling, waste prevention and resource efficiency – and thus elements of the move to a circular economy. The EU Waste Framework Directive, for example, sets recycling targets and requires the preparation of waste prevention programmes, either integrated with waste management plans or in parallel with them.

Three focus countries – Japan, Korea and Netherlands – developed advanced circular economy policies (see Section 3.3). Other countries include circular economy policy goals in broader environmental policy documents. For example, Poland's Strategy for Innovative and Efficient Economy 2013 includes resource efficiency goals, while Hungary's National Environmental Technology Innovation Strategy includes quantified material productivity targets. However, often such approaches do not ensure that action plans or institutional arrangements are in place to support the achievement of these goals.

In many countries, regional and/or municipal authorities also carry out waste management planning processes, outlining how waste will be managed within their jurisdiction. Often, lower level plans are required under legislation (for example, Colombia, Estonia, Korea, Poland). In Poland and Estonia, these plans must specifically address the provisions of the national-level plan. In Japan, lower-level planning is not mandatory, but subsidies are granted to prefectures with a waste treatment plan in place. In some cases where a regional or municipal planning process is not in place, national plans will also set out goals and objectives for local governments (for example, Israel).

Limited vertical co-ordination between such plans set out at different government levels can result in missed opportunities in terms of building a comprehensive approach to waste management. This was noted in Colombia, where it was noted that the failure to develop policies and management plans in parallel undermined the potential to improve the effectiveness and efficiency of waste policies and build an efficient waste infrastructure network. In Colombia and in many OECD countries, municipal governments play a key role in managing MSW collection and treatment: consequently, co-ordination is needed to ensure a common, national approach. However, vertical co-ordination may become too burdensome if the requirements are too complex. This was noted in the previous planning process in Poland, where waste planning was carried out at four levels (national, regional, county and municipality), with requirements that each plan be consistent with the plan at the level above, with reporting requirements flowing upwards. This approach was amended to a two-level (national and regional) approach. Norway's Pollution Control Act previously required municipalities to prepare waste management plans for municipal waste. This legal requirement was dropped; however, some municipalities still prepare such plans.

3.3. Policy frameworks for the circular economy

A review of the Environmental Performance Reviews of the focus countries suggests that comprehensive policy frameworks for the move to a circular economy, though increasing, are still relatively rare in OECD countries.[2] Nonetheless, aspects of circular economy principles are increasingly seen in the legal and policy frameworks of OECD countries. While some countries refer to the transition to a circular economy (especially in EU Member States), others refer to resource productivity, resource efficiency, sustainable materials management and sustainable production and consumption (the latter, for example, in Colombia). Japan has a policy framework for a sound-material cycle society and the "3Rs" (reduce, reuse, recycle); Korea's policies also support the 3Rs and resource circulation. The OECD has aimed to support policy making in this area through, for example, the 2008 Recommendation of the Council on Resource Productivity (Box 3.2).

Box 3.2. OECD Policy Guidance on Resource Efficiency, 2016

This guidance for policy-makers, which was prepared at the request of G7 leaders, notes a number of key policy actions to be taken at the national level to effectively support resource efficiency, contributing to the shift to a circular economy. These policy actions include:

1. **Apply mixes of policy instruments so as to provide a coherent set of incentives for resource efficiency throughout the policy lifecycle**.
   These policy mixes should ensure that each of the main stages of a product's lifecycle are addressed: material extraction, transport, production, consumption, recycling and final disposal. Currently, evidence suggests that policies are more focused on the post-consumption stages, and policy mixes could be rebalanced to provide more focus upstream in the production and consumption phases. In particular, waste prevention is not being fully exploited in policy mixes.

2. **Implement policies that promote resource efficiency across the lifecycle of products**.
   To avoid shifting problems being displaced along product lifecycles, environmental risks need to be managed in an integrated way. Three policy

approaches are outlined that use different policy mixes to address resource efficiency along the lifecycle: EPR; green public procurement; partnership with business and other stakeholders.

3. **Treat resource efficiency as an economic policy challenge and integrate it into cross-cutting and sectoral policies.**
   Integrating resource efficiency into cross-cutting and sectoral policies, in the manner of other economic policy challenges, helps support the transition to a circular economy. This can help to ensure coherence in policy-making by aligning sectoral policies with resource efficiency objectives. Resource efficiency can also be promoted by integrating it into cross-cutting policy domains, including innovation policy, investment planning, and education and vocational training. Such mainstreaming requires effective governance arrangements, at a sufficiently high level of government.

4. **Strengthen policy development and evaluation through better data and analysis**.
   Material flow accounts and indicators for resource efficiency are necessary for policy setting and implementation; however, significant data gaps impede the development of these tools. The Guidance notes that better evidence on the macroeconomic benefits of resource efficiency and the costs of environmental externalities of current resource consumption patterns could help to build the case for policies that improve resource efficiency.

The shift from a linear approach to a circular approach can be seen in policies and measures that emphasise resource efficiency and link waste management with other phases in life-cycle of products and materials (design, production, consumption). The implementation of the waste hierarchy into waste management; policy objectives or measures promoting ecodesign, recycling and re-use; targets for decoupling waste generation from economic growth; and extended producer responsibility (EPR) schemes – these may all be seen as means of incorporating circular economy principles into policy and legal frameworks. As noted in the 2016 OECD Policy Guidance on Resource Efficiency, an effective combination of these instruments can improve their overall impact and efficiency.

Three of the focus countries had a comprehensive policy framework for the circular economy at the time of their Environmental Performance Reviews: Korea; Japan; and the Netherlands.[3] In Japan (Box 3.3) and Korea, the circular economy framework has been set out in legislation. Korea's Framework Act on Resource Circulation, adopted in May 2016 and coming into effect in 2018, is intended to move from a waste and pollution-oriented strategy towards an integrated, circular economy approach. The Framework Act brings together all legislation on waste disposal, recycling and international movement of waste. It sets quantitative targets for landfilling (no more than 3% of waste treatment) and waste recovery (87% of all waste), and establishes incentives for business actions for resource recovery.

Box 3.3. Japan's Sound Material-Cycle Society framework

In Japan, circular economy policy is integrated into the legislative and policy framework for waste through the Basic Law for a Sound Material-Cycle (SMC) Society (2000) and the Fundamental Plan for Establishing a SMC Society (2003, revised in 2008).

Japan's SMC Society package, adopted in 2000, represents a comprehensive circular economy framework for waste management. While a circular economy approach could be seen in the legal and policy framework prior to 2000, for example in the emphasis on recycling in the Law for the Promotion of the Effective Utilisation of Resources (1991), the SMC framework represents a further shift "from waste management to sound materials management", consolidating and broadening the scope of Japan's waste legislation. The framework integrates the 3Rs – reduction, re-use and recycling – into Japanese legislation. It also emphasises the responsibilities of the waste generator in the sound management of materials, and extends producer responsibility for end-of-life products.

The legal framework (the Basic Law) sets out an action planning process, the Fundamental Plan, which is revised periodically according to the recommendations of the Central Environmental Council, a consultative body composed of experts, industry associations, consumer organisations, trade unions, and non-governmental organisations (NGOs). This plan sets out a broad range of quantitative targets on resource efficiency, cyclical material use rate, waste reduction, awareness raising, and environmental business practices (e.g. green purchasing). The Plan also sets an approach for monitoring performance against the targets, based on economy-wide material flow indicators. At the time of the Environmental Performance Review, Japan was on track to meet its targets for 2015.

Since the adoption of the SMC framework in 2000, the 3Rs approach has been integrated into other legislation to ensure a coherent approach to waste management. These pieces of legislation include laws on soil contamination, polychlorinated biphenyls (PCB) and agriculture, forestry and fishery biofuels.

In the Netherlands, the second National Waste Management Plan (covering the period 2009-17, with a view to 2021) introduced a new emphasis on resource efficiency. Following the government's broader Green Growth Strategy, the 2012 "Waste to Resource" programme set out ambitious circular economy objectives, including a target to halve the volume of material that leaves the economy by 2024.[4]

Japan's Fundamental Plan Establishing a SMC Society sets out a detailed approach for monitoring performance against policy objectives according to economy-wide material flow indicators. Both Korea and the Netherlands were considering information and monitoring approaches at the times of their Performance Reviews: for both countries, the reviews recommend the development of material flow accounts and indicators.

Other review countries did not have comprehensive circular economy policy frameworks, but circular economy principles can often be seen in the general legal and policy frameworks for waste, environmental protection, industrial development and waste. For

example, in Norway, circular economy policy can be seen in aspects of the country's waste policy, including its extensive use of EPR programmes. The country's general environmental policy framework, set out in white papers, included waste reduction targets and actions to achieve these targets. Israel's Towards Green Growth Strategy of 2012 seeks to build the information basis for circular economy policy and start to put a policy framework in place. The Strategy has been integrated into the work plans of ministries but is not yet integrated in government development strategies. In Switzerland, the Green Economy Action Plan sets out the country's strategy for clean technology innovation, resource efficiency, consumer awareness and environmental taxation. In Slovenia, one of the four main objectives of the National Environmental Action Programme for 2005-12 was to ensure sustainable production and consumption, and it called for a shift from waste incineration towards materials recovery. The Czech Republic includes goals relevant to resource efficiency in its State Environmental Policy, the National Strategy for Sustainable Development and the Ten-Year Programme for Sustainable Consumption and Production, as well as relevant sectoral policy documents (for example, the State Energy Policy). In Hungary, the National Environmental Technology Innovation Strategy includes quantitative targets for reducing the material intensity of production. However, these targets are indicative and are not supported by specific actions or a review process.

Circular economy objectives may also be set out in economic development programmes. While its waste policy framework is largely focused on managing and limiting the immediate negative impacts of waste, Colombia's Sustainable Production and Consumption Policy, regarded to be the most comprehensive in Latin America, indicates progress towards a comprehensive circular economy policy framework. The Sustainable Production and Consumption Policy sets out resource efficiency targets, supporting efforts for cleaner production and plans for the future implementation of EPR and green public purchasing. The national development plan (PND) includes environmental sustainability as a cross-cutting goal and the 2010-14 PND adopts some of the resource efficiency targets set out in the Sustainable Production and Consumption Policy. Similarly, Poland's 2003 strategy on production and consumption called for decoupling resource consumption from economic growth. The National Reform Programme in the Czech Republic includes objectives on the effective use of secondary raw materials, conversion of waste to resources and recycling.

Under EU legislation, all EU Member States are required to adopt certain policy measures that support a circular economy approach. The Waste Framework Directive has a particularly strong role here. The Directive requires the incorporation of the waste hierarchy into legal and policy frameworks, the establishment of waste prevention programmes, and encourages Member States to adopt EPR schemes. Other pieces of EU legislation support, at least to some extent, a circular economy approach to waste management, including the Waste Electrical and Electronic Equipment (WEEE) Directive, the Batteries Directive, the Directive on End-of-Life Vehicles, and the Packaging Directive. (The Circular Economy Legislative Package proposed in 2015 would amend some of these pieces of legislation, setting new and/or more ambitious targets than those currently in EU legislation.) Thus, all EU OECD countries have, at least to some extent, incorporated circular economy policy into their legal and policy frameworks. This is seen, for example, in Slovenia, where changes to the waste legal framework following its 2004 accession to the EU integrated, at least to some extent, circular economy principles.

The OECD Council Recommendation on Resource Productivity (OECD, 2008) emphasises the importance of improving the productivity of resource use at all stages of the life-cycle for products to avoid waste of resources and reduce negative environmental impacts. As

noted in the OECD's 2014 Report on the Implementation of the 2008 Recommendation, however, only a few OECD countries have developed policies to address several stages of the materials life-cycle: it appears that many so far have focused on products and waste stages rather than up-stream activities such as resource extraction. Moreover, countries have tended to focus on life-cycle stages occurring within their territories rather than those that take place beyond their boundaries.

3.4. Institutional frameworks

The regulation of waste management requires government institutions to carry out a number of different activities: the development of legal and policy frameworks; setting of policy objectives; implementation of those frameworks (including permitting and enforcement functions); data collection, monitoring and evaluation; information and knowledge sharing; consultation of stakeholders; and the co-ordination of actors. These activities are shared among a number of institutions, and, in OECD countries, are almost always shared across different levels of government (OECD, 1999).

The 11 OECD countries studied in-depth display a broad range of institutional arrangements for waste management policy. Nonetheless, all focus countries have some common features, with a two-tiered or three-tiered governance system in place in all countries. Typically, national governments set the high-level policy objectives (for example, in national waste plans and strategies) and establish the legal framework.

The ministry responsible for environmental policy is the lead agency for waste policy in all focus countries. These ministries consult horizontally with other relevant ministries in the national government, such as the ministries responsible for economy or industrial development (on circular economy issues and/or industrial waste), agriculture (agricultural waste), health (clinical waste, public health), and land-use planning (planning of waste treatment sites). In some countries, different ministries are in charge of overall waste management policy and MSWpolicies. For example, in Hungary the lead ministry for waste management policies is the Ministry of Agriculture while MSW falls under the responsibility of the Ministry of National Development. Similarly, in Colombia, the Ministry of Environmental and Sustainable Development is in charge of waste policies, the Ministry of Housing, Cities and Territories being in charge of MSW. In the Czech Republic, the Ministry of Environment established the Waste Management Board, composed of relevant experts from all government departments and NGO representatives, to advise on waste policy and support the coherence of waste policy across relevant policy areas. Often a separate enforcement agency may be involved in enforcement and compliance (for example, the Green Policy in Israel, the Chief Inspectorate for Environmental Protection in Poland, the Environmental Inspectorate in Estonia). Separate national environmental authorities may also have a role in the implementation and enforcement of waste management policy (for example, Slovenia) or in policy-focused research (for example, the Netherlands Environmental Assessment Agency). In some cases, a national, independent regulatory authority monitors waste activities (for example, in Portugal). (See Section 4.7 for a further description of regulatory approaches for enforcement.)

National authorities may also carry out a number of other roles: permitting of certain activities (for example, the national authority in Norway is responsible for the permitting of hazardous waste operators); operating national hazardous waste facilities (for example, in Israel and Estonia); collecting reported information from municipalities; supporting local authorities in their implementation roles through capacity building actions (for example,

Korea, Poland); and co-ordinating inter-municipality collaboration (for example, the Local Government Policy Council in Korea).

In some OECD countries, regional or provincial governments also play a role in both policy-setting and action planning. This role is typically stronger in countries with a federal system of government, where the regional government may set policy objectives and legislative frameworks, and national government may have a more restricted role. However, even in countries where a unitary system is in place, regional or sub-national governments will often have a strong role in waste management policy and action-planning. This is seen in Poland, where the voivods prepare waste management plans for their voivodeship and are responsible for most permitting of waste facilities. Similarly, provincial authorities play a role in permitting and enforcement in the Netherlands and Korea.

