PART II

Chapter 5

Waste and materials management

This chapter examines the Netherlands' track record in the area of waste prevention and management and recent efforts to stimulate the transition towards a circular economy. It provides an overview of trends in material consumption and waste management, as well as related policy and institutional frameworks. The chapter discusses the main objectives for waste management over the review period and assesses performance. Finally, the chapter examines the efforts to promote a circular economy and reviews the next steps that can encourage further progress. The recommendations on waste and materials management are summarised in a box at the end of the chapter.

1. Introduction

Sustainable waste management has been one of the Netherlands' strengths in environmental policy for many years. More recently, building on its well-established track record in waste management, the government has been laying the groundwork to stimulate the transition towards a circular economy. This is defined as "an economic system that is predicated on the reusability of products and raw materials and the conservation of natural resources and that pursues the creation of value in each link in the system" (Ministry of Infrastructure and Environment, 2014a). The circular economy requires going beyond the domain of traditional waste management into less well-developed terrain. With ambitious targets for the circular economy, the country faces new challenges in terms of developing new policies, encouraging new business models and finding new ways of working with businesses and society.

This chapter provides an overview of the main objectives, policies and institutions for waste management and the circular economy. It reviews trends in waste management and material consumption over the review period and assesses performance against the country's objectives. Finally, the chapter examines the efforts to date to promote the circular economy and the challenges that lie ahead.

2. Objectives, policies and institutions for waste management and the circular economy

2.1. *Waste management policy framework*

The Netherlands was one of the pioneers of sustainable waste management planning in the OECD. The first National Waste Management Plan (NWMP) (*Landelijk Afvalbeheer Plan,* LAP), which covered the period 2003-09, set targets to be achieved by 2012. It was subsequently updated by the second NWMP of 2009, which covers the period from late 2009 to 2015 and sets targets for 2015 and 2021. These plans built on policies put in place in the 1990s to reduce landfilling and improve recycling and recovery. Each plan has been updated over the period of its implementation to reflect significant changes in the sector. A new NWMP is prepared every five to six years. A third NWMP, expected in late 2016, will cover the period until 2022.

Each NWMP covers extensively the key issues for waste management and sets policy objectives, targets and actions. The plans cover the overall policy framework, as well as specific sectors.[1] The first plan also covered capacity planning for waste disposal facilities. In addition, the plans set out the roles and responsibilities of various actors and include provisions for monitoring and evaluation. The overarching objectives of the plans are as follows:

- continue the decoupling between waste production and GDP growth
- increase levels of recovery, including energy recovery and recycling
- reduce quantities of waste sent to landfill
- decrease overall environmental impact of waste management.

The Netherlands reached most of the quantitative targets in the first NWMP ahead of schedule. The second plan built on these achievements by setting more ambitious and refined targets (Table 5.1). The plans incorporate, and in many areas go beyond, targets set in EU legislation. Both plans have been independently evaluated. The European Commission has also reviewed these plans in recent projects, along with those of other member states (European Commission, 2013).

Table 5.1. **Towards achieving key targets from the National Waste Management Plans**

	Objectives, targets and performance[a]			
	1st NWMP (2003)		2nd NWMP (2009)	
	Target	Performance	Target	Performance
Waste production	66 million tonnes (Mt) in 2012 (from a base of 63 Mt in 2000).	By 2010, waste generation was down 5% from 2000.	68 Mt in 2015 and 73 Mt in 2021.	Waste generation still below 2000 levels.
Waste recovery/Reuse[b]	Increase total waste recovery rate from 77% to more than 83% between in 2000-12.	Achieved by 2005.	Increase total waste recovery rate from 83% to 85% between 2006-15.	Achieved by 2010.
Household	---		Increase waste recovery/reuse of household waste from 51% to 60% between 2006-15.	78% by 2010.
Small business/trade/ government (HDO)	---		Increase recovery/reuse of waste from business, government and services from 46% to 60% between 2006-15.	78% by 2010.
Industry	---		Maintain the level of recovery/reuse rate for industrial waste at 90%.	88% in 2010.
Construction and Demolition (C&D)	---		Maintain the level of recovery/reuse rate for construction and demolition waste at 95%.	At least 95% reached in 2010.
Disposal/Landfill	Limit the quantity of waste to be disposed of in 2012 to a maximum of 9.5 Mt, comprised of: 2 Mt of landfilled non-combustible waste 5.1 Mt of non-hazardous waste incinerated 0.1 Mt of hazardous waste incinerated in rotary furnaces and waste incinerators 2.3 Mt of sewage sludge.	Achieved by 2010	Reduce the landfilling of "combustible" waste originating in the Netherlands from 1.7 Mt to 0 Mt between 2007-12 (non-combustible waste is not included in this target).	By 2012, only 1% of all MSW generated was landfilled.
Material efficiency	No specific quantitative target set in objectives.		Using the cradle to cradle concept as inspiration, reduce the environmental impacts of seven material streams by 20% by 2015.	Not achieved.
Energy content of waste	---		Increase the energy output (electricity and heat) of incineration plant by 10% by 2012.	Achieved.
Emissions from waste treatment	---		Reduce CO_2 emissions from waste treatment facilities by 30% by 2020 compared with 1990. Remove any danger to humans and the environment from hazardous materials.	Achieved.

Source: CE Delft (2014a).

a) There are significant differences between the two NWMPs, which impact on their comparability. For example, the targets have different base years (2000 for the first plan and 2006 for the second). The second NWMP is broader in scope and covers additional areas such as material efficiency, the energy content of waste and emissions from waste treatment operations.

b) The targets for "useful recovery" include incineration for energy recovery, as well as reuse and recycling.

In addition to the targets above, other objectives of the NWMPs include the liberalisation of the waste market and the harmonisation of waste policies throughout the country. The promotion of market forces in waste management seeks to provide greater

entrepreneurial freedom to waste management firms, reduce central planning of incineration capacity and encourage trade through open borders for import and export of non-hazardous combustible waste for incineration. The push to harmonise waste policies throughout the country aimed to reduce regional differences, while still allowing discretion for provinces and municipalities in policy implementation.

2.2. Legal framework for waste management

The Netherlands was one of the first European countries to develop comprehensive national waste management planning systems and reporting. The Environmental Management Act (EMA) of 2002 provides the main legal basis for waste management[2] in the Netherlands and introduced the legal requirement to develop NWMPs. This act preceded EU legislation setting out such a requirement (Article 28 of the 2008 EU Waste Framework Directive). While EU legislation now sets the general framework for waste management policy and legislation, the Dutch played a central and pioneering role in shaping EU waste legislation, in particular the use of core principles such as the "waste hierarchy". Further, the targets and policies put in place in the country are often more ambitious than those set out by the EU.

2.3. From waste policy towards a circular economy

In order to promote material efficiency and the transition towards a circular economy, the Netherlands has taken important steps in recent years to lay the groundwork for further progress. The second NWMP represented one of the first steps to look beyond traditional waste management and examine how to move towards greater resource efficiency. In a circular economy, the aim is to broaden the focus from strictly managing waste to minimising the environmental impact of materials across entire product chains from "cradle to cradle", covering raw material extraction, production, use and waste management, including reuse.

In 2014, the government set out an ambitious "Waste to Resource" programme. The programme built on the "More Value from Waste" programme outlined in 2011 and the first Waste Prevention Plan in 2013. Among the main objectives of the Waste to Resource programme is to halve the volume of material that "leaves" the economy within a span of ten years. In 2012, an estimated 10 million tonnes of waste went to incineration or landfill. The Waste to Resource programme seeks to drastically cut the resources "lost" in this way, through increased recycling and more sustainable production and consumption. The broad objectives and lines of action for the programme are summarised in Table 5.2. In addition to domestic efforts, the Netherlands has actively contributed to the development of a common policy on resource efficiency at EU level.