The OECD Council Recommendation on Resource Productivity (OECD, 2008) highlights the importance of involving all relevant government bodies. The 2014 Report on the implementation of this recommendation, found that only a few countries have effective mechanisms for policy co-ordination and coherence. The Environmental Performance Reviews also suggest that national institutional frameworks dedicated to the horizontal co-ordination of circular economy policy are rare. Such arrangements can integrate circular economy goals into relevant cross-cutting and sectoral policies. In the review for the Czech Republic, while it was noted that the Waste Management Board plays an important role in circular economy policy, there is a need for an institutional platform specifically dedicated to broader co-operation beyond waste policy. Where institutional responsibilities for circular economy (or sustainable material use) have been allocated, it is often the ministry responsible for environmental policy that takes the leading role. This is seen, for example, in the Netherlands, the Czech Republic, and in Japan, where the Ministry of Environment is responsible for 3Rs policy. In the Netherlands, it was noted that some consideration is being given to the roles and responsibilities of different actors for circular economy.

3.5. Organising municipal solid waste services

In many OECD countries, the management of MSW is carried out at multiple levels of government, with municipal governments often playing a key role. Their implementation role may involve ensuring the collection, transport and treatment of waste. Municipalities may also be involved in the setting and collection of fees (often in line with regional or national legislation), while the licensing and permitting of waste facilities is more often carried out at the national level or at the regional level (particularly in countries with a federal system of government). Municipalities may also be involved in action planning (for example, through a local waste management plan). Often these roles are carried out in districts that bring together neighbouring municipalities.

Arrangements for the collection and transport of municipal waste often vary between municipalities in a country, with most countries displaying a mix of approaches (Box 3.4). These arrangements can usually be categorised into one of three main approaches:

- **In-house service delivery.** Municipal governments may directly deliver waste management services. For example, in Israel, municipal waste collection is predominantly carried out by the municipal sanitation department, although private sector collection is increasingly more common. In other cases, as in some municipalities in Norway, the collection and transport and treatment may be

delegated to a municipality-owned company or a company jointly owned by a number of municipalities through an exclusive contract.

- **Competitive tendering.** Waste collection and transport services for one (or more) municipal areas may be contracted out to commercial providers. This occurs in a number of OECD countries, for example, Estonia, Poland and Colombia.
- **"Side-by-side" collection**. Individual households are responsible for arranging the collection and transport of their waste. This approach results in direct contracting between households and waste collectors so that multiple companies may be operating "side-by-side" in the same municipality. This approach is increasingly rare in the OECD: it was in place in Poland prior to the 2013 reforms and continues to be used in Ireland.

The experience in some countries – Poland, Israel and Japan – suggests that tendering is increasingly being used to provide municipal waste collection and transport services. Cost effectiveness is likely to be a key driver behind this shift. In the Netherlands, liberalisation of the waste market is a goal in both the National Waste Management Plans prepared to date, and the liberalisation of the waste treatment market has seen waste treatment prices increase at a lower rate than inflation. Studies comparing waste collection services in Israel suggest that costs are lower in municipalities where private operators collect waste.

Side-by-side collection - direct contracting between municipal waste generators and commercial service providers does occur in OECD countries (for example, Ireland), but is unusual. Until recently, in Poland, municipalities were not directly responsible for household waste collection, and households contracted directly with commercial providers for the collection and transport of waste. With multiple companies operating in the same municipality, the increased number of trucks resulted in increased traffic, air and noise pollution. In addition, illegal dumping by both households and operators was relatively easy, due to the weak role of municipalities and the possibility of free-riding by households. Reforms in 2011 made municipalities responsible for competitive tendering to ensure waste collection services for households. While challenges were observed during the transitional period, early results suggest the reforms were leading to benefits, such as improved service coverage and increased separate collection of waste.

Box 3.4. Overview of municipal solid waste collection arrangements in the focus countries

Colombia	Predominantly competitive tendering**.**
Czech Republic	Mix of in-house delivery and competitive tendering.
Estonia	Competitive tendering, with households directly paying companies.
Hungary	Competitive tendering among certified public sector operators via municipal governments, with central authority responsible for fee setting, collection and payment of contractors.
Israel	Predominantly in-house, with increasing use of competitive tendering.
Japan	Predominantly competitive tendering, with some in-house service delivery.
Korea	Mix of in-house delivery and competitive tendering.
Netherlands	Mix of in-house delivery and competitive tendering.
Norway	Predominantly in-house through a municipal department or municipally-owned company. Some competitive tendering.
Poland	Previously "side-by-side", replaced by competitive tendering. In-house delivery is also possible since January 2017.
Slovenia	In-house, predominantly through publicly-owned companies.

Challenges in the implementation of reforms to institutional arrangements for municipal waste are not unique – private sector or informal sector operators already in the market can be expected to challenge reforms that threaten their investments, and municipalities may lack the capacity to manage new roles (OECD, 2013) – as the example in Estonia highlights. Changes in the Estonian institutional framework for management of municipal waste have created continuing uncertainty concerning the role of municipal governments and the private sector in waste collection. Similarly, in Hungary, frequent recent changes in the role of municipal governments regarding MSW, particularly in the setting and payment of service fees, risk undermining the potential for cost-recovery in MSW collection and reducing incentives for municipal governments to pursue waste reduction and recycling improvements.

3.5.1. Collecting recyclables at kerbside

The collection of recyclable MSW at the kerb (also called 'door-to-door') can support higher rates of separate collection and of recycling. Several Environmental Performance Reviews found that reforms have increased the use of kerbside collection: this was seen, for example, in Hungary, Korea and Poland. Other countries, however, continued to rely on voluntary deposits at containers and civic amenity sites, as seen in the Czech Republic. Environmental Performance Reviews, for example for Slovenia, have recommended greater use of kerbside collection.

3.5.2. Role of the informal sector

In some countries, the informal sector is an important player for waste management. The involvement of the informal sector in recycling is often seen in many countries, particularly

in waste streams involving high-value materials (end-of-life vehicles, some WEEE), as noted in the Environmental Performance Reviews for Chile, Colombia, Estonia, Israel, Korea, Mexico and Poland. In many cases, informal recyclers make significant contributions to overall recycling efforts. Indeed, in Colombia, half of all recycling actions are carried out by the informal sector, and approximately 14 000 people rely on the sector for their livelihoods. These operators can assist in meeting recycling targets in the absence of infrastructure for the separate collection of waste. However, informal waste picking can also lead to illegal dumping of waste and undermine the cost effectiveness of formal recycling programmes, including EPR schemes.

Integrating these operators into the formal waste management system can help to maximise the positive contributions waste pickers make to recycling objectives, while minimising the risk of negative consequences. Some success in integrating the informal sector was seen in Bogota, Colombia, during the lengthy process of formalising the city's waste pickers. The process lasted more than a decade, and involved legal challenges from the informal sector to the city's plans to competitively award municipal waste services. At the direction of the courts, the city entered into negotiations with the informal sector and developed a social and financial plan for the integration of waste pickers into the city municipal waste management system. Formal recognition of the role of waste pickers in waste management, and providing financial incentives for them to participate in the formal system, appeared to be key factors in integrating the informal sector. A sound understanding of the sector and how it functions is critical to setting the right incentives for integration, as was recommended in the review for Korea.

3.5.3. Size of municipal waste collection areas

The size of municipal waste collection areas impacts the efficiency of collection services, and the level of competition in the waste collection market, resulting in a trade-off between economies of scale and competition. In many countries, the collection area is the individual municipality. However, legislation can be used to designate larger waste collection areas where appropriate. Alternatively, municipalities may join together for joint contracting of waste collection and transport services to achieve economies of scale: this is seen in Poland, Japan and Norway. In other countries, these opportunities to achieve efficiencies through joint action are not always taken. In Slovenia, there are a large number of small municipalities, and there is a recognition of the need to develop larger regions for waste management, which is permitted under the legal framework. However, no regions had been established at the time of the review. In Estonia as well, municipalities could voluntarily join together in common waste districts (up to a service area of 30 000 inhabitants); however, few municipalities did so. In the Czech Republic, where 6 000 small municipalities have responsibilities for waste management, most (90%) participate in some kind of inter-municipal arrangement. However, opportunities for inter-municipal co-operation are often missed in the areas where they may be most needed due to administrative capacity issues.

3.5.4. Institutional capacity for tendering

Efficient public procurement of high quality services can be challenging for the public sector. For municipalities with potentially limited experience in procurement, contracting with private sector companies to provide waste collection, transport and treatment services can be particularly challenging.

In some cases, public procurement processes may overemphasise price as a decisive factor in the award of contracts, potentially leading to poor quality outcomes in terms of how the successful bidder performs the contract. This was reported in the Poland review, although recent data suggests improvements in this area, with just 16% of tenders being awarded on price alone in 2016 compared to 83% in 2014 (European Commission, 2016). This may be in part due to investments in capacity building efforts for municipalities (Box 3.5). Slovenia also faces challenges in this area (78% of tenders awarded on price alone in 2016). Concerns may also be raised regarding the competitive advantage of municipality-owned facilities in the market for contracts, a factor seen in Poland.

Appeals from unsuccessful bidders against the tendering processes can delay the procurement of waste services. This was seen during the transition to competitive tendering in Bogota, Colombia, where the informal sector launched a challenge. It is also seen in Estonia, where appeals against the award of a contract can lead to the contract being set aside, and the process beginning again. This creates an incentive for losing bidders to launch appeals, and as a result such challenges are common. When appeals lead to contracts being set aside, waste generators are left without waste collection and transport services, increasing the risk of illegal disposal. Contrastingly, in the Netherlands, where a contract award is set aside, the incumbent contractor continues to perform its duties until the matter is resolved.

During the transition phase to competitive tendering of private sector waste services, trade unions may also oppose reforms. This was reported in Israel, where local labour unions have opposed the outsourcing of municipal waste collection. Mixed systems can create uncertainties and legal challenges: in Poland, for example, municipally owned waste companies could compete for tenders in their city, leading to court cases over potentially unfair awards.

Consequently, institutional capacity is a key factor for the success of municipal waste services procurement. To be successful, competitive tendering requires “a cultural change in government and a new mix of skills” in municipal governments, and incentives for local governments to competitively award waste management contracts are relatively weak (OECD, 2007). Often, imbalances exist in the capacity and incentives of the parties involved in tendering processes; municipalities, particularly small, often rural, communities, may be limited in terms of expertise and resources, while private operators may be well resourced with considerable financial interests to pursue. Limitations in the capacity of municipalities to manage their roles in waste management, which may include managing competitive tendering processes, were reported in a number of the focus countries, including Estonia, Korea, Poland and Slovenia. In some cases (Korea, Poland), national governments carry out capacity building activities to support municipalities in their work. The establishment of inter-municipal or regional waste management districts can also help to address this challenge, as seen in Poland, Japan and Norway and under discussion in Slovenia.

Box 3.5. Municipality capacity building in Poland

There was a strong need to build the capacity of municipalities in Poland after the reforms of 2011. Prior to the reforms, the role of municipalities was limited to enforcement activities, overseeing the private operators collecting and transporting waste, and many municipalities did not take a strong role. Since the reforms, municipalities are responsible for the overall delivery of municipal waste services, requiring them to procure waste management services through competitive tendering, ensure separate collection of recyclables and set and collect fees from households and small businesses.

The national government, through the responsible environment ministry, took a number of capacity-building actions to ensure municipalities were to carry out their new role. The ministry published a guidance manual, held conferences and meetings, and operated an internet hotline staffed by experts on waste technology, fee collection, public procurement and contract management. In some cases, municipalities that had adopted the reforms early provided training to other towns based on their experiences. Municipalities were also provided with communications materials to provide to residents to inform them about the changes.

3.6. Role of the private sector

As noted in Section 3.5 above, municipalities frequently contract with private operators for the collection, transport and/or treatment of municipal waste. Usually tenders are awarded to one contractor per municipality, so that economies of scale and density may be achieved. Contracting with private waste service providers by generators of industrial and hazardous waste is also common. Private sector investment in waste treatment facilities plays an important role in developing waste management infrastructure in most OECD countries (see Chapter 5).

At a broader scale, public and private co-operation has an important role for waste management and also for the move to the circular economy. For example, in the Netherlands, the private sector is involved in the development of National Waste Management Plans and has responsibilities for waste management set out in legislation. Similarly, in Japan, the private sector is involved in the SMC Fundamental Planning process and shares responsibility for waste management and resource efficiency under the SMC Law. OECD's 2014 Report on the Implementation of the 2008 Recommendation on Resource Productivity highlights the need for stakeholder engagement in ensuring full implementation of these policies, as many economic sectors need to be involved.

Governments can support improved waste management practices in industry through information exchange networks. In Israel, a joint government-private sector initiative established a waste material exchange bulletin board, supporting relatively high rates of recycling and recovery of industrial waste. In Colombia, the National Center for Cleaner Production and Environmental Technology promotes better waste management in industry. The Centre enters into voluntary agreements with industry sectors and provides technical assistance to companies on waste management. It also operates an information system that supports the exchange of recovered materials between companies. In Japan, the government seeks to raise private sector awareness of waste and resource efficiency

through the Eco-Town Programme. In the Czech Republic, the authorities support information exchange through conferences on waste reduction and a contest, Turning Waste into Resources, which promotes recycling and the use of secondary raw materials by businesses. These activities are in line with OECD recommendations on environmentally sound waste management, which recommend that OECD countries encourage information exchange between private sector operators to foster waste prevention and optimise recovery operations (OECD, 2004). More generally, gathering and sharing valuable information is a key factor for the move to a circular economy.

EPR schemes involved extensive private sector participation. These schemes are discussed in more detail in Section 4.3.

Notes

[1] Since the publication of its Environmental Performance Review, Colombia adopted the National Policy for the Integrated Management of Solid Waste (Política Nacional para la Gestión Integral de Residuos Sólidos) in November 2016, which takes an integrated approach to managing all solid waste sectors.

[2] Four of the 11 reviews did not specifically cover the subject of circular economy in their waste chapters. In these cases, the information on policy and legislative frameworks were reviewed to identify, where possible, policy objectives and measures that seek to integrate a circular economy approach into waste policy.

[3] Other countries have taken steps for a circular economy since their environmental performance reviews. Slovenia's recent Development Strategy 2030 includes a low-carbon circular economy among its goals. See: www.vlada.si/en/projects/slovenian_development_strategy_2030/.

[4] Since the Environmental Performance Review, the Netherlands has taken further steps, including the publication of *A Circular Economy in the Netherlands by 2050: Government-wide Programme for a Circular Economy* (September 2016). See: www.government.nl/documents/policy-notes/2016/09/14/a-circular-economy-in-the-netherlands-by-2050.

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Chapter 4. Policy instruments for waste and materials management

This chapter reviews a range of policy instruments that OECD countries have put in place for waste and materials management: regulatory instruments, economic instruments, extended producer responsibility (EPR), green public purchasing, public information, monitoring and reporting and enforcement mechanisms. It highlights good practices identified in the Environmental Performance Reviews.

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

This chapter reviews a range of policy instruments that OECD countries have put in place for waste and materials management and highlights good practices identified in the Environmental Performance Reviews (Box 4.1). In particular it reviews the following types of policy instruments: regulatory instruments, economic instruments, extended producer responsibility (EPR), green public purchasing, public information, monitoring and reporting and enforcement. The various types of instruments discussed in this chapter – together with financing (described in Chapter 5) – need to be combined in an effective mix appropriate to the policy challenges. Policy documents such as waste management plans can provide a context for establishing and updating the mix of instruments to address policy needs.

In Israel, for example, the 2006 Sustainable Solid Waste Management Master Plan identified priorities, set objectives and led to the introduction of new instruments, notably Extended Producer Responsibility schemes as well as economic instruments such as a landfill levy; the 2010 Recycling Action Plan further developed the mix of policy instruments, stimulating separate collection and recycling of household waste.

Korea has applied a successful mix of instruments to address food waste, a priority area for attention in national waste policy. Korea introduced a ban on landfilling of untreated food waste in 2005 and a ban on ocean dumping in 2012, together with mandatory separate collection, starting in 2010, and a volume-based waste fee for waste not going to recycling or composting. The government also signed voluntary agreements with key economic sectors generating food waste such as restaurants and hotels, and launched campaigns as well as public-private initiatives to raise awareness of this issue. At the same time, funding and loans supported separate collection and recycling of food waste.

In another example, Poland and Slovenia adopted the EU's strict landfill standards and closure requirements on the Union. In parallel, the availability of EU funds helped to finance the closure of old landfills not meeting the standards and investment in separate collection and new waste management facilities for their replacement. Stronger enforcement helped to ensure that new landfills and facilities met requirements.

Box 4.1. Examples of good practices for policy instruments

Regulatory instruments

- Linking regulatory instruments with economic instruments and awareness raising to create a strong policy mix (Netherlands landfill ban).
- Product standards to support recycling and the circular economy (EU Directive on end-of-life vehicles).
- Capacity-building measures where necessary to ensure that key bodies can implement tasks (Poland MSW management reforms).

Economic instruments

- Use of pay-as-you-throw pricing models for MSW services to encourage waste reduction and separation (as seen in volume-based pricing for MSW services in Korea and parts of the Netherlands).

- Full recovery of waste management costs to implement the polluter pays principle (Netherlands, Norway).
- Ongoing refinement of pricing of MSW services to improve cost recovery and avoid perverse incentives (Colombia).
- The use of revenue raised through MSW service delivery to build the capacity of municipalities for their MSW management functions (Poland).
- Differentiating disposal taxes according to the environmental harm associated with different types of waste treatment (Norway, prior to 2010).
- Using environmental product fees discourage the use of environmentally damaging products (Hungary).

Extended producer responsibility

- Consolidation of producer responsibility organisations (PROs) to ensure efficiency and economies of scale (Netherlands and Korea).
- Clearinghouse mechanisms to co-ordinate multiple PROs (Denmark, cited in the Review for Estonia).
- Certification of PROs to ensure they meet environmental standards (Norway).
- Advanced disposal fee for small waste streams for which a take-back programme would be too costly (Korea).
- Setting of fees so that the full end-of-life costs of products are recovered, thereby incorporating the polluter pays principle and creating incentives to reduce the harmful impacts of products (many OECD countries).
- Consultation with stakeholders during the establishment of schemes and their ongoing operation to secure the engagement of industry and relevant authorities (Netherlands).
- A portfolio approach to implementing EPR schemes, ensuring key aspects such as recycling targets are in place to ensure effectiveness (Colombia). Flanking policies, such as landfill taxes, can also ensure that EPRs are part of a transformational shift in waste management.
- Discouraging free-riding by holding retailers and distributors responsible for product take-back when manufacturers or importers fail to meet their obligations, thereby encouraging retailers to ensure supplier compliance (Czech Republic).

Green public purchasing

- Use of eco-labels to guide public procurement choices (Korea).
- Promotion of waste reduction within government (Norway).
- Setting targets for the implementation of GPP (Netherlands).
- Use of procurement as a tool for the circular economy: supporting recycled goods and ‘circular procurement’ (Netherlands).
- Monitoring of green public procurement to hold purchasing agencies accountable (Czech Republic).

Public information and awareness raising

- Including waste reduction and recycling in environmental education programmes (Colombia).

- Encouraging and supporting non-governmental organisation (NGO) activities for public awareness, such as clean-up actions (Estonia, Colombia).

Monitoring and reporting

- Comprehensive monitoring and reporting of waste generation and treatment to support the development and review of policies (Norway).
- Introducing advanced information systems to track industrial and other waste (Korea).
- Development of information systems, indicators and material flow accounts to understand the development of circular material flows in the economy (Japan).
- Addressing information gaps to improve understanding of international flows of materials, such as flows of raw materials embodied in traded goods (Japan since 2010 review, Netherlands).

Enforcement and compliance promotion

- Co-ordination mechanisms among enforcement bodies (Israel, Poland).
- Capacity building for enforcement bodies to strengthen enforcement (EU IMPEL network).
- Compliance promotion to ensure awareness among polluters and waste management actors (Norway).
- Risk-based approach to inspections, targeting activities where there is a higher risk of non-compliance to ensure efficient use of enforcement resources (Korea, Norway, Poland).
- Covenants with companies with strong compliance records to focus enforcement on high risk activities (Netherlands).
- Specialised units to investigate and prosecute major waste violations (Colombia, Norway).
- International co-ordination of enforcement bodies, particularly for waste shipments.

4.1. Regulatory instruments

Most OECD countries have a broad framework of regulations to govern key aspects of waste management. These include technical definitions for the main categories of waste, including hazardous waste, and requirements for waste handling and treatment to ensure safety and environmental protection. The OECD Council Recommendation on the Environmentally Sound Management of Waste sets out aspects that waste regulatory frameworks should take into account to ensure environmentally sound waste management (Box 4.2). It includes a list of core performance elements to be in place in waste management facilities such as environmental management systems, occupational health, staff training and plans for closure and after-care. Some key elements of this Recommendation that are specifically relevant to regulatory instruments are summarised below.

Box 4.2. OECD Council Recommendation on the Environmentally Sound Management of Waste

The OECD Recommendation C(2004)100 sets out a number of elements that may be necessary in a country's regulatory framework to ensure the environmentally sound and economically efficient management of waste. These include:

- An adequate regulatory and enforcement infrastructure at an appropriate governmental level, consisting of legal requirements such as authorisations/licences/permits, or standards.
- Practices and instruments that facilitate the efforts of competent authorities to monitor the performance of facilities in line with core performance elements (CPEs), control waste management activities and carry out enforcement activities. Facilities that meet fulfil these CPEs may be provided with incentives or relief measures.
- Ensuring that waste management facilities are operating according to best available techniques and continually improving environmental performance.
- An environmental liability regime for facilities that carry out risky or potentially risky activities to ensure adequate measures upon definite cessation of activities and to prevent environmental damage.

OECD countries that joined the EU in 2004 experienced significant changes to the regulatory framework through their accession to the EU environmental acquis. These countries were required to transpose the Landfill Directive (1991/31/EC as amended), whose rules cover controls to protect water and soil near landfills, gas controls to reduce methane emissions, and closure requirements to ensure ongoing protection after operations end: for many of the new EU Member States, this directive brought major changes in their regulatory frameworks. The Environmental Performance Reviews of the Czech Republic, Estonia, Hungary, Poland and Slovenia highlighted these countries' efforts to put in place these standards, including the proper closure of many landfills that did not meet them, including those for MSW (Box 4.3). This challenge is also faced by countries outside the European Union who are seeking to strengthen their regulatory frameworks for waste management. For example, in Colombia, where there are challenges in ensuring significant landfill capacity, there are concerns about the environmental safety of existing landfills, with the Environmental Performance Review reporting that 30% of landfills in the country do not meet environmental standards. Regulatory measures taken in 2005 and new technical standards in 2012 have sought to address this problem.

Box 4.3. Closing substandard landfills in the new EU Member States

Several Environmental Performance Reviews report progress of OECD countries that joined the EU in meeting landfill requirements. In Slovenia, eight public landfills for MSW out of 60 met the EU requirements in 2010, 28 were in the process of upgrading the remainder were closed. In Poland, the 2003 Environmental Performance Review highlighted this issue; the original target date of 2007 had to be extended by five years: the 2015 review reported that all landfills not meeting EU standards had been closed. In Estonia, the last of about 150 small landfills for MSW were closed to meet these requirements, and five new landfills had been constructed.

Further rules may affect the siting of waste treatment facilities. In Colombia, as in many OECD countries, facilities are not allowed in protected areas. For OECD countries in the European Union, the Landfill Directive sets requirements for the location of these facilities, their safe operation and their closure. Israel improved environmental and sanitary standards for landfills in the review period; the Environmental Performance Review called for further strengthening of these requirements.

In line with the OECD Council Recommendation on the Environmentally Sound Management of Waste, OECD countries also set rules for waste service operators, such as companies handling and treating hazardous waste. In Japan, regional prefectures as well as large cities license and regulate waste management companies in their territories. Colombia created a register of hazardous waste operators.

Several OECD countries have established bans on landfilling, either for specific waste streams or more broadly for MSW, as part of efforts to improve recycling and recovery. The European Union, for example, has banned the landfilling of *tyres* and *waste batteries* and *accumulators* (whose incineration moreover is also banned). Israel envisaged a ban on landfilling tyres starting in 2013, and also planned a 2020 ban on landfilling of *packaging waste*.

Korea has worked to reduce and recycle *food waste*: among the policy instruments, it introduced a ban on direct landfilling of food waste in 2005 (followed by a 2012 ban on dumping of all organic waste at sea); this ban was accompanied by voluntary agreements with industry, awareness raising and other actions to address food waste. In 2009, Norway has banned landfilling of all *biodegradable waste* with a total organic carbon content above 10%; this built on previous bans of certain types of organic waste, starting in 1992. Despite the 2009 ban, at the time of the Environmental Performance Review about 40% of biodegradable waste received exemptions as alternative treatment facilities were still under development.

Among the countries with broad-based landfill bans, the Netherlands in 1995 banned the landfilling of 35 categories of waste, in particular waste streams that could be recycled or recovered for energy, except in locations that lacked alternative treatment facilities; this was accompanied by a landfill tax, to encourage construction of recycling and incineration plants. In the year prior to the landfill bans, national rules required separate collection for household organic waste. The Czech Republic will ban the landfilling of unsorted mixed municipal waste and recoverable waste from 2024, and require the separate collection of glass, paper, plastic, metal and biodegradable waste in all municipalities.

OECD countries have used a range of other regulatory instruments for waste management. Some, such as Korea, have required separate collection of household and municipal waste to promote recycling. EU legislation calls for the pre-treatment of all waste going to landfills.[1] In Israel, quarries are required to accept construction and demolition waste, in proportion to their production levels.

In addition to legal standards and OECD work, international standards in areas such as environmental management and occupational health and safety can help to ensure proper operation of waste facilities. In Israel, for example, the state-owned companies operating the country's main hazardous waste disposal facilities complies with several of the standards developed by the International Standards Organisation (ISO).

Finally, product standards can play a role in encouraging the shift to a circular economy. EU legislation on end-of-life vehicles, for example, bans the use of several hazardous materials in automobiles (lead, mercury, cadmium and chromium), to improve their recyclability. The Environmental Performance Review of the Netherlands called on the government to consider a range of policy instruments to support the circular economy, including minimum quality standards and legal requirements on the reparability of products. In most cases, this is an area under development: it may be a valuable topic for future Environmental Performance Reviews.

4.2. Economic instruments

Economic instruments can be an effective policy tool in the prevention, minimisation and sound management of waste. Fees and charges are economic instruments that can be used to recover the costs of waste management and support the principle of user pays, helping to ensure the financial sustainability of waste management services. Economic instruments such as taxes and extended producer responsibilities support the principle of polluter pays by internalising environmental and human health costs. This is in line with OECD recommendations on environmentally sound waste management, which recommend that OECD countries seek the "internalisation of environmental and human health costs in waste management" (OECD, 2004). Finally, economic instruments can be useful in encouraging the behaviour changes (for example, waste reduction or investment in improved waste treatment technology) necessary to achieve waste policy objectives. A typology of economic instruments that may be used in waste management policy is based on the OECD's database on Policy Instruments for the Environment (OECD, 2017a) (Box 4.4).

Other economic instruments used in waste management policy might include greenhouse gas emissions trading schemes for emissions from landfills and incineration facilities, financial reserves for remediation of former landfills, or feed-in tariffs for the generation of electricity from waste incineration.

Often these measures allow for the collection of revenue. How this revenue is used can be important in setting the right incentives for waste reduction and responsible waste management.

Box 4.4. Key types of economic instruments for waste management and circular economy

- **Taxes** increase the cost of polluting products or activities, and thereby discourage their consumption or production. In waste policy, they are used to internalise the environmental costs of waste treatment and disposal, making more environmentally harmful treatment methods more costly and creating incentives to use alternative treatment methods such as recovery and recycling, such as landfill and incineration taxes. In policies supporting a circular economy, taxes may be used to discourage the consumption of natural resources, including biological resources, minerals and raw materials.
- **Fees and charges** are used to recover the costs of providing goods or services. Unlike taxes, fees and charges are a requited payment, meaning that the person paying gets something in return in proportion to the payment, whereas taxes are unrequited payments. In waste management this may include items such as municipal waste service charges or landfill gate fees.
- **Deposit-refund systems** place a surcharge on the price of a product likely to pollute the environment. In waste management, this may include measures used to internalise the environmental costs of end-of-life products, such as product levies, advanced recycling fees and extended producer responsibility measures (the latter are covered under Section 4.3).
- **Subsidies** can be used in environmental policy to directly or indirectly reduce the use of something that has a proven, negative effect on the environment. In waste management, subsidies may be used to encourage better waste management, waste reduction and investments in improved waste management, and may take the form of direct subsidies or tax exemptions.
- **Tradable permit schemes** can be used to allocate emission or resource exploitation rights. In waste management. There is some use of such measures in waste policy, for example, the United Kingdom's Landfill Allowance Trading Scheme. They may also be used to support circular economy objectives by discouraging the over-exploitation of natural resources, for example, in fisheries management.

4.2.1. Municipal waste service charges and cost recovery

With most households in OECD countries paying a charge for the collection and transport of MSW, municipal waste service charges are one of the most commonly employed economic instruments in waste management. Effectively setting these charges so that they cover the costs of service delivery is challenging for authorities. As noted in the Korea performance review, fee-setting requires the balancing of multiple objectives: the polluter pays principle; the cost-effectiveness of waste management systems; and the need to keep fees for essential public services at socially acceptable level.

Authorities apply a number of different methods in calculating MSW charges (Box 4.5), and these methods may vary from municipality to municipality within the same country. Often, municipalities set these charges themselves. Guidance on how fees should be set may be provided in legislation or in a methodology prepared by national authorities. Fee-setting methods are often based on volume of waste generated, the size of the household, either in terms of area or number of residents, or set according to another variable (for example, household water consumption, as seen in Poland).