The government is exploring which specific measures or actions can and should be taken to achieve these broad objectives as well as determining priority areas and specific targets. It is also considering potential roles and responsibilities of the various actors involved, including the government. Given this exploratory process is ongoing at both the national and EU levels, the Netherlands has not yet outlined a detailed roadmap for achieving the transition to a circular economy. Ultimately, objectives and ambitions for the circular economy should feed into the third NWMP, expected in late 2016.

2.4. Institutional arrangements

The Ministry for Infrastructure and Environment is responsible for the policy and regulatory framework for waste management at the central government level. The ministry develops, co-ordinates, enforces and monitors the NWMPs. It ensures implementation of EU

Table 5.2. **Objectives and lines of action for the Waste to Resource programme**

High-level objectives	Actions
1. Promoting sustainability at the front of the chain	• ensuring the circular design of products • closing local and global cycles
2. Making consumption patterns more sustainable	• developing an approach to sustainable consumption patterns based on behavioural knowledge • strengthening the role of the retail sector, thrift stores and repair companies • using the purchasing power of the government to create a circular economy
3. Improving waste separation and collection	• minimising the quantity of residual Dutch waste in incineration plants • facilitating municipalities in improving waste separation and collection • inspiring households to improve their separation of waste • separating waste from offices, shops and public spaces
4. Focusing existing waste policy on a circular economy	• identifying and eliminating unnecessary obstacles in legislation • stimulating the application of end-of-waste status • promoting recycling through a level European playing field for waste • creating scope for innovation in legislation and in standards
5. Adopting an approach to specific material chains and waste streams	• setting up a support desk for a material chain approach • accelerating specific material chains such as the one for plastics • stimulating high-quality recycling in each material chain • using residual biotic streams in a high-quality way
6. Developing financial and other market incentives	• stimulating the use of new business models • driving the dissemination of knowledge and widespread use of innovative solutions • adapting landfill tax rules to ensure they tie in with promoting the circular economy
7. Connecting knowledge and education to the circular economy	• setting up knowledge and education programmes for Waste to Resource • focusing European research programmes on the circular economy • making the Netherlands a circular hot spot
8. Simplifying measurement methods, indicators and certification labels	• harmonising and standardising methods and indicators • improving information about waste streams.

Source: Ministry of Infrastructure and Environment (2014b).

directives and international obligations, as well as establishes detailed rules for the implementation of waste legislation. It also authorises collection of several specific waste streams, manages exemptions and enforces the landfill ban. The ministry's executive arm, the Rijkswaterstaat, develops and evaluates waste policies and regulations, and supports policy implementation.

Provincial authorities are primarily responsible for the licensing and enforcement of waste management activities (based on minimum standards established in the NWMPs). They are also responsible for the long-term closure and aftercare of landfills. To carry out these functions, they can charge a levy on landfilled waste. Revenues from this levy are put in a fund to cover post-closure landfill stewardship costs.

Municipal authorities are responsible for the collection of municipal waste, including promotion of separate collection of certain waste streams, as well as the stimulation of waste prevention. Their bylaws specify which types of household waste have to be separated and the frequency of collection. More than 400 municipalities in the Netherlands are in charge of waste collection and separation. They can collect waste themselves or outsource collection to a private party. Municipalities also set tariffs for waste collection, issue permits for some waste processing companies and monitor their actions.

Along with various levels of government, the waste management industry and civil society also play a role in waste management. Both industry and the public are involved in the development of the NWMPs and have legal obligations for responsible waste management. For instance, Dutch environmental legislation establishes a duty-of-care related to waste for the private sector (including both companies and citizens). Companies are required to contract an authorised party to collect their waste. In addition, extended

producer responsibility (EPR) rules apply for several product streams (e.g. electrical and electronic equipment, packaging and "end-of-life" vehicles). Citizens are responsible for waste prevention and responsible waste management, for instance, by separating waste for collection according to municipal rules.

In the area of materials efficiency and the circular economy, the Ministry for Infrastructure and the Environment works with other key ministries, including the Ministry of Economic Affairs and the Ministry of Foreign Affairs. Consumer associations, industry and other private parties are also actively involved in shaping policy initiatives in this domain. In contrast to traditional waste management, roles and responsibilities of different actors for the circular economy are still under consideration.

3. Trends in waste management and material consumption

This section summarises key trends in waste generation, treatment and trade, as well as material consumption in the Netherlands over the review period. There are significant differences in how total waste is measured by Dutch national statistics and how it is measured by OECD and Eurostat statistics (Box 5.1). This section relies on national data when discussing progress towards national goals; it uses OECD or Eurostat data when comparing the country's performance with others.

Box 5.1. **Waste definitions**

As defined in the EU Waste Framework Directive, waste is "any substance or object which the holder discards or intends or is required to discard". As noted in the first NWMP, the interpretation of this definition sometimes leads to debate about whether a substance constitutes waste.

For *total waste*, Dutch national statistics exclude several types of waste that are included in OECD and Eurostat definitions: dredging spoils, animal manure, soils (including contaminated soils) and secondary wastes generated by waste treatment and recycling facilities. For *municipal solid waste* (MSW), certain building and demolition waste, some used paper and cardboard, as well as waste electrical and electronic equipment (WEEE) are included in national statistics, but not in OECD and Eurostat statistics.

These distinct definitions lead to very large differences. In particular, OECD and Eurostat data puts total waste produced in the Netherlands at around 120 Mt per year; approximately double the amount calculated by national waste statistics (around 60 Mt per year). The difference is much less pronounced (around 5%) with regards to municipal solid waste.

In this chapter, the assessment of national performance against goals set in the NWMPs draws on national statistics. In contrast, comparing the performance of the Netherlands with OECD and EU peers requires OECD and Eurostat data.

3.1. *Waste trends*

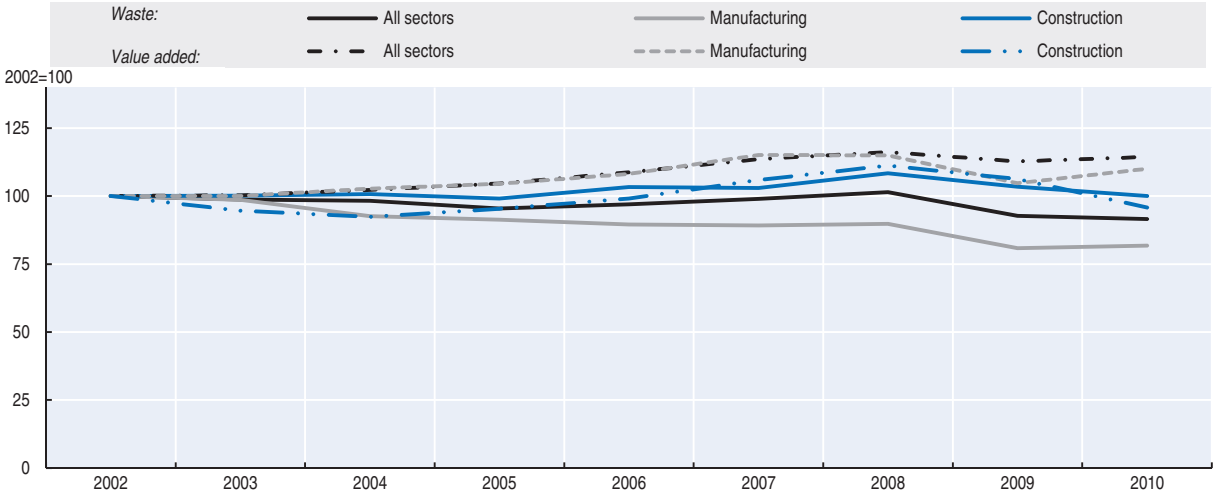
Waste generation

The Netherlands has reduced the amount of waste produced over the past decade, achieving an absolute decoupling of waste generation from gross domestic product (GDP). According to Dutch waste statistics, total waste generation in 2012 was 4% less than in 2000. This was driven by waste prevention and management policies, as well as macroeconomic factors, including the impact of the global economic crisis, which

dampened overall consumption (CE Delft, 2014a). Nevertheless, in the context of modest GDP growth over the period, the fall in waste production is an important achievement. This is especially significant in light of the substantial increase in waste generation between 1985 and 2000 (from 45 Mt to 61 Mt).