Box 4.5. Fee-setting arrangements for MSW services

Colombia	Sanitation fees set according to detailed national methodology, with each household in the same service area and same socio-economic category pays the same fee, with cross-subsidies according to socio-economic categories (*estratos*).
Czech Republic	Municipalities have three options for setting fees: pay-as-you-throw; annual fee based on household size; or a contractual fee. Around 15% of municipalities use the pay-as-you-throw option.
Estonia	Estonian households pay waste service companies directly for MSW services.
Hungary	Fees are set centrally by the national authority according to a national standard. The method does not guarantee full cost recovery and may result in cross-subsidisation between municipalities.
Israel	Fees are set according to the size of a household or business. The fee is included in municipal property taxes. However, the waste portion of the tax is not identified and does not cover the full cost of collection and treatment.
Japan	Just over half of Japanese municipalities charge for MSW services; however, the performance review does not describe how these fees are set.
Korea	A volume-based waste fee system applies to the collection of mixed household waste and, since 2010, food waste. Separate collection of recyclable waste is free.
Netherlands	Almost all municipalities impose a MSW fee, which may be a fixed amount, set according to the size of the household, or based on the volume of waste (diftar, or differentiated tariff). In 2013, 53% of municipalities used a levy based on the household size, 40% used diftar systems and only 7% charged the same rates to each household.
Norway	Fees vary according to the costs of service delivery in a community, with only limited progress in differentiating fees according to the amount of waste generated.
Poland	Municipalities can choose between three nationally determined approaches – fees can be set per head; by area of home; or on the basis of water consumption. Fees are lower for households that separate waste.
Slovenia	At the time of the performance review, the national environmental authority was preparing a methodology for setting fees, and municipalities use various approaches to setting fees, for example, per capita, or by volume.

Volume-based charges integrate the polluter pays principle into municipal waste management, and create an incentive to reduce waste generation and increase the pre-collection separation of recyclables. Volume-based charges can be seen in some

municipalities in the Netherlands (Box 4.6), the Czech Republic and in most administrative districts in Korea (Box 4.7).

Box 4.6. The Netherlands diftar scheme

In the Netherlands, municipalities have responsibility for setting MSW fees, with the fee-setting approach varying across the country. Fees can be a fixed amount, set according to the size of the household, or based on the volume of waste (the diftar scheme). In 2013, 53% of municipalities used a levy based on the household size, 40% used the diftar approach and only 7% charged the same rates to each household. Use of the diftar system has expanded steadily, up from only 13% of municipalities in 1998. Municipalities use a number of different approaches in calculating the differentiated tariff, with the size of waste bins, the frequency of collection or the amount of unsorted waste often providing the basis for fee setting.

The performance review suggests that the diftar approach has been more efficient and more environmentally effective, with separate collection much higher in areas where a diftar is in place (60%, compared to as low as 7% in areas where a different fee setting approach is used).

Box 4.7. Volume-based waste fee, Korea

Korea applies a volume-based waste fee to the collection mixed household waste and, since 2010, food waste. Combined with free collection of separated waste, this system has been instrumental in reducing waste generation and landfilling, with landfill rates decreasing to 15% in 2015, and recovery rates reaching 59%.

- Sophisticated methods are available to administering authorities (local administrative districts) for the calculation of fees.
- A system based on radio frequency identification-based billing, which uses electronic tags to record the collection of waste containers and calculate the fee according to weight.
- A payment chip or sticker, attached to waste containers.
- A designated garbage bag system – the most common system – where the management fee is included in the price of disposal bags used by generators. The fee for the bags can be adjusted by local governments according to local circumstances.

However, the fee-level is relatively low and may be losing its incentive effective. Efforts to increase the fee in 2008 were unsuccessful, due to a reluctance to increase household costs during the recession. Concerns about the continued effectiveness of the scheme suggest a need for ongoing improvement efforts and progressive increases to the fee amount.

While, there is considered to be a risk that volume-based charges may induce illegal waste dumping (OECD, 2007); no evidence of such an effect was found in the Environmental Performance Reviews for countries where they were in place. While illegal dumping is a

concern in Korea, it was reported to be declining in recent years despite the introduction of a volume-based fee system. Israel has been exploring the possibility of introducing volume-based fees, as recommended in the Performance Review of 2011. OECD Environmental Performance Reviews have also suggested the adoption of incentive pricing for municipal waste management in France.

Recovery of the costs of managing municipal waste is considered important in two respects. First, it assists in ensuring the financial sustainability of municipal waste management activities. Secondly, it supports the polluter pays principle by ensuring that waste management costs are borne by those who are responsible for generating waste. Setting the appropriate fee is not easy – authorities may exhibit reluctance to set fees too high due to political concerns. In addition, accurate or complete data on the full costs of waste services may be difficult to obtain.

Full recovery of MSW management costs was rare in the countries reviewed, with only the Netherlands and Norway reporting almost full cost recovery. While not all countries reported the level of cost recovery; the performance reviews that did include this information suggest low levels of cost recovery, with Israel recovering around 10% of MSW management costs, around one-third of costs in Korea, and on average 70% of costs in Czech Republic. In some countries, the government has included a goal of full recovery of waste management costs in policy (Colombia, Slovenia) or legislation (the Czech Republic, Norway, Poland). Nonetheless, in most countries, costs were not fully recovered and MSW management costs were subsidised by other areas of the municipal budget, transfers from the central government budget or other sources, such as EU funds, development assistance. These sources of funding tend to be used for capital investments and institutional capacity building. The performance reviews for Japan and Israel recommended that MSW charges be used to improve the rate of cost recovery.

It is often municipal authorities that are tasked with setting and collecting MSW fees, often in the face of significant challenges. While this arrangement can help to ensure that fees are set at levels that reflect local waste management costs, municipalities may lack experience in setting fees, they may not have a strong information basis for fee-setting, or they may struggle to set fees at a socially acceptable level while also covering the costs of service delivery. In other cases, legal arrangements may mean that municipalities may lack the autonomy to set fees at a level sufficient to recover costs.

The challenges of fee-setting at the municipal level was seen in Poland and Slovenia, where national authorities were required to support municipalities when fee-setting functions were delegated to municipal authorities.

In Poland, following the 2013 reforms to municipal waste management, municipalities were tasked with setting and collecting fees from households and small businesses for municipal waste services. In this case, fee setting was particularly challenging, as the situation prior to the reforms was based on households directly contracting with companies for waste services, meaning there was no historical data to work with. Fees varied significantly between municipalities, and with some city councils reluctant to set high fees, it is likely that fees do not address the full costs of services. The Polish environment ministry undertook a number of capacity building actions and waste revenue was used to provide training to municipalities via the National Fund for Environment Protection. The Polish performance review also recommended that Poland establish a mechanism to support and monitor municipalities in their waste management roles, particularly in tariff-setting.

In Slovenia, the transfer of pricing responsibility to local communities in 2009 led to a substantial increase in fees with no consistency in how fees are set. In Slovenia, at the time of the review, national authorities were preparing a fee-setting methodology to support municipalities.

Often authorities do not set fees that are high enough to fully recover costs due to concerns about the social and political acceptability of increasing MSW fees. As noted in Box 4.7, such concerns have prevented Korea from increasing fees. Consequently, the performance review for Korea recommends that the volume-based waste fee be progressively increased to ensure greater cost recovery. In Colombia, a highly defined system for water and sanitation charges is in place, whereby households in higher socio-economic categories subsidise the water and sanitation costs of households in lower socio-economic categories. This may support an equitable approach to pricing, but undermines the incentive effect of MSW fees, as the volume of waste generated is not a factor in the prices paid by individual households. Furthermore, the fee is too low to achieve cost recovery. In recent years, the Colombian Government has taken measures to progressively refine the fee-setting approach to support better cost recovery and provide incentives for waste reduction and separation.

Central government involvement in fee-setting and payment of contractors can help to improve consistency in fees and improve oversight of waste operations; however, it may also undermine the principles of cost recovery and polluter pays. In Slovenia and Israel, local authorities require central authority approval for changes to MSW fees. In Israel, this was reported to be a barrier to full cost recovery. This suggests that there is a need for countries to balance ensuring autonomy for local authorities in setting fees according to local waste management costs with the need to support the capacity of municipalities in fee-setting. In Hungary, fee-setting and contractor payment functions were recentralised in 2016 to address wide discrepancies in fees across different municipalities. However, the Environmental Performance Review noted that this has the potential to undermine the ability of municipalities to recover the full costs of MSW management. The national standardisation of fees may result in cross-subsidisation of MSW services between municipalities, undermining the polluter pays principle. The performance review noted the need for an evaluation of the new system to optimise institutional arrangement and ensure cost recovery.

In cases where municipalities find it challenging to set fees at a level that ensures cost recovery, or struggle to contain cost growth, an improved understanding of costs may help authorities to manage costs and set fees at an appropriate level. This was noted in France, where waste management expenditure has increased despite waste generation levels remaining relatively stable. This was found to be due in part to improved management methods, but insufficient control over the costs of collection and treatment were also a factor. The Environmental Performance Review noted that the French environmental agency had developed a reference framework for waste management costs. The review recommended that this framework should be incorporated into a cost accounting system for waste and the development of cost tracking indicators for annual municipal waste management reports.

4.2.2. Taxes on waste treatment and disposal

Taxes on waste treatment and disposal can be used to internalise the environmental costs of waste treatment, and help in diverting waste away from the most harmful treatment methods (landfill, incineration without energy recovery) by making these methods more

costly. With the exception of Colombia, the performance reviews for all focus countries reported that taxes were in place for waste treatment and disposal. These taxes tend to cover landfilling, with some countries also taxing waste incineration (Box 4.8).

Box 4.8. Disposal taxes in the focus countries

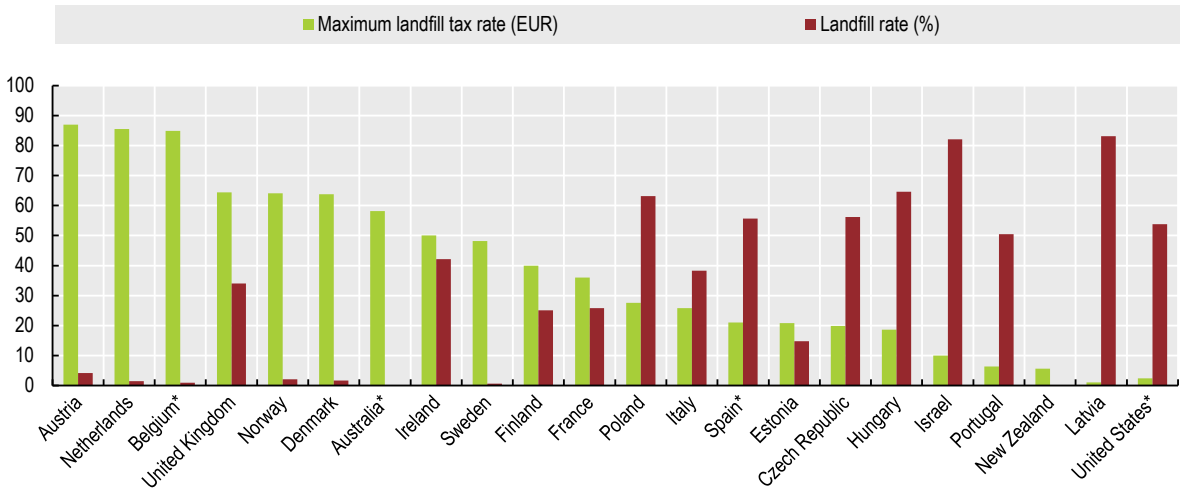
Czech Republic	A landfill tax applies, with a low tax applied to general waste and a significantly higher tax imposed on hazardous waste.
Estonia	Waste disposal tax applied to landfilled waste, calculated according to the hazard level.
Hungary	Tax is applied to landfill of MSW and industrial waste.
Israel	Levy applied to landfilled waste, calculated according to the type of waste.
Japan	A landfill tax on industrial waste is applied in 27 (of 47) prefectures, and one city.
Korea	Currently local authorities can impose a charge on landfilling to cover operational costs and post-closure costs. The new Framework Act on Resource Circulation will apply a disposal tax to waste that is landfilled or incinerated without energy recovery.
Netherlands	Disposal tax applied to landfilling and incineration of waste, calculated according to the treatment method and type of waste.
Norway	Final disposal tax was applied to incineration[2] and landfilling of waste, with taxes differentiated according to the environmental harm.
Poland	Tax applied to landfilling of waste.
Slovenia	Tax applied to landfilling of waste.

In some countries, the Environmental Performance Reviews found that the taxes had been effective in diverting waste away from landfill (Figure 4.1). In Estonia, it was noted that the waste disposal tax had made other treatment options more competitive and resulted in a significant decline in landfilling. Similarly, in Norway, landfilling declined following the introduction of the final disposal tax. Nonetheless, taxes were often set too low to fully incentivise recovery and recycling. This was noted in relation to the tax rate for incineration in the Netherlands, and in relation to the landfill taxes in the Czech Republic,[3] Hungary, Poland and Slovenia. Data from the OECD's recent *Green Growth Indicators* study (OECD, 2017c), presented in the figure below, suggests a link between higher landfill taxes and lower landfilling rates.

Incineration taxes may be based on the nature and volume of the waste incinerated (the Netherlands) or the emissions from the waste (Norway, prior to its abolition in 2010). The performance review for the Netherlands recommended the government consider an emission-based tax, noting that this approach would more effectively provide incentives to incinerators to reduce the emissions from their facilities.

Figure 4.1. Countries with high landfill taxes tend to have low landfill rates

Municipal waste landfilling and tax rates, 2013



Note: Tax rates refer to Flanders for Belgium, to Catalonia for Spain, and to New Jersey, North Carolina, Mississippi and Indiana for the United States.
Source: OECD, Municipal waste landfilling and tax rates, 2013, Green Growth Indicators, 2017.

StatLink https://doi.org/10.1787/888933976042

Box 4.9. The final disposal tax in Norway

Norway introduced a final disposal tax for the landfill and incineration of waste in 1999. Reduced tax rates are applied to incineration with energy recovery and landfills with good environmental practices. Hazardous wastes were initially exempted from final disposal tax to avoid incentives for illegal treatment.

Following a 2003 review that suggested that incineration tax rates did not effectively cover the full environmental costs of emissions from incineration, the incineration tax was based on emissions, rather than amount of energy recovered.

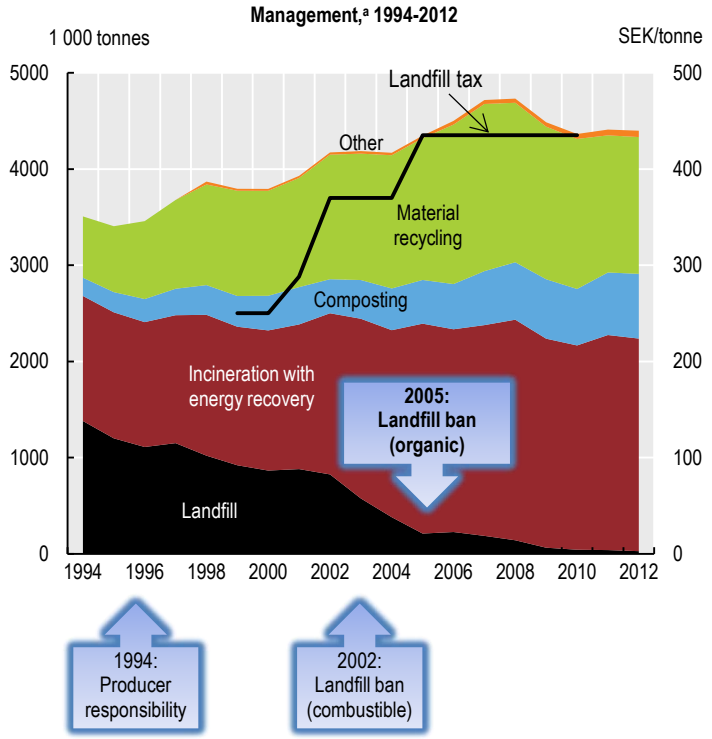
The Norway performance review reported that the tax has decreased the amount of waste landfilled and led to a reduction of emissions from incinerations. Nonetheless, the incineration tax was abolished in 2010 due to increasing exports of waste to Sweden for incineration, where taxes were not in place.

Differentiation in taxes based on a risk assessment of the waste was seen in most countries. Some countries further differentiated taxes according to the environmental impacts of the treatment method. For example, in Korea, under the new legal framework, taxes will be highest for landfilling of waste and incineration of waste without energy recovery. Such differentiation helps ensure that the taxes more accurately internalise the environmental costs of waste and set the right incentives for waste treatment. Nonetheless, some countries choose to fully or partially exempt particularly hazardous forms of waste from final disposal charges to ensure that it is not disposed of illegally in unsafe sites. This was seen in Norway (Box 4.9), where hazardous waste was initially exempt from the final disposal

tax, and in Estonia, where asbestos is subject to a lower tax rate. As waste disposal taxes are specifically focused on internalisation of the environmental costs of disposal and to create incentives to divert waste away from more environmentally harmful treatment methods, they are often imposed in conjunction with other fees, such as landfill gate fees that aim to recover the immediate costs of disposal. In some cases, landfill prices aim to cover both aspects, but will need to be based on a sound understanding of both the environmental costs of waste disposal and the costs of providing treatment services. This challenge is seen with the landfill levy in Israel, which aims to both cover the costs of providing landfill services and internalise the environmental costs of landfilling. However, at the time of the performance review, it was set too low to recover disposal costs much less any broader environmental costs.

Figure 4.2. The policy mix of landfill tax and landfill bans was effective in diverting municipal waste from landfills in Sweden

Treatment of MSW, Sweden, 1994-2012



Note: a) Waste collected by or for municipalities, including household, bulky and commercial waste, and similar waste handled at the same facilities. Includes hazardous waste from households (i.e. impregnated wood and asbestos), b) At constant 2005 prices.
Source: Avfall Sverige (2013), Swedish Waste Management; OECD (2014), OECD Environment Statistics (database).

StatLink https://doi.org/10.1787/888933976251

The Environmental Performance Review for Sweden provides an example of how economic instruments can be used as part of a broader policy mix to achieve waste policy goals. The introduction of producer responsibility in 1994 appears to have supported a shift away from landfilling. From 2000 landfill taxes were combined with regulatory instruments

– in this case, bans on the landfilling of combustible and organic materials – to reduce the landfilling of waste to less than 1% of municipal waste treatment by 2012 (Figure 4.2).

It should be noted that the imposition of taxes on individual waste treatment methods can create the potential for perverse outcomes. The contribution of landfill taxes to overinvestment, and resulting overcapacity, in other treatment methods, particularly incineration and Mechanical biological treatment (MBT), was reported in Estonia. Similar challenges were reported in the Netherlands and a future risk of locking-in incineration waste noted in the Czech Republic. While these methods may be less environmentally harmful than landfilling, an overemphasis on MBT and/or incineration (even with energy recovery) can mean that opportunities to improve recycling and resource recovery are missed. This suggests that when costs are internalised into waste treatment methods, there is a need to ensure that the pricing of all treatment methods is considered at the same time.

To be fully effective in internalising costs, and shifting incentives, disposal taxes should be passed on to waste generators, including generators of municipal waste. In Israel, it was reported that municipalities have been unable to pass on landfill levy costs due to the requirement to obtain central government authorisation for fee increases and concerns about the social acceptability of such increases. In other countries, disposal taxes are not applied to mixed domestic waste, which limits the potential to internalise environmental costs into MSW fees.

4.2.3. Incentives, subsidies and product fees

Governments frequently use incentives and subsidies to induce certain behaviours among firms and households. In particular, subsidies and tax exemptions are often used to promote investment in improved waste management infrastructure (discussed in further detail in Chapter 5). A number of countries also used product taxes and advanced disposal fees as a part of EPR schemes (discussed in further detail in Section 4.3).

Other incentives reported in the performance reviews included measures taken by (usually national) governments to encourage certain practices at other levels of government. These include financial payments to municipalities and treatment facilities that improve the efficiency of waste treatment (Colombia), subsidies for prefectures that implement a waste management plan (Japan), and the payment of "host fees" to local authorities that agree to host a landfill in their municipality, calculated per tonne of waste disposed of at the landfill (Israel).

Other incentives include payments to firms or households to encourage recycling and sound waste management practices. These include preferential interest rates for firms from the national development bank according to the firm's environmental rating, which included waste management practices as a factor (Japan), subsidies for home composting in the form of reduced waste collection charges or reduced-price compost bins (Norway), and the consideration of cash incentives for households who recycle waste in cities with particularly low recycling rates (the Netherlands). Spain introduced a deposit fee system for construction and demolition waste.

Product fees are a further economic instrument that may be used in waste management to shift incentives away from products that are more likely to result in environmental damage, such as increased waste. These can be seen in Hungary, where environmental product fees are applied to a number of products including tyres and single-use plastic bags. The performance review noted that these fees have been important in reducing the use of plastic bags. However, there is a risk that these fees can be used as revenue-raising instruments

without environmental benefits. This was also observed in the performance review for Hungary, where it was noted that the recent extension of the fees to new product categories, such as photovoltaic panels, may undermine environmental objectives. It was also noted that a relatively limited portion of revenue from product fees (between 22% and 31%) is used for end-of-life product management costs.

4.2.4. Resource taxes

Resource taxes can support the objectives of a circular economy by encouraging more efficient resource use. Where rates are low, however, these taxes will mainly have a revenue-raising function.

In Colombia, natural resource royalties are levied on oil and mining as a percentage of production. The Environmental Performance Review observes that the overall tax on minerals is low, relative to other countries, and that taxes could be raised and focus more on profits, rather than production. In Estonia, mining companies pay a tax for the extraction and use of resources. Given the size of the oil shale industry in Estonia, this potentially amounts to a significant source of revenue; however, the Environmental Performance Review noted that a methodology for setting taxes on the estimated value of resources was in place, and taxes had recently been reduced significantly to assist the industry in light of lower oil prices. These factors could undermine the effectiveness of the resource tax in promoting resource efficiency. Similarly, in Hungary, a mining fee applies to the extraction of virgin construction material, but was not implemented for environmental purposes and is set too low to promote the use of recycled materials. In Norway, oil and gas extraction and hydropower production are subject to resource rent taxes, in addition to ordinary company taxes. This amounts to a relatively high marginal tax rate (78%) for oil and gas production, which is taxed at a higher rate than hydropower production.

The Environmental Performance Reviews recommendations highlight opportunities to increase the use of resource taxes to promote resource efficiency. In Poland, where a mineral extraction fee for copper ore is already in place, the review recommended assessment of economic instruments to enhance material productivity, including strengthening the incentive effect of taxes on the extraction of minerals and aggregates. Similarly, in Slovenia, the review recommended that a tax on the use of primary aggregates be considered as a means for improving the recovery and recycling of construction and demolition waste. Tax breaks and subsidies may undermine the effectiveness of resource taxes, as noted in the performance reviews for Colombia and Israel. It is also important to maintain the incentive function of resource taxes, as noted in the Performance Review for Sweden, where the tax rate for virgin aggregates (natural gravel, which is scarce in much Sweden) has been progressively raised to encourage use of substitutes.

4.2.5. Revenue use

While MSW fees tend to be used to fund ongoing service provision, countries take differing approaches in how they use the revenue from waste disposal taxes, resource taxes and other waste-related taxes (e.g. advanced disposal fees). These taxes can be absorbed into the government's central budget, which occurs in Norway. However, they are more often earmarked for investment in waste management. Landfill taxes are often used for managing the post-closure costs of landfills (Korea, the Netherlands) or municipal waste management costs (Estonia, Israel, Slovenia). Often some revenue is directed to a specific environmental fund or centre that carries out or funds projects related to waste management (Estonia, Israel, Poland, Korea).

Earmarking revenue for waste management can create complications. As noted in the performance review for Israel, there is a risk that earmarking of revenue creates dependency on funds from harmful activities and locks-in inefficient spending commitments. For example, in Estonia, where municipalities are dependent on landfill taxes to fund their waste management activities, declining landfilling rates have resulted in significant budget shortfalls. Earmarking may also contribute to perverse incentives. For example, in Slovenia, until 2010 municipalities were able to avoid paying disposal taxes by directing an equivalent amount to capital investments. This undermined the disincentive effect of the landfill tax, and could become a source of revenue for municipalities in the absence of strict oversight of how such funds were spent. This perverse incentive was abolished in 2010.

4.3. Extended producer responsibility

With the increased adoption of EPR schemes globally since 2001 (OECD, 2016), many OECD countries have now adopted EPR schemes. The OECD updated its guidance on EPR schemes for policy makers in 2016 (Box 4.10). The principle of EPR is focused on internalising some of the end-of-life costs of products, included waste management costs and environmental impacts, by extending producer responsibility to the end of a product's life-cycle. Typically, EPR schemes are established by legislation that makes producers responsible for the collection and final treatment of end-of-life products. EPRs typically represent a mix of policy instruments – take-back requirements, recycling targets, producer fees – that, collectively, make producers responsible for products at the end of their life. Depending on how the scheme is established, producers may be able to meet this responsibility by contributing financially through producer fees to these activities, or by taking over these activities. In many cases, producers can work collectively to collect and treat end-of-life products, for example, through a PRO. To ensure that EPR support decreased landfilling of waste, EPR schemes can include recycling targets and/or treatment requirements for end-of-life products. At their core, EPR schemes rely on producer fees, as well as penalties in cases of non-compliance, to extend responsibility to producers.

Box 4.10. Extended Producer Responsibility: OECD Guidance

In 2016, the OECD updated its 2001 guidance for policy-makers on developing EPR schemes, reflecting on the lessons learned from approximately 400 schemes now in place worldwide. The guidance notes the need for policy-makers to take into consideration the following aspects when developing and implementing EPR schemes:

- The **design and governance of EPR**, including: the need to periodically review and adjust policies; the important role of enforcement in mandatory schemes; the need for adequate and sustainable resourcing; the need to harmonise schemes to the extent possible; and the challenge of addressing free-riding.
- The need to address **competition policy issues in EPR schemes**, including the need to address collusion among producers and to consult competition authorities during the design phase of EPR systems.
- Providing **incentives for design for environment**, which may require ensuring producers' fees are closely linked to the actual end-of-life costs of products, for example, through weight-based rather than unit-based fees.
- The importance of **integrating informal workers in EPR systems**, particularly in emerging and developing countries. While challenging, it is important to

ensure that the role of the informal sector is taken into account in the design of EPR systems in emerging and developing countries.

4.3.1. Schemes in place in the focus countries

All focus countries had some type of EPR measures in place (Table 4.1). Consistent with the findings of previous studies (OECD, 2013), EPR measures tended to focus on a limited number of waste streams, with waste electronics, packaging waste and batteries featuring most prominently (each of these product categories were subject to EPR requirements in eight of the focus countries). Vehicles, used tyres, and used oil were also covered by EPR requirements in most of the focus countries. Other EPR measures targeted construction materials (Norway), pesticides (Colombia), and medicines (Colombia, Hungary).

In some cases, focus countries have led the development of EPR measures. For example, Norway became the first European country to implement a take-back scheme for waste electronic equipment in 1998. Norway also operates the world's only EPR measure for sulphur hexafluoride (SF_6). The waste streams targeted tended to focus on products where landfilling carries particularly high environmental risks and where there are a large number of consumers of the product, making collection challenging (for example, electronic waste, tyres). In some cases, EPR measures reflect national concerns about certain waste streams. Colombia's EPR measure for pesticides reflects concerns about hazardous waste from the agriculture sector.

There are a number of policy instruments that can be used to implement the principle of EPR. These include take-back requirements with recycling targets, or economic instruments, such as deposit-refund schemes or advanced recycling fees. While the policy instrument used for each EPR measure was not always identified in the Environmental Performance Reviews, take-back schemes seemed to be the most prevalent. Advanced deposit fees were also found in the focus countries (in Japan for packaging, vehicles and some appliances; in Korea for a number of small waste streams; and in the Netherlands for packaging and vehicles; in Slovenia for used vehicles and tyres).

Table 4.1. Coverage of EPR schemes, 11 focus countries

	WEEE[1]	Packaging waste[2]	Batteries	End-of-life vehicles	Used tyres	Used oil	Construction materials	Other
Colombia	✓		Partial[3]		✓			Pesticides; Medicines
Czech Republic	✓	✓	✓	✓	✓	✓		
Estonia	✓	✓	✓	✓	✓			Waste agricultural plastic
Hungary	✓	✓	✓	✓				Medicines
Israel		✓			✓			
Japan	✓[4]	✓	Partial[5]	✓			✓	Food
Korea	✓	✓	✓		✓			
Netherlands	✓	✓	✓	✓	✓	✓		
Norway	✓	✓	✓	✓	✓	✓	✓	HFCs, PFCs, SF_6, TRI, PER, PCB windows
Poland	✓	✓	✓	✓	✓	✓		
Slovenia	✓	✓	✓	✓	✓	✓		Medicines; graveside lanterns

Note: 1) Includes lighting and fluorescent lamps. Not all EPR schemes cover the full range of waste electrical and electronic equipment. 2) Includes beverage containers. All countries that had beverage container measures in place also had packaging measures in place. 3) Lead acid batteries only. 4) Covers a limited number of household appliances only: air conditioners, televisions, refrigerators, washing machines, clothes dryers. 5) Rechargeable batteries only.

Most measures involved at least one PRO, paid by responsible producers to collect waste and arrange for sorting, processing and recycling. In some cases, the legislation requires producers to join an accredited PRO (for example, Norway's Waste Electrical and Electronic Equipment [WEEE] scheme); in other schemes, PROs are set up to deal with small producers and orphan products (the Japanese home appliance scheme). In cases where there is a relatively small number of responsible producers and consumers, there may not be a need for a PRO to co-ordinate activities (for example, the agricultural plastic programme in Estonia). For some specific waste streams (packaging, industrial and automotive batteries, some WEEE) in Hungary, the government modified governance arrangements in 2012 so that PROs could no longer operate. Instead, producers could choose between joining a co-ordination system operated by the central government for a fee, and taking a self-compliance approach with a reduced fee. These changes were intended to facilitate improvements in waste management data and recycling rates. However, the performance review notes that fees collected under this approach are not specifically earmarked for EPR purposes and the incentives for producers to reduce the end-of-life costs of products are limited. The review identified a need to monitor these new arrangements to ensure that negative impacts, such as the directing of funds to other purposes, are avoided.

4.3.2. Challenges and lessons learned

A review of the focus countries reveals challenges and lessons for the implementation of EPR measures. In some cases, shortcomings in the EPR legislation itself undermine the success of EPR schemes. For example, in Colombia, the legislation establishes take-back requirements for producers and collection targets but not recycling targets. As a result,

waste collected under EPR programmes is accumulating with no legal requirement for its recycling.