According to Dutch statistics, the building industry (construction and demolition waste) produces the most waste (41%), followed by manufacturing (24%), and "consumers" (14%). Together, these three groups accounted for approximately 80% of all waste generated in 2012. Figure 5.1 shows the trends in waste generation for construction and manufacturing for 2002-10, along with the trend in value-added of these sectors.

Figure 5.1. **Waste generation declined while value added rose, 2002-10**



Source: CBS (2015), *StatLine* (database).

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As with the trend for total waste, there was an absolute decoupling of MSW[3] generation from GDP. Household waste accounts for the large majority (nearly 90%) of MSW. While GDP increased, the amount of MSW produced dropped slightly from 9.5 Mt to 8.8 Mt in 2000-13 (CBS, 2014) to just under one-sixth of total waste produced, according to Dutch statistics.

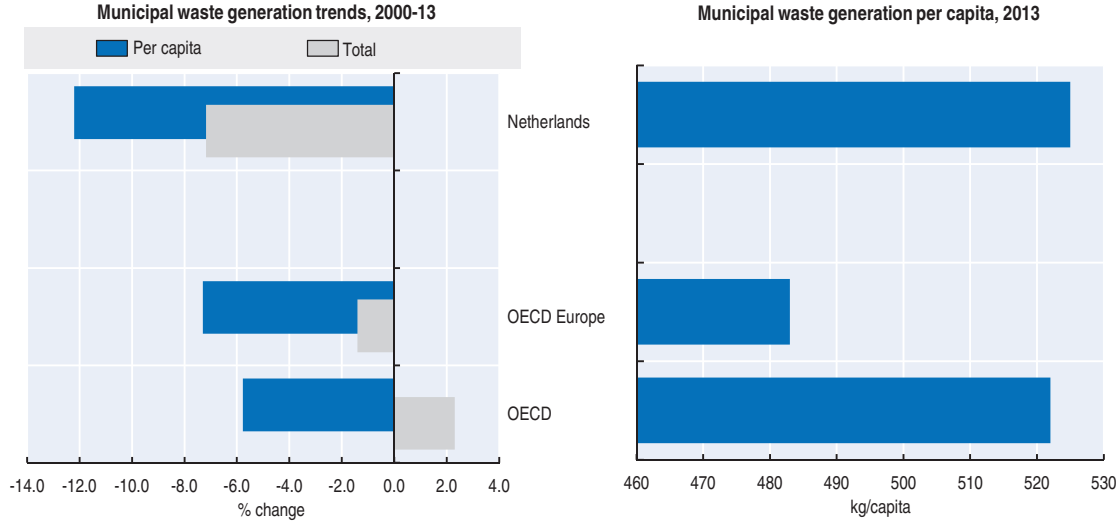
According to OECD statistics, MSW on a per capita basis showed a significant decline, falling from 598 kg to 525 kg between 2000 and 2013; this is slightly above the OECD and OECD Europe averages of 520 kg and 480 kg respectively in 2013 (OECD, 2015) (Figure 5.2).

While the vast majority of waste produced is non-hazardous, the Netherlands generates a substantial amount of hazardous waste, nearly 4.9 Mt in 2012 (Eurostat, 2015). It is among the top ten OECD countries in terms of production of hazardous waste, according to 2010 data (Figure 5.3).

Waste treatment and trade

In terms of waste treatment, there has been a marked shift from landfilling to incineration, and within incineration, a shift from disposal to energy recovery. This shift was especially prominent for the treatment of household MSW. Landfilling of MSW declined from about 11% to 1.5% between 2000 and 2013. In 2012, almost half (48%) of household MSW was incinerated for energy recovery (Figure 5.4). Both industrial waste and

Figure 5.2. **Municipal solid waste per capita declined yet remains slightly higher than OECD average**



Source: OECD (2015), "Municipal waste", *OECD Environment Statistics* (database).

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construction and demolition (C&D) waste already had very high rates of "useful recovery" (including incineration for energy recovery, as well as reuse and recycling) at the beginning of the review period and stood at 88% and 90% respectively in 2010.

The amount of electricity and heat produced from waste incineration during the period increased substantially. For example, gross production of electricity from waste increased from 2.5 GWh in 2000 to 3.4 GWh in 2010 (CBS, 2012). Approximately half of this is classified as renewable energy.

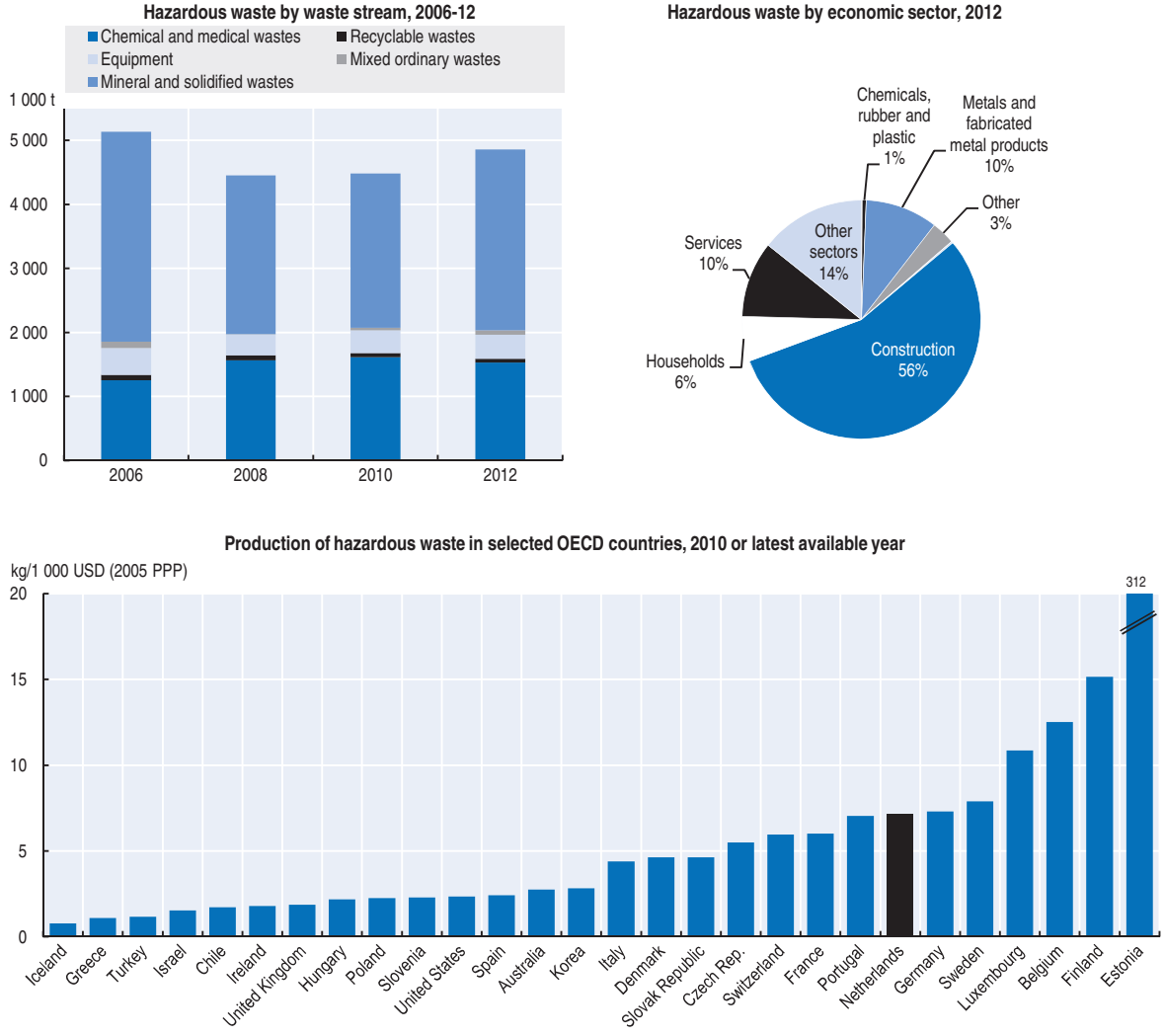
Material recycling rates (including recycling and composting) remained generally stable, showing some improvement, over the review period. Material recycling of household MSW increased slowly with rates growing from 50% to 56% in 2000-12 (CBS, 2014). Composted waste represented about one half of this total. Overall, the amount of waste separately collected from households had a modest increase from 45% to 51% over 2002-12.