Fee setting can also undermine the effectiveness of schemes. In Japan, where the producers have responsibility for end-of-life home appliances, the fee charged to consumers does not cover the full costs of collecting and recycling. This approach does partially extend producer responsibility, but the costs of recycling are not fully internalised in the product price. In 2008, it was estimated that only half of the household appliances disposed of were taken back. Similarly, in Slovenia, producers do not always bear the full costs associated with the collection of some products (for example, packaging), where municipalities collect the products. Changes in markets for recycled products can also make fee setting challenging (seen in the used tyre programmes in Estonia and Israel).

Certain conditions must also be in place to ensure the success of EPR measures. In Colombia, a key challenge is that the funding and infrastructure is not yet in place to support the recycling of accumulated waste. For some waste streams (for example, packaging), separate collection of household waste is an important precondition for success. This was seen in Poland, where MSW reforms in 2013 were a key factor in the improved performance of producer responsibility for packaging waste. Estonia and Slovenia currently face a similar challenge.

The co-ordination of the multiple actors involved in EPR measures can also be challenging. There is a need to co-ordinate the collection and recycling activities of municipalities and the actors involved in the product chain (brand owners, importers, manufacturers, retailers, etc.). There is also a need for co-ordination in relation to fee setting and collecting, contracting and payments, data collection, reporting to authorities, and communications with consumers.

Co-ordination challenges among the actors in EPR measures were seen in a number of countries. For example, in the Israel used tyres programme, insufficient co-ordination was reported between garages (who are responsible for collecting waste tyres from consumers) and importers and manufactures (responsible for collecting tyres from garages and recycling them). In the early years of the Dutch scheme for packaging materials, a large number of PROs covered separate waste streams, leading to high complexity for authorities and producers. Through the years, the system has evolved so that fewer PROs now operate, and charge producers directly under government supervision. In Korea, to reduce administrative costs, the government merged seven packaging waste PROs into one in 2013. In addition, Korea uses an advanced disposal fee for products that contain hazardous substances, are difficult to recycle, or are likely to cause management problems. In some cases, these products are later incorporated into an EPR scheme, but the advanced disposal fee is also used to internalise management costs for small waste streams for which a take-back programme would be too costly. Co-ordination of PROs remains a challenge in Estonia, while compliance with standards is a challenge in Poland.

An increased role for government authorities can assist in improving co-ordination. Alternatively, a clearinghouse organisation can be useful, as proposed in the performance review of Estonia. Such organisations can include: maintaining a register of responsible producers, setting fees in line with collection rates and costs of collection and processing, collecting data and preparing reports to authorities; a key task, however, can be to balance payments among multiple PROs collecting the same waste stream. Certification of PROs, as occurs in Norway, can help to ensure that they meet environmental standards.

Other challenges include waste leakage, where waste with an inherent value (for example, scrap metal in appliances, end-of-life vehicles) escapes the system, often through the informal recycling sector. While this is noted in the OECD guidance as a particular issue in emerging and developing countries, it is also a challenge in more developed economies, and was reported in the reviews for Japan, Slovenia, Poland and Estonia and also likely in Korea due to the large informal recycling sector. Such leakage is a problem, as goods with higher value are removed from the EPR scheme, leaving low quality waste leading to overall higher costs. Free rider problems often arise, particularly with the rise of online sales from small suppliers (reported in Estonia). While it is unlikely to address the challenges from online sales, the Czech Republic holds retailers and distributors responsible for take-back obligations when manufacturers or importers fail to meet their obligations. This provides retailers with a strong incentive to ensure that suppliers meet their obligations and the review reported that it had been an effective measure against free-riding. Other challenges include: low awareness among consumers (Slovenia); incomplete or inaccurate data collection impeding the ability to measure progress and make improvements (the Netherlands, Estonia); and local opposition to storage sites for end-of-life products (Israel). Sound legal frameworks and enforcement practices are necessary to overcome these challenges.

4.4. Green public purchasing

Government purchasing can encourage markets in recycled products, and more broadly as a key tool to promote the move to a circular economy. The power of public purchasing is recognised in the OECD Council Recommendation on Waste Paper Recovery, which called on member countries to contribute to building demand for recycled paper products by encouraging the use of recycled paper by government agencies. In Estonia, the National Reform Programme calls for resource efficiency considerations in public procurement, a direction supported by the Environmental Performance Review.

In Korea, national legislation requires government bodies to buy products that have received an environmental certification, when possible, in particular the Eco-Label or the Good Recycling mark. The Public Procurement Service has also identified products that meet a ‘minimum green standard’, based on life-cycle assessment. OECD called on Korea to extend its green public purchasing system, including through engagement with producers to develop green products for public sector needs as well as ensuring strict standards for certified products.

Public procurement in Norway must consider “resource implications and environmental consequences”. OECD’s Review encouraged Norway to go further and set targets for waste reduction in government bodies.

The central government in the Netherlands essentially reached a target for 100% sustainable procurement by 2010, though municipal and provincial authorities did not. At the time of the Review, the Netherlands was considering new methods such as circular procurement – ensuring that products are repairable and can be easily broken down into recyclable components at the end of the useable life; OECD encouraged the efforts to use of public procurement as a tool to promote the circular economy.

The Czech Republic effectively made green public procurement mandatory in 2010 for central and local authorities, with the Ministry of Environment monitoring procurement and publishing data annually. The country has since achieved 78% green procurement for ICT equipment and 56% for furniture. Despite this success, challenges in procurement

practices generally have hampered further progress green public procurement. A key challenge in green public procurement arises when there is an over-emphasis on price as a criterion in tendering procedures, and purchasing authorities lack the capacity to assess non-price criteria, such as the environmental credentials of products.

4.5. Public information and awareness raising

Public awareness and support are key factors in changing behaviour and thus for the success of many waste policies, including waste reduction and separate collection and recycling.

Educating young people can be a key path to raising public awareness. Several countries have established environmental education initiatives. Colombia's national government established a Communication and Environmental Agenda (2010-14) that fostered projects across all levels of schools. Israel has a Green Education Project and also provides grants for 'green schools' that promote resource efficiency and separate collection of waste streams. Korea's Environmental Education Master Plan created a network of environmental education centres.

In Poland, the national environment ministry has organised awareness campaigns: Poland's "Don't Litter Your Conscience" campaign used the character of a priest who told parishioners to separate recyclable waste and not burn household waste in their gardens or illegally dump it; another campaign encouraged the reuse of toys as a means to encourage resource efficiency. As fly tipping remained an important problem in Poland, the Environmental Performance Review encouraged further efforts, along the lines of campaigns in Ireland to address this issue. Similar campaigns and activities to address illegal dumping are carried out in Hungary, where the Ministry for Agriculture supports the "TsSzedd!" ("Pick up!") Campaign to raise awareness about sound waste management practices.

Some OECD countries work via local government. In Israel, for example, the Ministry of Environmental Protection funds municipal activities for environmental education and awareness raising, and the country's 2010 Recycling Action Plan acknowledges the need for further actions to raise public awareness and change behaviour towards separate collection.

Working with business, including PROs, can play an important role in fostering public awareness of recycling. In Korea, voluntary agreements with business include activities to raise public awareness on topics including waste reduction and recycling; the country's PROs spend between 1% to 5% of their proceeds for information and awareness campaigns (in these initiatives, Korea has responded to a recommendation in the previous, 2006 Environmental Performance Review). In Poland, PROs are required to allocate 5% of their profits each year on public awareness. In the Netherlands, PROs support awareness campaigns for separate collection and recycling. OECD's Review of Estonia found that consumer awareness of separate collection schemes, such as WEEE, was low: it called for PROs to take a larger role in supporting public awareness of separate collection and recycling.

Civil society organisations can also play an important role in promoting public awareness. In Estonia, "Let's do it! My Estonia" is an independently organised annual day of community activities, including litter clean-up. In Slovenia, about 200 000 volunteers worked together in 2010 for "Let's clean Slovenia in one day", a similar independent day to clean up litter and illegal waste sites, matched with environmental education activities. Colombia's Ministry of Environment and Sustainable Development teamed up with WWF

Colombia to establish the 'Soy ECOlombian' campaign, which included a "Let's clean Colombia" day in ten cities (Colombia limpia, 2018).

Public engagement is particularly important for the move to a circular economy. In Korea, the reduction of food waste has been a key objective: the government broadcast TV advertisements during national holidays and organised public contests to waste reduction methods. Japan has evoked the "mottainai" spirit, a simple lifestyle, to encourage household waste prevention in its 3Rs information campaign. Japan also established a quantitative target for public awareness in its First Fundamental Plan for Establishing a Sound Material Cycle Society: 90% of survey responded should be aware of and trying to put into practice waste reduction and recycling and the purchase of environmentally friendly products.

OECD's has highlighted that economic actors and the public are often not aware of economic benefits related to resource productivity, and this represents an obstacle in the move to a circular economy.

4.6. Monitoring and reporting

Effective monitoring and reporting is a key tool for effective waste management. In Colombia, for example, efforts to address waste issues are hampered by poor reporting in a range of areas, including non-hazardous industrial waste and construction and demolition waste – as well as waste and other environmental impacts from the country's small mines and illegal mines. In contrast, reforms have ensured effective reporting (and management) of the country's medical waste. The OECD Environmental Performance Review called for better enforcement of existing reporting requirements.

In the Czech Republic, the co-existence of two separate, inconsistent information systems for waste data has led to duplications, gaps and discrepancies in the information base. This has undermined the ability of authorities to monitor policy implementation, measure performance against targets and plan investments in waste treatment. The review highlights the importance of ensure consistent waste classifications, definitions, reporting boundaries and surveying methods.

In Slovenia, while reporting levels for most public waste services and industrial waste producers was strong, data on construction and demolition waste were poor, and the Environmental Performance Review called for better reporting and audits of the mass flows of waste from construction and demolition sites. Estonia strengthened several areas of monitoring, for example a requirement to weigh all waste arriving at landfills, a necessary step to implement the country's landfill tax. The review for Estonia identified remaining shortcomings, including reporting by EPR schemes, and it called on strengthened data and information systems to address these issues.

Reporting requirements can create an administrative burden for waste producers and operators, which needs to be weighed against the information benefit. In Colombia, generators of less than 1.2 tonnes of hazardous waste per year are not required to report; however, the Environmental Performance Review reported that this may miss up to half of the country's hazardous waste. Advanced information systems, such as Korea's Allbaro (Box 4.11), can provide detailed waste information and tracking.

Box 4.11. Allbaro: an advanced waste tracking system in Korea

The Korea Environment Corporation, a government body, manages an online waste information and management system, Allbaro, working with the Ministry of Environment, local governments and the Korea Coast Guard. Allbaro, originally established in 2001 to track hazardous waste, uses radio-frequency identification (RFID) to follow waste movements. The system also provides online preparation of official transfer documents. Most of the waste generated by businesses is covered by Allbaro. The performance review suggested that Korea combine Allbaro data with material flow data to monitor the circulation of materials and waste in the economy and better track and assess circular economy policies. The Review also suggested raising industry awareness of the economic and environmental benefits of the circular economy and resource efficiency, preparing guidance on design for environment and guidance to SMEs on waste minimisation.

Improved reporting can change the perspective on waste streams. In Norway, the amount of hazardous waste increased about two-thirds between 1995 and 2008: the main reason appears to have been better reporting (and collection) of waste streams. Effective information systems are a key tool for policy action. Poland has worked to develop a National Database on Products, Packaging and Waste Management, a project that was delayed at the time of the 2015 Environmental Performance Review, which called for its completion and for further efforts to improve the accuracy of underlying waste data.

Information and reporting is vital to track and implement policies that move towards the circular economy. The OECD Recommendations on Material Flows and Resource Productivity (2004 and 2008) note the importance of data on materials flows, both within and among countries. However, a 2014 OECD Progress Report noted that progress on strengthening this information basis has been limited: the lack of reliable data to target policies and measures and monitor their effects has been an obstacle (OECD, 2014b). Limitations in the information basis for circular economy basis can also be seen in the Environmental Performance Reviews. For example, in both Korea and the Czech Republic, it was noted that while macro-level material flow accounts are available, they are not linked to waste statistics, preventing insights into the impacts between material flows and waste streams and opportunities for improvements. It was similarly recommended in the review for the Netherlands that the authorities improve coherence between waste and material flow statistics.

On the other hand, the Environment Performance Review of Japan noted that this country has been a leader in studying material flows for the economy and use material flow accounts in government policy. The National Institute for Environmental Studies has linked material flows from micro to macro levels. A growing number of companies use eco-efficiency indicators to track their environmental performance. The government and companies work together on the development of these measures through the Japan Environmental Efficiency Forum.

The OECD's 2014 Progress Report also noted gaps in information on international flows of materials. The Environmental Performance Reviews for Japan noted the need to better assess trade-related material flows; since the 2010 review, Japan has funded further research by the National Institute for Environmental Studies to support trade-related flow and material flow analysis.

4.7. Enforcement and compliance promotion

A range of activities are needed to ensure that waste operators, businesses and households follow waste rules. These include enforcement actions, such as on-site inspections and sanctions for violators, as well as the broader range of compliance promotion activities to ensure that operators and polluters are aware of requirements (and related penalties); these activities can be linked to broader public awareness campaigns (see Section 4.5).

4.7.1. Enforcement bodies: co-ordination and capacity building

Enforcement of waste requirements is usually carried out alongside other types of environmental enforcement. In most OECD countries a range of authorities work on enforcement, including in the waste sector.

Co-ordination is needed across levels of government: in the Netherlands, for example, the national Human Environment and Transport Inspectorate works with provincial authorities, which license and enforce most waste management activities. In Poland, the Chief Inspectorate for Environmental Protection at national level is flanked by Voivodship Inspectorates at regional level. The 2015 Review noted that co-ordination had improved, but further efforts were needed in the country's multi-level enforcement system.

Several bodies may also be responsible for enforcement. In Israel, the Ministry of Environmental Protection has a force of 'Green Police', which works closely with the Environmental Unit of the Israel Police, in particular on enforcement, as the 'Green Police' lack the authority to arrest suspects; in addition, the Yahalom enforcement unit under the Nature and Parks Authority is responsible for enforcement of waste offences, in particular related to construction and demolition waste.

Enforcement bodies need adequate capacity to carry out their work. The Review of Israel, for example, said that inspectors needed further training and equipment to carry out multi-media inspections on their site visits. In Norway, the Environmental Performance Review highlighted the need to strengthen capacity for regional and local environmental authorities, including for enforcement work. In Poland, accession to the EU brought new waste requirements, increasing enforcement needs. Enforcement bodies in Poland and other EU Member States have participated in the IMPEL network, which has focused on strengthening enforcement: IMPEL has worked in several areas of waste management, and waste shipments have been a common area of work.

4.7.2. Compliance promotion

Alongside enforcement actions, compliance promotion can play an important role in raising the awareness of potential polluters. Norway's national Climate and Pollution Agency (KLIF) is responsible for enforcement and inspections; the agency has also carried out compliance promotion campaigns, for example informing SMEs about hazardous waste requirements.

In the Netherlands, an OECD country at the forefront of enforcement work, the national Inspectorate follows a policy of 'mutual trust' with organisations it supervises. The Inspectorate has established covenants with companies with a good compliance track record, and the government was exploring systems for private compliance assurance.