The Netherlands' status as a major importer and exporter of waste expanded considerably during the review period. According to Dutch statistics from CBS, the amount of waste exported rose from 6.7 Mt to 12 Mt in 2000-10, reaching 20% of total waste generated. In a similar vein, the amount of waste imported nearly doubled, increasing from 6.6 Mt to 13 Mt. The vast majority of this waste was non-hazardous and traded among neighbouring countries, especially Germany and Belgium. In 2013, between 1.6-1.7 Mt of waste was imported for incineration, most of it coming from the United Kingdom.

3.2. Emissions from waste

Greenhouse gas (GHG) emissions from the waste sector dropped by over 60% between 2000 and 2012. This huge drop can be explained in part by the marked shift from landfilling towards incineration for energy recovery; since the country's waste incineration facilities also produce electricity or heat for energy purposes, their GHG emissions are attributed to

Figure 5.3. **The Netherlands is among the top ten OECD member countries in production of hazardous waste**



Note: Hazardous waste classified according to the Waste Framework Directive (Directive 2008/98/EC) which excludes radioactive waste.
Source: Eurostat (2015), *Eurostat Environmental Data Centre on Waste* (database); OECD (2015), *OECD Environment Statistics* (database); OECD (2013), *Environment at a Glance 2013: OECD Indicators.*

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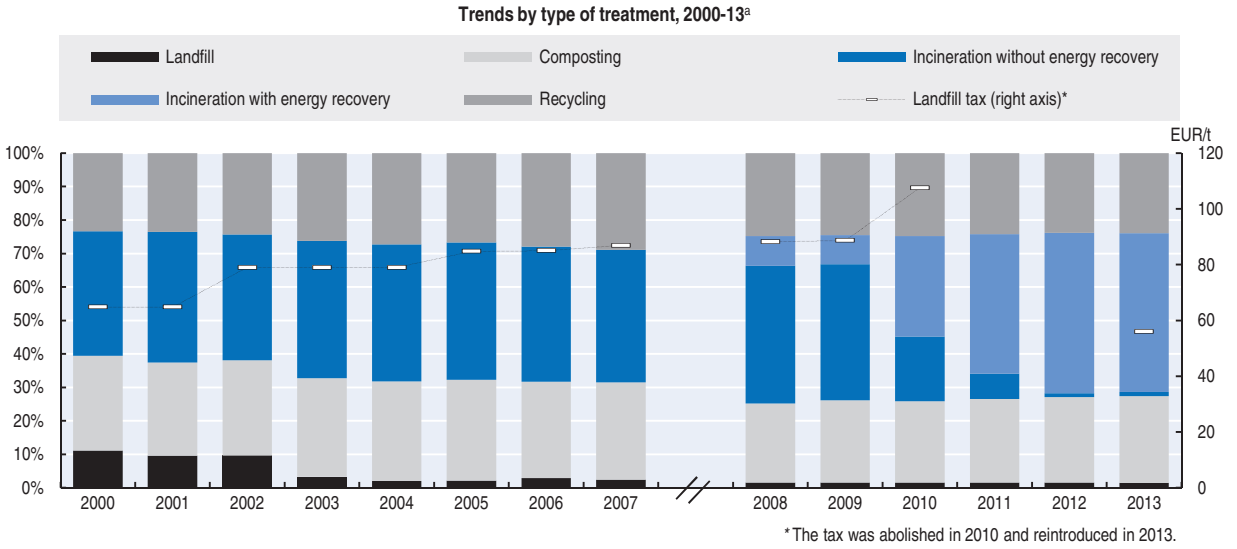
the energy rather than the waste sector (RIVM, 2013). GHG emissions from the waste sector have traditionally been a small contributor to overall emissions; in 2012, they accounted for only 2% of total GHGs (Chapter 1).

The composition of waste emissions has changed over time. In 1990, the bulk of emissions consisted mainly of methane (CH_4) from landfills, with a relatively low percentage of emissions from composting and incinerating. With the decline of landfilling after the ban in 1995, emissions from methane decreased steadily. From the early 2000s, emissions from landfills continued their downward trend, while stricter recycling measures reduced emissions further. Nevertheless, landfills continue to emit methane for decades after a site is closed. The Netherlands has therefore developed emission control systems that recover

Figure 5.4. **Marked shift towards incineration with energy recovery, 2000-13**



a) Waste collected by or for municipalities including household, bulky and commercial waste, and similar waste handled at the same facilities. Includes separate collection for recycling purposes. Up to 2008, data for total treatment exclude amounts undergoing mechanical sorting before further treatment/disposal.
Source: CBS (2015), *Statline* (database); OECD (2015), "Municipal waste", *OECD Environment Statistics* (database).

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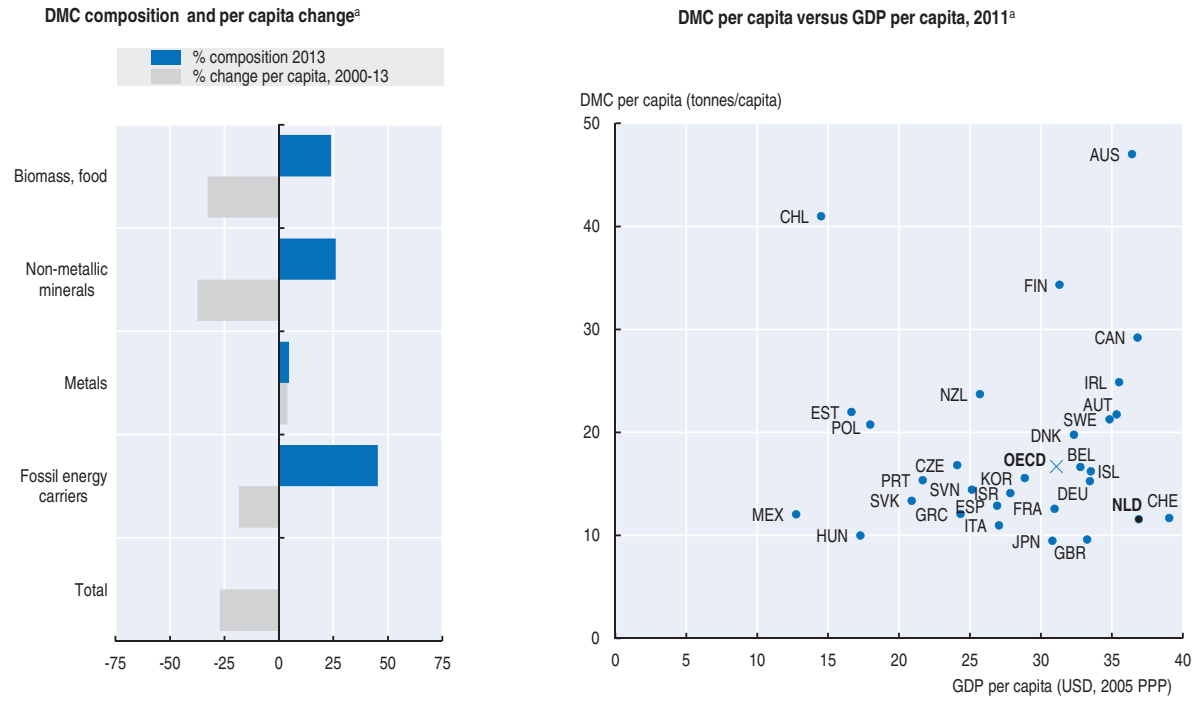
landfill methane before it is released into the atmosphere; it is used to generate electricity, which is an effective emissions reduction strategy (EEA, 2013; CE Delft, 2014a).