4.7.3. Facility inspections

Inspections of waste management facilities – along with waste management at industrial plants and other locations – are a core enforcement activity. OECD countries are increasingly using risk assessments to target inspection activities and resources. In Korea, for example, large incinerators are inspected more frequently than small ones. Poland introduced a risk-based approach in the review period. A leading example was seen in Norway, where the national Climate and Pollution Agency divides facilities into four, risk-based categories: these determine the frequency of inspections and their approaches.

A number of countries carry out unannounced spot checks, in particular for high-risk facilities: this is seen, for example, in Norway.

Some OECD countries have set overall priorities for inspection and enforcement: in Israel, illegal waste sites and illegal dumping were an environmental priority and a focus on enforcement actions. At the same time, the Review highlighted the need for further attention in this area.

4.7.4. Waste shipment inspections

Shipments of waste – and in particular of hazardous waste – are a key area for enforcement attention to ensure compliance with the Basel Convention and related OECD requirements, in particular to ensure proper control of exports to non-OECD countries.

Several OECD countries have raised the profile of waste shipment inspections and enforcement following prominent cases. A key one was the 2006 case of the *Probo Koala*, a Dutch-operated tanker that delivered waste sludge to Cote d'Ivoire: the case led to strengthened enforcement of waste shipments in both the Netherlands as well as Estonia, where the ship stopped on both its outbound and return journeys. In Japan as well, waste shipment cases highlighted a weakness of controls: here, the Environmental Performance Review concluded that further enforcement was needed alongside Japan's compliance promotion efforts, such as seminars for stakeholders and customs agents.

Good enforcement of waste shipment rules will require co-operation across government bodies. Poland, for example, strengthened inspections of these shipments – responding to the recommendation of a previous OECD Environmental Performance Review – by developed a co-ordinated system involving the national and regional environmental inspectorates, border guards, customs authorities, the Road Transport Inspectorate and the Rail Transport Office. In Norway, the national Climate and Pollution Agency improved co-operation with Norwegian Customs and Excise Directorate and the Maritime Directorate for greater inspections of waste shipments in ports and at border stations.

OECD countries are increasingly relying on risk-based approaches, as seen, for example, in the Netherlands. The risk-based approach – under which enforcement actions seek to identify and target high-risk shipments – can be vital for areas of high waste trade: in 2010, waste represented an estimated one-fifth of shipments by road from the Netherlands to Germany.

International co-operation has supported enforcement work: for example, the IMPEL network among EU countries has played a key role in strengthening enforcement of waste shipment rules.

4.7.5. Pursuing violations: violations and criminal charges

Even in OECD countries with advanced enforcement approaches, there can be gaps to address. In the Netherlands, the Court of Audit found that in a high share of cases of detected illegal shipments - about 30% - the prosecutor opted not to pursue waste shipment violations. Due to the country's open economy, waste shipments are frequent and illegal shipments are estimated to be numerous. The Environmental Performance Review called for reinforced efforts to address illegal waste trade, continuing the use of risk-based approaches.

Several countries have established specialised units to investigate and prosecute environmental crimes. In Colombia, the Attorney General's Office created a Prosecution Unit for Crimes against Natural Resources and the Environment in 2011, with 45 staff and five subnational sections: among its objectives is to address problems arising from illegal mining. Similarly, Norway created the *Økokrim* unit (Box 4.12).

Box 4.12. Norway's *Økokrim* unit

Norway's *Økokrim* (the National Authority for Investigation and Prosecution of Economic and Environmental Crime) is both a police unit and a prosecuting authority, with about 150 employees organised in multi-disciplinary teams. It supports police and enforcement agencies. Cases cited in the Environmental Performance Review included importers of electrical and electronic products that did not register with an approved recycling company and the illegal transport and dumping of industrial waste.

Notes

[1] This requirement was clarified (and, arguably, significantly strengthened) by the recent 'Malagrotta' ruling of the Court of Justice of the EU.

[2] Incineration tax abolished in 2010, after the completion of the Environmental Performance Review.

[3] The Czech Republic proposes to significantly increase landfill taxes from 2024.

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Chapter 5. Investment and financing mechanisms for waste management

The Environmental Performance Reviews have shown that government support through grants, loans, tax exemptions and other mechanisms are a key part of the overall policy mix for waste management. Moreover, governments are seeking effective financial mechanisms to support the move to a circular economy. Private and public waste operators as well as private companies also provide a key component of waste management financing. In the circular economy, investments by businesses will be a key factor. This chapter examines trends in waste management investments as well as investment and financing mechanisms for waste management in the 11 focus countries to identify good practices.

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

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Box 5.1. Examples of good practices in investment and financing mechanisms

Financing sources and mechanisms

- Following the guidelines in OECD's 2006 Recommendation on Public Environmental Expenditure Management, as well as the OECD's 2012 Principles on Public-Private Partnerships.
- Set out investment needs and expected financing mechanisms in waste management strategies and plans, integrating them in the overall policy mix (e.g. Poland).

Innovative financing to promote the circular economy

- Financing to provide incentives for pilot work on the circular economy (Japan).

Financing and other instruments to address contaminated sites

- Establish clear liability rules to ensure that polluters pay for site contamination (Japan, Korea).
- Prepare registers of potential contaminated sites and their severity (Israel).
- Focus public and private resources on priority sites, based on environmental and health objectives (Norway).

5.1. Trends in waste management investments

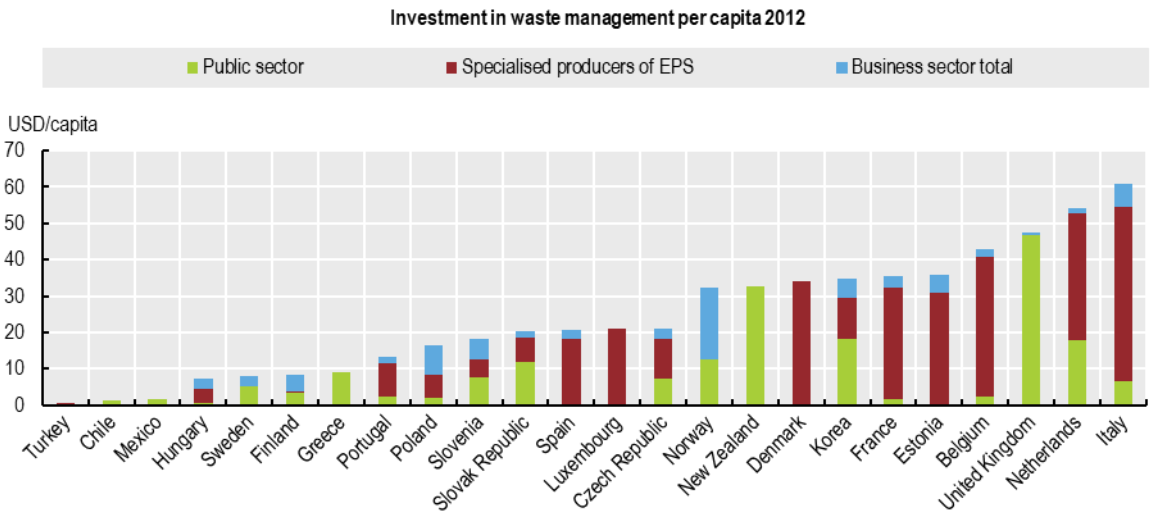
The level of investments for waste management varied significantly across OECD countries in 2012 – from under USD 50 per capita to over USD 200 per capita in Estonia, Korea, Slovenia and Netherlands. These investments are made by three main sectors: public, business and specialised producers – the latter includes public and private companies providing waste management services. The relative shares of these sectors vary significantly across countries: in Korea and Spain, for example, the public sector represented the largest share; for Estonia and France, it was specialised producers; and in Finland and Slovenia, the business sector (see Figure 5.1)

For most of the focus countries, investment levels by and large increased between 2000 and 2013 (Figure 5.2). The Netherlands and Slovenia saw declines in investment levels after 2007, and Estonia after 2008 (for Estonia and Slovenia, investment increased later in the period).

5.2. Financing sources and mechanisms

The Reviews have shown that governments have played a key role in many OECD countries by providing support for waste management investments. Governments have used several financing mechanisms, including grants, loans and tax exemptions that support investments made by business and specialised producers. The expenditure statistics shown in Figure 5.1 and Figure 5.2 indicate the point of investment and thus do not reflect financing mechanisms and their financial transfers.

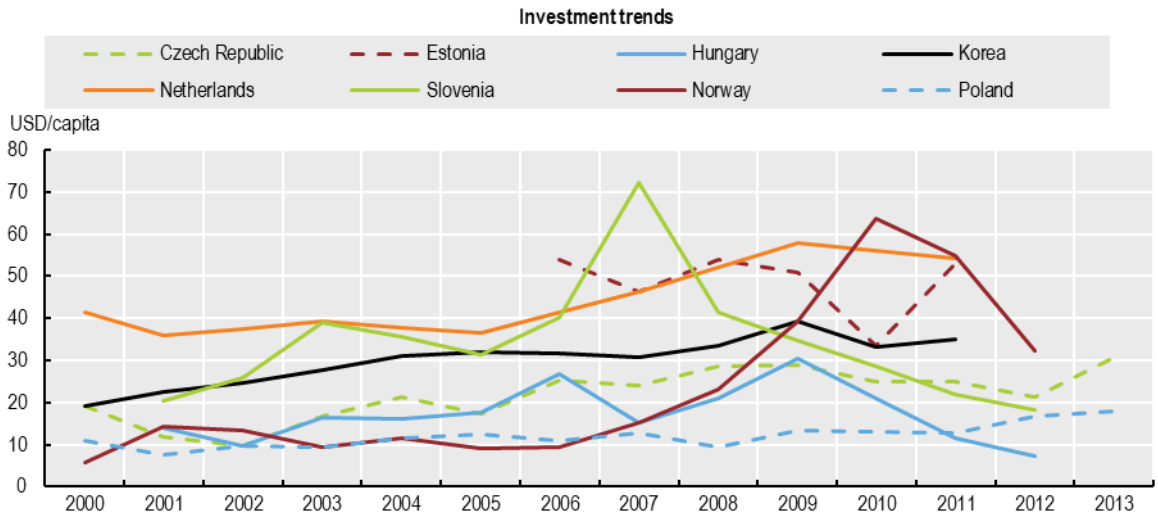
Figure 5.1. The sources and levels of investment in waste management vary across OECD countries



Note: Based on GDP at purchasing power parities. Partial reporting in some countries: for Greece, Israel and Mexico, only public sector reported. For Norway, only data on public sector and business sector total reported. 2011 data provided for Italy, Netherlands and Korea.
Source: OECD (2017), "Environmental protection expenditure and revenues", OECD Environment Statistics (database), http://dx.doi.org/10.1787/data-00694-en.

StatLink https://doi.org/10.1787/888933976270

Figure 5.2. Investment in waste management has increased since 2000



Source: OECD (2017), "Environmental protection expenditure and revenues", OECD Environment Statistics (database), http://dx.doi.org/10.1787/data-00694-en.

StatLink https://doi.org/10.1787/888933976061

The Korean government, for example, has used all three of these mechanisms to support investments in recycling and incineration: in 2014, the national government provided KRW 105.3 billion in financial aid for the construction of waste-to-energy plants; government subsidies, tax credits and long-term, low-interest loans have financed recycling investments, including for food waste; and the government has supported recycling companies, focusing on SMEs, with long-term, low-interest loans for investments in facilities and technology development.

Under Colombia's National Development Plan 2010-14, government bodies provided subsidies in particular for investment in landfills and transfer stations. National and regional bodies subsidised investments at about one-quarter of municipalities. In addition, since 2001 the government has provided tax exemptions for investments in recycling and for energy generated by agricultural waste.

A 2006 OECD Recommendation calls for Member countries to ensure that public environmental expenditure is environmental effective, economically efficient and follows sound principles of public expenditure management. The Recommendation sets out good practices for public environmental expenditure, and these need to be considered for support to investments for waste management (Box 5.2).

Box 5.2. The 2006 OECD Recommendation on Public Environmental Expenditure Management

The Recommendation sets out three checklists, each of which identifies a series of principles for consideration on public environmental expenditure.

Performance in terms of environmental effectiveness

1. Additionality and consistency with other environmental policy instruments
2. Well-defined programming framework
3. Clear identification of environmental outcomes
4. Maximise environmental effect from available funds
5. Leverage additional finance

Performance in Terms of Budgetary Good Practice

1. Fiscal integrity of revenues
2. Avoid constraints to efficiency
3. High standards of fiscal discipline
4. Accountability and transparency
5. Collection of revenues and public procurement separated from expenditure management

Performance in Terms of Management Efficiency

1. Sound governance
2. Professional executive management
3. Sound project cycle management
4. Fair and unbiased relations with external stakeholders
5. Effective management of financial products and related risks

5.2.1. Dedicated environmental funds

Several OECD countries have used funds whose revenues come from environmental charges and taxes. These include Estonia's Environmental Investment Centre, the Czech Republic's State Environmental Fund, and Poland's national and regional environmental funds, whose revenues include waste charges and taxes (see Box 5.3). These funds effectively earmark revenues for environmental spending: the OECD Recommendation warns that this can be a constraint to efficiency, unless the advantages are demonstrated. In Israel, a landfill levy was collected into a fund that is used to finance municipal and private sector waste management activities and build needed waste infrastructure. Estonia, the Czech Republic, Hungary, Poland as well as other countries that recently joined the EU have used these funds for major improvements in their environmental infrastructure, including for waste management. As noted in Box 5.2, the OECD Recommendation called for better transparency, accountability and effectiveness for its system of environmental funds.

Several OECD countries have used external public financing for waste investments. In Europe, EU funds have provided grants to support environmental investments in low-income regions. These were used in countries including Estonia, where EU funds supported separate collection of MSW. In Poland, the Czech Republic, Hungary and Slovenia, grants from EU funds supported a broad range of waste treatment investments,

including integrated waste facilities that combined sorting, recycling and composting for MSW. Both Estonia and Poland have employed their national funds as management bodies for these EU programmes. Poland among others has combined these resources (Box 5.3).

Many EU countries, including Estonia and Poland, have received loans from the European Investment Bank, an EU institution, to finance waste treatment investments. External resources supported waste investments in Colombia: funding sources have included the World Bank and bilateral aid programmes. Several OECD countries have provided international assistance in the waste field (see Chapter 6).

Several countries use revenues from waste and other environmental charges to finance waste management investments. Poland has provided low-interest loans from its national and regional environmental funds, institutions whose revenues come from environmental taxes and charges.

Box 5.3. Poland's system of environmental funds

Poland's National Fund for Environmental Protection and Water Management, together with 16 regional funds, have become the main instrument for financing environmental investments. These funds receive the proceeds of environmental charges and fees and use the revenue to make low-interest loans. These bodies also manage EU funding. The 2015 Environmental Performance Review found that National Fund in particular strengthened its professional capacity. Moreover, the funds improved their transparency, accountability and effectiveness – key recommendations from the previous Review in 2003. The National Fund strengthened its rules for project selection and for co-financing and developed a joint strategy with the regional funds. Large projects, such as integrated waste management facilities in Pomerania, a region in the North of Poland, are financed through a combination of EU grants and national and regional fund loans.