Since the second NMWP in 2009, the Netherlands has paid more attention to reducing emissions in product value chains. Most of the energy savings are due to improved recycling, while about one-third of emissions decreased as a result of the shift towards incineration with energy recovery. From 2010, methane emissions from landfills started to have less of an impact on the environment compared to emissions from incineration, which take the form of carbon dioxide (CO_2) and nitrous oxide (N_2O). These emissions were mainly caused by large volumes of plastics in the incinerated waste and the relatively low efficiency of incinerators. Studies have shown, however, that even highly efficient incinerators would only reduce emissions by about one-third compared to increased recycling. From this perspective, high-quality recycling or reuse of recovered materials should be preferred over incineration (Corstena et al., 2013). Although, emissions from incineration are balanced out by the avoided emissions associated with the recovery of energy (EEA, 2013).

3.3. Materials consumption

The Netherlands is one of the most resource-efficient countries in the OECD in terms of GDP per unit of domestic material consumption[4] (DMC) (Figure 5.5). It has a relatively low level of DMC per capita[5], compared to the EU average, which has declined over the review period. This is partly explained by the structure of the Dutch economy, which has a strong service sector and is less focused on manufacturing, which is relatively material-intensive. In addition, upstream raw materials, which are embodied in imports, are not reflected in DMC data. In a small, open economy such as the Netherlands, the impact of such factors on measures of resource efficiency could be considerable.[6] Figure 5.5 shows the breakdown of DMC across materials and the trends in DMC per capita for each category between 2000 and 2013.

Figure 5.5. **One of the most resource-efficient countries in the OECD**



a) Domestic material consumption (DMC) designates the sum of domestic extraction of raw materials used by an economy and the physical trade balance (imports minus exports of raw materials and manufactured products).

Source: OECD (2015), "Material resources", *OECD Environment Statistics* (database); Eurostat (2014), "Material Flows and Resource Productivity", *Environment Statistics* (database).

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4. Performance in managing waste

The Netherlands is one of the OECD's best performers in the area of waste prevention and management and has pioneered comprehensive planning and policy measures. It has set and achieved progressively ambitious targets to increase recycling and other useful forms of recovery (including incineration for energy recovery) across all major waste streams.

A recent evaluation of the NWMPs (CE Delft, 2014a) indicated that waste management costs have risen less than inflation over the period since the plans were in place. Costs have also risen less than in other countries with high-quality waste disposal, such as Germany, Austria and Belgium.

Several important measures put in place in the 1990s helped lay the groundwork for this strong performance. The Waste Decree of 1995 enacted a landfill ban on combustible or biologically decomposable waste if the waste might be reused, recycled or incinerated with energy recovery. The decree specified 35 categories of waste banned from landfilling (EEA, 2013), while a number of exemptions allowed for landfilling where alternative treatment capacity was lacking. To encourage expansion of alternative treatment, a landfill tax was introduced in 1995 (EUR 13 per tonne of waste[7]). In addition to the landfill ban and tax, the government introduced mandatory separate collection for household organic waste in 1994.

This section reviews the performance of various aspects of waste management, highlighting key issues over the review period.

4.1. *From landfilling to incineration for energy recovery*

The government took several steps to build on the progress made in the 1990s to shift waste treatment from landfilling towards recovery. The second NWMP set a quantitative target to eliminate landfilling of combustible waste. The landfill tax on combustible waste has been progressively increased over the 2000s, making it the most expensive method of waste disposal.[8] By 2010, the combination of the landfill tax and operator gate fees resulted in costs as high as approximately EUR 127/tonne compared with around EUR 90/tonne for incineration (ETC/SCP, 2012).[9] No equivalent tax for incineration was introduced during this time.[10] The number of categories of waste banned from landfill increased from 35 to 64. In 2000, the government introduced a moratorium on new landfills and landfill expansion.

The government also encouraged the expansion of incineration for energy recovery. The second NWMP set a target to increase the total waste recovery rate from 83% to 85% between 2006 and 2015. To that end, the government took a number of measures to promote investment in incineration for energy recovery and to liberalise the waste treatment market. First, it removed a moratorium on the expansion of incineration capacity in 2000 and eliminated the requirement for municipalities to use incineration capacity within their vicinity. Second, the government, waste incineration companies and other stakeholders signed a voluntary agreement to increase energy production from incineration plants by 23% between 1997 and 2004. Third, in 2007, the import of combustible waste for incineration (but not landfilling) was permitted. Finally, to reduce costs and share liabilities of investments in incineration for energy recovery, a number of municipalities signed long-term contracts with project developers for waste treatment.[11]

Three important external factors also aided the expansion of incineration for energy recovery within the Netherlands. First, Germany introduced its own landfill ban in 2005, eliminating the possibility for Dutch waste to be exported there and increasing waste available in the Netherlands for potential incineration. Second, the EU changed the rules in 2010 for classifying incineration for disposal and incineration for recovery. These changes allowed efficient incineration plants that produced heat and electricity to be classified as recovery installations, which affected all Dutch incinerators. Finally, with the introduction of renewable energy targets in the EU, the electricity and heat generated by the "biomass proportion" of waste incinerated could count towards national renewable energy targets.

Achieving targets for discouraging waste disposal and encouraging useful recovery have led to a number of side effects. Revenues from landfill taxes fell from nearly EUR 180 million in 2006 to just over EUR 40 million in 2010 (ETC/SCP, 2012). The tax was removed as of 1 January 2012 as a part of the Ministry of Finance's efforts to simplify the tax regime. The removal created a small "rebound effect", increasing landfilling slightly. The tax was re-introduced in 2014 to help defray landfill costs and extended to cover incineration.[12]

Another effect of the marked shift towards incineration for energy recovery has been overcapacity of waste incineration in 2005-10, which led to a significant increase in waste imported from other countries. Finally, measures to strongly encourage incineration for energy recovery may have thwarted progress towards higher rates of recycling (CE Delft, 2014a).

4.2. *Encouraging waste reduction, reuse and recycling*

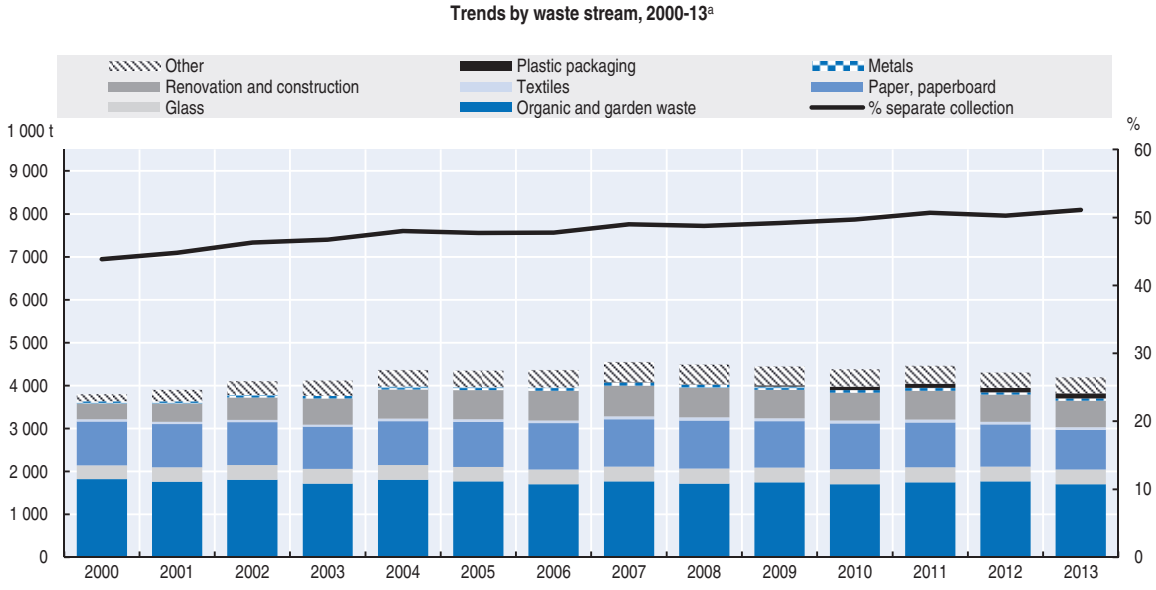
Over the review period, the Netherlands has employed a range of policy instruments to encourage the reduction, reuse and recycling of waste. These include municipal charging schemes, separate collection requirements, voluntary agreements with industry,

and extended producer responsibility schemes, among others. There have also been some efforts to promote the market for recyclables through compensation schemes and price supports for recycled materials.[13] This section reviews several of the key instruments.

Material recovery rates (including both recycling and composting) have not improved much over the review period. Composting makes up about half of material recovery rates of household waste, underlining the important role of mandatory separate collection of organic waste introduced in the 1990s.

One of the main policy goals of the Waste to Resource programme is to halve the volume of Dutch generated waste material that "leaves" the economy through waste incineration and landfilling (from 10 Mt to 5 Mt). This will require a significant increase in recycling rates of MSW and waste from business, government and services ("HDO"). To support this, the government has set targets for the separate collection of MSW and HDO waste aiming to reach 60-65% separately collected by 2015, 75% by 2020 and 100% in the longer term. Figure 5.6 presents the trends in separate collection of household waste in 2000-13. As the rate of separate collection of household waste was just slightly above 50% in 2013, the 2015 target appears out of reach. However, there have been some promising examples of municipalities that have made significant gains in separate collection rates.

Figure 5.6. **Rate of separate collection of household waste grew slowly, 2000-13**



a) 20013: Preliminary data.
Source: CBS (2015), *Environmental Data Compendium* (website).

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Municipal charging systems (along with extended producer responsibility schemes, discussed below) are a key instrument to encourage greater separation of household waste. There are several different types of municipal waste levies used in Dutch cities, described in Box 5.2.

In addition to differences in charging schemes, other factors contribute to differences in rates of separate collection between cities. High population density in large cities allows for "free-riding" in terms of waste separation. Lower-income levels in certain

Box 5.2. **Municipal waste levies**

Under Dutch waste law, municipalities operate and finance municipal waste management. While almost all municipalities impose a waste levy, charging systems and levies vary from town to town.

There are three main types of charging systems in Dutch cities:

- a fixed amount for each household
- a levy that depends on the size of the household
- a "pay-as-you-throw" levy that depends on the amount of residual and separated waste collected (called "Diftar", referring to "differentiated rate").

Overall, the evidence suggests the use of Diftar charging schemes is both more effective and more efficient than alternatives. The Diftar scheme encourages households to separate waste, reducing residual waste and generally leading to lower overall waste charges for households than non-differentiated rate systems. Costs are lowered because the consumer reduces the amount of post-collection separation involved for municipalities, and hence increases the value of the waste.

There are significant regional differences in rates of separate collection. In some areas, generally those using Diftar schemes, separately collected waste accounted for more than 60% of all household waste while it accounted for as little as 7% of household waste in others areas, generally those using fixed charges. This implies significant potential for the broader application of Diftar charging schemes to encourage higher rates of separate collection.

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. Use of the Diftar system has expanded steadily, up from only 13% of municipalities in 1998.

Source: Oosterhuis et al. (2009); Dijkgraff and Gradus (2014).

neighbourhoods can be associated with lower rates of separate waste collection. Finally, less available space for separate collection bins within the average urban households can also deter separation. Below-average performers in separate collection include large cities such as Amsterdam, The Hague and Rotterdam. Promoting post-collection separation of certain waste streams, like plastics, may be a suitable option to encourage recycling in large urban areas (CE Delft, 2011). Box 5.3 illustrates municipal waste management in a major Dutch city.

To promote the exchange of good practice between cities, a national benchmarking system is planned to assess and compare municipal performance in waste generation and separate collection. It is not, however, the intention to prescribe a particular system of charging.

Meeting the targets of the Waste to Resource programme will require increased recycling even in difficult categories such as plastics. Recycling plastics presents both economic and technical challenges. Plastic waste is bulky and low value, which increases costs for collectors. It is also difficult to process. Two recent studies covering deposit-refund systems for plastic bottles illustrate aspects of these challenges (Box 5.4). These challenges are common in other EU and OECD member countries where plastic recycling rates rarely exceed one-third of waste generated.

Despite these challenges, the amount of plastic waste separately collected in the Netherlands has increased significantly in recent years, particularly packaging waste. Extended producer responsibility schemes for packaging waste have contributed to this

Box 5.3. **Municipal waste management in a major Dutch city: The case of Rotterdam**

In Rotterdam, 610 000 people live in approximately 315 000 households. The city produces 290 kt of waste per year, or 475 kg per capita, just below the national average of 525 kg. Of this, 23% is recycled, 77% is incinerated and less than 1% is landfilled.

The main recipient of residual (non-recycled) waste is a recently privatised waste-to-energy plant within the city's boundaries (AVR). The energy generated from this plant produces electricity for the national grid, while a dedicated heat transportation network produces heat for the city. The city is a shareholder in the company that owns the heat transportation network.

Overall, annual costs of waste collection amount to EUR 100 million per year, towards which Rotterdam's households pay EUR 372.50.

Rotterdam has a generally low performance in separate collection. The main reasons are a lack of space in apartments, and the difficulty in monitoring and collecting separated waste from high-rise buildings. Social issues related to poverty also contribute (Rotterdam City Council, 2014).

The aim is to increase the recycling rate from 23% to 32% in 2012-18, while reducing waste management costs by 4%. One such option to achieve this is to provide a cash incentive to customers for separating waste (the "cash for trash" scheme). The city is also looking at options to improve post-collection separation, which may decrease costs, albeit at the risk of potentially lowering the overall quality of plastic recyclate (e.g. the output material from the recycling process) due to technical constraints.

Other cities, such as Arnhem, are promoting separate collection by making residual waste collection more difficult. The "reversed collection" scheme is aiming to do this by providing a higher service level for recyclables and a lower service level for residual waste.

Box 5.4. **Dutch deposit-refund systems for PET bottles**

Wageningen University (WUR, 2012) analysed Dutch deposit-refund systems for large (> 0.5 L) polyethylene terephthalate (PET) bottles in terms of costs, material and energy use. A life cycle analysis covering all processing steps revealed the Dutch system costs between EUR 25-45 million annually and yields approximately 21 kt of PET regranulate (rPET) flakes (or 19 k of regranulates). The analysis found that the economic efficiency of the deposit-refund system is limited, since the produced recycled PET regranulates costs roughly 1.2 to 1.8 times more than virgin PET granulate. Although the system helps reduce the environmental impact of beverage bottles in the Netherlands, its output (rPET) is more expensive than alternatives (virgin PET).