5.2.2. The role of the business sector and specialised producers

Other countries have relied more extensively on investments made directly by the **business sector** and **specialised producers**. In Estonia, for example, the government-owned energy company provided the main financing for the country's MSW incineration plant (with co-financing for European Investment Bank), while private waste companies built mechanical biological treatment (MBT) facilities.

Specialised producers provide a majority of waste financing in several European countries, including Belgium, Denmark and France, and other OECD countries have turned to the private sector for waste management investments. In Japan, increased involvement of the private sector in MSW collection and treatment has financed new projects – primarily incineration facilities. In Israel, the Environmental Performance Review called for a greater private sector role in waste management, including separate collection as well as financing facilities such as waste-to-energy plants. The 2014 Environmental Performance Review of Colombia also called for greater private involvement to address resource constraints for waste investments.

Across all areas of infrastructure, **public-private partnerships** represent about USD 0.8 trillion of investment in OECD countries, with further projects in the pipelines. The Environmental Performance Reviews, however, contain few references to public-private partnerships for waste management projects. One example was in Poland,

where financing from national sources, EU funds and the private sector were brought together for the construction and operation of an incinerator in Poznan. This was the first public-private partnership project in the waste sector in Poland, and about ten years passed from initial discussions to agreement and the start of construction. An analysis of this project highlighted the need for greater capacity on the part of public authorities to manage and implement public-private partnerships financing for large investment projects. OECD has set out three broad principles for these types of agreements (Box 5.4).

Box 5.4. OECD: Recommendations of the Council on Principles for Public Governance of Public-Private Partnerships (2012)

- Establish a clear, predictable and legitimate institutional framework supported by competent and well-resourced authorities.
- Ground the selection of Public-Private Partnerships in Value for Money.
- Use the budgetary process transparently to minimise fiscal risks and ensure the integrity of the procurement process.

5.2.3. Investment planning

The OECD Recommendation on Public Environmental Expenditure calls for a well-defined programming framework. The Reviews have shown how OECD countries have linked government financing to policy frameworks: this is the case for the 3Rs approach in Japan, as well as the national and regional waste management plans in Poland.

In Israel, the Recycling Action Plan has envisaged investments in infrastructure for separate collection, sorting and recycling of waste, as well as incineration facilities. Under this Plan, the national Ministry of Environmental Protection intended to allocate NIS 3 billion to municipal governments, who would make investments. Here, the Environmental Performance Review underlined that synchronisation of policy instruments, including the landfill levy and investment subsidies, was needed to avoid potential over-investment, in this case in recycling capacity.[1]

In the Netherlands, the second Netherlands Waste Management Partnership (NWMP) set targets to eliminate the landfilling of combustible waste and to increase level of waste recovery between 2006 and 2015. Government actions included a landfill tax along with voluntary agreements with waste incineration companies, which invested in greater capacity. In contrast, Estonia set a broad target to increase the recovery of MSW and also put in place a landfill tax, but left investment decisions for new waste treatment facilities to companies, which constructed both an incineration plant and several MBT plants.

The experience in Estonia and the Netherlands provides cautionary tales, as both countries found themselves with overcapacity: the Netherlands for incineration and Estonia for MBT and incineration, in part addressed by the import of waste for incineration. Moreover, while the waste-to-energy plants have boosted renewable energy production in both countries, these investments have likely reduced progress towards recycling. Similar challenges are seen in other OECD EU countries, including Germany, Sweden and Switzerland, and may be a risk for the Czech Republic, where public funds support incineration facilities and planned changes in the policy mix (landfill bans, increased landfill taxes) are likely to make incineration more attractive to investors. The Czech review noted that, when planning new

waste treatment facilities, it is important that authorities consider the benefits of alternative treatment technologies as well as treatment capacity in neighbouring countries.

5.3. Innovative financing to promote the circular economy

As noted in Chapter 3, only a few OECD countries had comprehensive circular economy policies in place at the time of the most recent Reviews. Japan is one of the leaders: its national government has supported industry and local authorities in circular economy projects (Box 5.5).

Box 5.5. Support for the circular economy: the Eco Town Programme in Japan

Japan has financed several programmes that implement the national 3Rs (reduce, reuse and recycle) approach. The Eco Town Programme combines town planning and community recycling and outreach with financing for recycling investments: it has subsidised private companies to put in place innovative recycling projects for MSW and for key waste streams including organic waste, plastic waste and Waste Electrical and Electronic Equipment (WEEE) (government support covered on average about one-third of investment costs). The programme has encouraged other companies to make recycling investments in the designated Eco Towns.

Other OECD countries have supported resource efficiency and eco-innovation investments that can support the move towards circular economies. Some of these investments support research and development: in Slovenia, the government has provided co-financing to industry for several innovation areas, including sustainable building technology. Others support resource efficiency investments in industry. In Israel, the government has financed industry investments that reduce the production of hazardous waste. Estonia's EIC has supported projects for resource efficiency, and in the 2014-20 period, the Centre planned to allocate EUR 100 million in grants from EU funds to resource and energy efficiency projects in industry. The Environmental Performance Review highlighted a need for an overall framework to address eco-innovation and the circular economy and also called to ensure that the EU resources were used effectively.

5.4. Financing and other instruments to address contaminated sites

Many of the focus countries face a legacy of contaminated sites, including old industrial areas as well as abandoned, often illegal landfills. The cost of clean-up can be high: in Japan, the Ministry of Environment estimated that soil contaminated potentially affected about 113 000 ha, with remediation costs of up to JPY 17 trillion (about 3% of yearly gross domestic product [GDP]).

One mechanism to ensuring funding for remediation is to establish liability for owners and polluters of contaminated sites. In Japan, the owner or polluter is required to bear the costs of remediation. Moreover, since 2010 listed companies have been required to report potential liabilities related to contaminated sites on their balance sheets. Korea has put in place strict liability provisions for contaminated sites, and in Colombia, industrial companies are responsible for remediation at sites they pollute: environmental authorities have required some oil and chemical companies to undertake site restoration work. Not all

OECD countries have clear requirements, and some performance reviews, as for Estonia and Israel, have called on governments to strengthen liability.

For many sites, a former owner has gone bankrupt or no single polluter can be identified: consequently, government financing has to play a key role in site investigation and clean-up. In Japan, both the national government and local authorities have provided financial assistance for assessing and treating soil contamination. In Norway, the national government, local municipalities and other government bodies have supported clean-up of sites where the polluter cannot be clearly identified, such as harbours. National or regional financing may be necessary to cover the high costs of remediation: in Colombia, municipalities are responsible for contaminated sites where the private polluters cannot be identified, but in general they lack resources to address the problem. Both Estonia and Poland have used grant financing from EU funds: Estonia, for example, used these resources for the remediation of industrial and military facilities, old landfills for mining and industrial waste from the oil shale sector, and abandoned industrial areas.

Nonetheless, many countries are likely to face financing constraints given the dimension of contamination problems. In Slovenia, for example, the national Court of Auditors noted delays in addressing contaminated sites, many of which were former industrial and mining facilities. The state had assumed liability for these sites, but a lack of resources had proven a key obstacle.

OECD Environmental Performance Reviews have called on countries to develop a register of sites, in order to better understand the issue: the review of Poland, for example, recommended completing a register that had been started. In Israel, a ministerial survey identified 3 300 potentially contaminated sites, including industrial facilities and commercial and agricultural areas, such as petrol station and sites where hazardous waste had been illegally buried.

Performance reviews have also called for a risk-based approach to focus government and other resources on the most serious problems. This approach has been followed in several countries, including Norway (Box 5.6), and the OECD called on Norway to continue to strengthen its efforts to address contaminated sites.

Box 5.6. Setting Clean-up priorities in Norway

In Norway, over 3 500 potentially contaminated sites were identified. Clean-up activities focused on priority areas: the 100 most heavily polluted sites, including old industrial facilities and former landfills; day-care centres, playgrounds and schools affected by contamination from former industrial activities and the use of contaminated soils in landscaping; and seriously contaminated marine sediment, in particular in areas for fish and shellfish harvesting.

Notes

[1] More recent evidence since the review period suggests that investment has not led to overcapacity in recycling facilities in Israel: OECD, Environmental Performance Reviews – Medium-term progress report: Israel (Working Party on Environmental Performance, 8 10 March 2016, ENV/EPOC/WPEP(2016)5, document prepared by the Israeli Ministry of the Environment).

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Chapter 6. International co-operation

This chapter provides an overview of international waste transfers in the focus countries, including commitments to international agreements. It also reviews international co-operation on waste management, including bilateral and multilateral discussions as well as technical assistance activities and identifies examples of good practices.

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Box 6.1. Examples of good practices for international co-operation

- Ratification and implementation of international instruments for transboundary movements of waste.
- International co-operation on illegal waste trade (Japan).
- Sharing of knowledge on waste management and the circular economy (Japan and Korea).

6.1. International instruments

Nearly all OECD countries are Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Waste, and all but nine are Parties to the "Ban Amendment", which prohibits export of hazardous waste from OECD countries (and EU Member States) to other parts of the world. Three focus countries did not ratify the Ban Amendment: Israel, Korea and Japan (Israel, however, complies with the provisions of this Amendment, according to its performance review). Few OECD countries have signed the 1999 Basel Protocol on Liability. Among the focus countries, however, Colombia, not an OECD country, has ratified this Protocol, and the performance review of Israel proposed its ratification. Neither the Ban Amendment nor the Liability Protocol were in force (as of mid-2017), as they had not yet reached the minimum number of Parties.

OECD countries approved the 2001 Council Decision concerning the Control of Transboundary Movements of Wastes Destined for Recovery Operations (C(2001)107/FINAL). The Decision establishes an operational intra-OECD system to control movements of waste destined for recovery in order to protect human health and the environment while encouraging the recovery of waste and the trade of recyclable materials. It aims to simplify administrative procedures for exports and imports of waste within the OECD. In order to simplify and accelerate the notification procedures, OECD members have the possibility to designate "pre-consented recovery facilities" for which they do not raise objections concerning regular transboundary movements of certain waste types. Transboundary shipments to pre-consented facilities benefit from an accelerated procedure. As of late 2017, four of the 11 focus countries had designated "pre-consented recovery facilities" to the database maintained by the OECD Secretariat: the Netherlands, Poland, Norway and Estonia.

The performance review of Colombia noted that this country's ratification of the Basel Convention in 1996 spurred the development of national legislation setting out requirements for the proper management of hazardous waste, including treatment facilities. The other performance reviews found that OECD countries comply with the provisions of the Basel Convention and of the 2001 OECD Council Decision.

6.2. International waste transfers

Several OECD countries have seen large increases in their waste trade. Japan, for example, saw a 26-fold rise in exports of waste listed in the Basel Convention over the review period: one major category of hazardous waste exports is lead acid batteries, which are sent to Korea for processing and Waste Electrical and Electronic Equipment (WEEE). Japan also exports a range of recyclable waste, including steel scrap, waste paper and plastic scrap (sent mainly to the People's Republic of China hereafter "China") and coal ash, sent to Korea for use in cement production.

Among the focus countries, those in the EU had high levels of waste shipments, in particular with their European neighbours. This was the case, for example, for the Netherlands (Box 6.2). Estonia imports MSW for incineration, principally from other EU Member States. Its trade in hazardous waste come mainly from Baltic neighbours: lead acid batteries are imported for treatment in Estonia, while the country exports waste treated wood, waste fluorescent lights and waste WEEE.

Box 6.2. The Netherlands: waste trade with neighbouring countries

The Netherlands encouraged the import and export of non-hazardous waste with its neighbours in its national waste management plans, and in 2010, about 12 million tonnes of total waste were imported, with a roughly similar level exported: the largest shares of this trade went to Belgium and Germany. The Netherlands was the EU's largest exporter of hazardous waste, as well as the Union's third-largest importer. Facilities in the country have specialised in the treatment of contaminated soil, while several waste streams including batteries, are exported. Consequently, the waste makes up an important share of the country's overall trade, at least in terms of volume, making up an estimated one-fifth of shipments between the Netherlands and Germany.

Norway saw a large increase in waste exports between 2002 and 2009, principally combustible waste sent to Denmark and Sweden for incineration, while its waste imports include hazardous incinerator fly ash. Norway abolished its incineration tax in 2010 to reduce these exports. While Norway had policy target to treat all hazardous waste domestically, about 10% was exported in 2008, including WEEE and waste batteries.

In response to high waste shipment rates, some European countries have adopted specific measure to control and monitor transboundary waste shipments. For example, in Hungary in 2015, a waste shipment department was established to oversee waste shipments. The department is responsible for preparing annual plans, reporting and inspecting shipments.

In contrast, other countries have much lower levels of waste trade. Israel, for example, exported about 2.5% of its hazardous waste for treatment, mainly in the European Union: key components include metal wastes, solvents and pharmaceuticals. Israel both exported and imported used batteries for treatment. While imports fell as OECD countries implemented the Basel Ban Amendment, the performance review predicted that these and other waste imports would increase after it joined the OECD.

Colombia has prohibited the import and transit of hazardous waste; a few waste streams are exported due to a lack of domestic treatment capacity, including obsolete pesticides, fluorescent lights and WEEE. OECD's technical accession review called on Colombia to: minimise waste exports, ensuring that adequate treatment capacity is available within the

country; control imports and exports of hazardous waste; and facilitate trade of waste for recovery within the OECD area.

OECD countries have also experienced cases of illegal traffic, including in countries such as the Netherlands with comparatively strong enforcement systems. Consequently, several performance reviews highlighted efforts to strengthen national enforcement against illegal waste traffic, in particular for hazardous waste (see also Section 4.7). Moreover, several OECD countries have led international initiatives to address illegal traffic, as described in the following section.

6.3. International co-operation

For several OECD countries, waste management has been an important area for bilateral and multilateral co-operation. Colombia and Chile's bilateral agreement of science and technology, for example, includes co-operation on hazardous waste management. China, Japan and Korea hold a yearly Tripartite Environment Ministers Meeting for Northeast Asia: waste is one of the ten topics, and parallel waste seminar is held each year under this framework.

Co-operation on illegal waste trade has been a key focus for international co-operation. In 2003, Japan launched the Asian Network for the Prevention of Illegal Transboundary Movement of Hazardous Waste: the network includes a policy dialogue and capacity building on implementation of the Basel Convention. Japan also supports the Basel Convention Partnership on the Environmentally Sound Management of WEEE for Asia-Pacific Region.

Several OECD countries have made waste management an element of their international co-operation. Korea, for example, has supported an incinerator project in China, a landfill in Cambodia and work on urban waste and abandoned mines in Mongolia; Korea also supported waste management planning in 11 developing countries between 2007 and 2015.

International co-operation on the circular economy is receiving growing attention. Korea and Japan (Box 6.3), for example, have promoted the 3Rs approach in Asia.

Box 6.3. Japan's support for the 3Rs approach in Asia

Japan has promoted the 3Rs approach through international conferences – such as the 2006 Asia 3Rs Conference and follow-up events – policy dialogue, information centres and networks, and technology co-operation. Japan has supported the 3Rs Knowledge HUB, initiated by the Asian Development Bank and UNEP. In any example of other co-operation activities, Japanese cities and prefectures shared their experience in the Eco-Town Programme with counterparts in China.

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(97 2018 47 1 P) ISBN 978-92-64-30938-8 – 2019

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ISBN 978-92-64-30938-8
97 2018 47 1 P