A more recent study on the same issue (CE Delft, 2014b), using a slightly different methodology, updated some of the costs. It suggested the costs of recycling large PET bottles are much lower than those estimated in the WUR study: 1.9 eurocents per bottle rather than 5.9 eurocents per bottle. This would mean that rPET is competitive with, or even cheaper than, virgin PET.

Source: WUR (2012); CE Delft (2014b).

positive trend. In addition, a packaging tax was in place from January 2009 until January 2013. Current plastic recycling rates still only represent around one-third of plastic waste produced (40% of plastic packaging) (CE Delft, 2011).

As discussed above, the rapid expansion of relatively inexpensive incineration for energy recovery may have stalled progress in increasing recycling rates (CE Delft, 2014a). The aim to promote higher recycling rates of Dutch waste is concurrent with the aim to avoid underusing the country's incineration capacity, which is currently too large for national waste treatment needs. Therefore, an increase in imports of residual waste is sought, thereby avoiding a conflict between the business interests of incineration facilities and government's goal of recycling more Dutch waste. The incineration tax, introduced in 2014, is charged on waste generated in the Netherlands, but not on imported residual waste (MRW, 2015).

Close co-operation between government and industry has also contributed to improving waste recovery rates, for example through a system of covenants and "Green Deals". The "Green Deals" programme launched in 2011 is an innovative way of working to remove obstacles to implementing environmental efforts by industry (Chapter 2). The deals consist of agreements between the government and various private parties that focus mainly on removing non-financial barriers related to regulations, legislation or licensing. Box 5.5 provides an illustration.

Box 5.5. **Green Deals to promote industrial recycling: The case of incineration ash**

Given the central role of incineration in waste treatment in the Netherlands, it is also a major producer of residual "bottom ash", which remains after the incineration process. This ash contains a range of materials, including metals and may only be reused under strict conditions.

To promote efficient and sustainable reuse of this ash, the Dutch government and waste incineration sector agreed on a Green Deal: in return for reprocessing (cleaning up) the bottom ash by 2020, the incinerators can market the (non-metallic) output as building material.

As a midpoint target, the deal aims to reprocess half of the ash by 2017. The agreement depends on the availability of necessary reprocessing technologies; the government and industry (operators of incineration and reprocessing plants) are working together on this issue.

Source: Dutch Waste Management Association (2014).

Given that recovery rates are already so high, the focus in recent years has been on increasing the quality (as opposed to the quantity) of recycled waste. One objective of the Waste to Resource programme is to help waste producers and traders better define when waste becomes product (e.g. "end-of-waste"). To support these efforts, the government has developed an e-tool for companies to make their own assessment of the quality and status of materials. The government also plans to develop further recycling standards for high and low quality waste. Such standards may be difficult to implement for waste that can be exported for treatment in other parts of the EU and beyond. The introduction of such standards in the Netherlands needs to consider the impact that overly stringent standards could have on waste exports.

Extended producer responsibility schemes

The Netherlands was one of the first OECD member countries to introduce extended producer responsibility (EPR) schemes in the 1990s and has benefited from experimentation with various approaches and extensive dialogue with stakeholders. Producers' responsibility was first referenced in a voluntary agreement on packaging waste in the 1990s (Box 5.6). Voluntary agreements for EPR were subsequently established for other waste streams, such as batteries, end-of-life vehicles (ELV) and waste electrical and electronic equipment (WEEE) (Box 5.7).

Box 5.6. **EPR scheme for packaging waste**

In the Netherlands, producers and importers of packaging are legally responsible for the prevention, collection and recycling of packaging and packaging waste. This producer responsibility is the implementation of the EU Directive on Packaging and Packaging Waste (Directive 94/62/EC); this directive has been implemented in Dutch national legislation by the Packaging Management Decree of 2014. To put the decree into effect, industry, municipalities and national government negotiated how responsibilities of producers and importers should be fulfilled, such as the recycling rates. This resulted in a private law arrangement, the "Packaging Agreement" in 2008-12 (Afvalfonds Verpakkingen, 2013). The agreement sets a number of recycling targets for packaging waste. Efforts to meet the targets are facilitated by a "Packaging Fund" organisation, which was a not-for-profit until 2012 and is now a private organisation.

The EPR scheme for packaging is one of the most important in the Netherlands in terms of tonnage and the impact on recycling, especially plastic. According to Eurostat, the volume of packaging waste generated in the Netherlands during 2003-12 has decreased by about 20% (from almost 3.5 Mt to less than 3 Mt). The targets of the EU's Packaging Directive (60% recovery and 55% recycling by 2014) have already been achieved in the Netherlands.

The most recent Packaging Agreement set ambitious national recycling targets for packaging materials in 2013: 43% of plastics, 90% of glass, 75% of paper, 85% of metal and 27% of wood. Each year, the targets for plastics and wood will be raised by 1% and 2% respectively until 2022, when the targets will be fixed at 52% for plastics and 45% for wood. The fulfillment of these plastic packaging collection targets would put the Netherlands among the world's best performers in terms of recycling rates. However, the cost of recycling plastics remains high. Therefore, the agreement contains incentives to reduce costs. The economic arguments in favour of higher recycling rates of plastics (see CE Delft, 2014b) are stronger if the full environmental costs of incinerating plastic waste instead of recycling it are considered. In purely financial terms, however, incineration is generally cheaper.

Source: CE Delft (2014b).

EPR schemes aim to increase collection and recycling rates of targeted waste and to shift financial responsibility of waste management from municipalities to producers.[14] In such schemes, producers manage waste generated by their products from production to disposal; this promotes the integration of environmental costs associated with goods' end-of-life costs into their market price. To meet the requirements of EPR schemes, producers organise and finance collective producer responsibility organisations (PROs) that collect or recycle end-of-life products on behalf of their members, or contract a third party to do so.

Several pieces of EU legislation refer to EPR as a recommended policy instrument, including the EU Waste Framework Directive and four other directives on collection and

Box 5.7. **EPR scheme for waste electrical and electronic equipment (WEEE)**

The Netherlands has an extensive network for the collection of WEEE and two PROs (Wecycle and WNL) work to collect and treat consumer WEEE. Other PROs are in charge of business WEEE. Under current EU rules (Directive 2002/96/EU), the Netherlands must collect 4 kg of WEEE per capita. This target was easily met and exceeded in the past decade, with the amount of WEEE collected in 2010 through official channels amounting to 7.5 kg per capita. Under the revised EU directive (Directive 2012/19/EU), the collection target will be a percentage of all WEEE produced in a country. By 2019, the Netherlands will be required to collect 65% of WEEE placed on the market or 85% of WEEE produced.

Lack of data on actual or estimated amounts of WEEE generated make it challenging to reach, and even measure progress towards, these targets. For example, WEEE can "leak" (be unaccounted for) if it is illegally shipped out of the Netherlands, hoarded in basements or left unrecorded as WEEE by recyclers. In 2012, Wecycle commissioned an extensive study to improve this information base (see Huisman et al., 2012).

Source: Huisman et al. (2012).

recycling targets in specific waste streams (packaging, batteries, ELVs and WEEE). Many of the Netherlands' EPR obligations derive from EU law, yet the national government has discretion as to how these obligations are implemented.

The systems in place for managing EPR schemes in the Netherlands have evolved considerably over recent years. Initially, for example, a number of schemes each covered a range of packaging materials. This led to problems with too many PROs covering too many separate waste streams. This approach, complex for both authorities and businesses, was replaced by a system of taxation that helped increase coverage of the waste streams, but also increased the regulatory burden. Finally, the system evolved to one based on PRO charging instead of taxation, with centralised control. Overall, this system enjoys both greater economies of scope (compared with having a large number of PROs) and reduced administrative costs (compared with a taxation-based system).

Over time, Dutch EPR schemes have been improved by broadening coverage (hence less "free-riding"), improving financial soundness (making charges broadly reflect costs), improving organisation and increasing transparency. The level of information available on certain waste streams has also improved through specific dedicated studies, in particular for WEEE.

Direct comparisons with EPR schemes in other countries are difficult (Bio, 2014), however, several general observations can be made. First, Dutch EPR schemes are, for the most part, based on the system of financial responsibility; producers pay for, but do not necessarily manage, them. Second, Dutch EPR schemes are relatively well-organised, with clear rules compared to other countries. Third, EPR schemes in the Netherlands are seen as highly effective, but may result in medium-to-high costs due in part to the aim for cost recovery through charges. In most cases, there is limited or no competition between PROs, which may, in theory, reduce incentives to reduce costs.[15] Finally, PROs will need to evolve in order to support the transition to the circular economy, which may require new activities.

4.3. Managing waste trade flows

The Netherlands' status as a major importer and exporter of waste expanded considerably during the review period. The main legislative instrument governing waste

shipment is the European Waste Shipment Regulation (WSR). It regulates the shipment of waste within, to and from the EU with a view to protecting the environment both within the EU and internationally. The regulation applies directly to EU member states, but governments have some discretion in certain areas, such as how to supervise its enforcement. In the Netherlands, the WSR has been transposed mainly via the EMA and the Economic Offences Act. The Human Environment and Transport Inspectorate (ILT), Customs and the police service inspect several thousand waste shipments every year for compliance with legal requirements (Algemene Rekenkamer, 2012).

In 2012, the Netherlands Court of Audit released findings from an audit of the Dutch government's enforcement of the WSR. The report found the country complies with requirements to control waste shipments and imposes appropriate penalties. However, it also found the high percentage of decisions not to prosecute offenses was a matter of concern (Algemene Rekenkamer, 2012). Other areas for improvement highlighted by the findings include better information management to gain more insight into the impact and effectiveness of inspection and enforcement, as well as of the WSR system itself.

In line with the broader trend of increasing waste trade flows, trade volumes of hazardous waste increased substantially over the review period. By 2009, the Netherlands was the EU's largest exporter of hazardous waste and third-largest importer behind France and Germany (European Commission, 2012a). These trade flows reflect the level of specialisation of north-western European countries in different types of hazardous waste treatment. For example, the Netherlands is well-equipped to treat certain types of hazardous waste, like contaminated soil, while it lacks facilities to process other types, such as battery waste. Trade flows have also increased because hazardous waste previously landfilled is now increasingly destined for recovery. This facilitates trade, as EU rules for recovery are less stringent than those for disposal.

Under the WSR, trade in hazardous waste outside of the OECD is subject to significant restrictions, particularly with respect to disposal. Nevertheless, illegal trade does occur, and can have significant environmental and social consequences when exported to countries that lack environmentally-sound treatment facilities. In certain cases, lack of expertise of front-line customs and port staff, as well as unclear procedures for dealing with illegally shipped waste, can lead to errors. In the *Probo Koala* case of 2006, for example, Dutch port authorities turned away a shipment of hazardous waste, which was subsequently exported to the Ivory Coast (Box 5.8).

Another challenge in managing trade in waste for Dutch authorities relates to the broad definitions applied to waste by different countries, most notably to scrap metal, plastic and paper waste. Traders may wish to import and export this waste, but it may be categorised as hazardous in some cases. The EU's WSR does not always set quantitative limits on the level of contamination that classifies waste as "hazardous". This complicates the enforcement of waste shipment rules. The introduction of "end-of-waste" rules by the EU should help address these issues and simplify the legal trade of such materials within the EU and OECD.

In the future, a main challenge will be to ensure that similar types of waste are treated in an environmentally-sound manner in neighbouring countries. At the very least, countries that trade significant quantities of waste should use a common definition of recycling. There have been cases reported whereby waste exported for recovery is treated through certain waste treatment methods (e.g. backfilling[16]), which would not be permitted in the Netherlands (Zero Waste, 2014).

Box 5.8. **Waste shipment challenges: The *Probo Koala***

In July 2006, the *Probo Koala* tanker docked in the Port of Amsterdam to discharge sludge (washing water and oil residues released after cleaning with caustic soda) from its hold for processing. When the 550 cubic metre (m^3) hold was emptied, the sludge proved to be considerably more polluted than the ship's operating company, Trafigura, had stated. The recipient company was only prepared to accept and process the sludge at more than 10 times the cost originally quoted. The sludge (250 m^3) was pumped back into the tanker, and Trafigura reported to the Amsterdam Port Authorities that it would be managed safely elsewhere. Because the sludge had been pumped back onto the tanker, it became the *Probo Koala*'s cargo, and hence a waste shipment. The tanker sailed for Estonia, where the tanker took on a cargo for Nigeria. After delivering this cargo, the *Probo Koala* sailed to the Ivory Coast, where Trafigura found a local company willing to accept the sludge. The sludge was dumped at night in public sites in Abidjan, creating respiratory illnesses and reportedly several deaths (Eze, 2008; ECA, 2013).

The shipment of the sludge to the Ivory Coast violated the WSR. The Netherlands Court of Appeal found that Trafigura was aware of the chemical composition of the sludge and exported it illegally to the Ivory Coast. A fine of EUR 1 million was imposed on the company in 2011 (ECA, 2013).

The European Court of Auditors has cited this case to illustrate the importance of proper enforcement of the WSR. In short, the decision to pump the sludge back into the tanker should not have been permitted. A lack of clear communication between port workers and waste shipment experts contributed to this error. Therefore, the case highlights the importance of good communication between waste experts and customs officers, as well as the need to put in place comprehensive waste shipment training for front-line staff.

In light of this incident, front-line customs officers in the Netherlands were trained in the enforcement of the Waste Shipment Regulation and instructed on when to consult a specialist from the Environmental Inspectorate. Other front-line environmental or customs officers have been told to consult a colleague with special training in the enforcement of the WSR when dealing with actual or potential waste shipments.

Source: Eze (2008); ECA (2013).

Enforcement authorities also face the challenge of properly managing the risks related to trade in waste. To this end, Dutch authorities have introduced a risk-based enforcement and compliance system to assess the probability and potential impact of non-compliant waste shipments. Despite the relatively large number of inspections by customs, environmental enforcement authorities and police, illegal waste shipments still occur and cannot be eliminated completely. In 2010, for example, 20% of road haulage to Germany involved waste transport; an estimated 7% of the freights were illegal (Scharff, 2014), a figure in line with other EU countries (Joas and Gressmann, 2011).

The public prosecutor declines to prosecute about 30% of detected illegal waste shipments, well above the target of dropping 10% of cases involving environmental charges (ECA, 2013). As discussed above, this was noted as a cause for concern by the Netherlands Court of Audit (Algemene Rekenkamer, 2012). While these issues represent problems for all OECD member countries, they are particularly important for an open, trading economy with Europe's largest port, the Port of Rotterdam.

4.4. Strengthening waste management performance

The Netherlands has a long record of strong performance in waste management. The Netherlands Environmental Assessment Agency, PBL, considers waste management to be a well-established environmental issue, which it describes as being in "the monitoring and enforcement phase" (PBL, 2013a).

As a pioneer of sustainable waste management planning in the OECD, the Netherlands has generated a range of good practices for other countries to learn from. Furthermore, the Netherlands excels in a range of areas that have presented problems for other countries, including the provision of relatively high-quality waste data, monitoring and enforcement, and raising public awareness. The Netherlands has examined and applied a relatively large range of waste policy measures and instruments (economic, regulatory and information-based) since the 2000s, and has developed a good understanding of what works and what does not. Finally, the country is one of the best performers in the OECD in MSW management, while keeping household waste charges at some of the lowest levels in OECD Europe and achieving nearly full cost recovery (CE Delft, 2014a); this is a considerable achievement.

Co-operation between different levels of national, regional and municipal government, as well as stakeholders is impressive. The early and active involvement of stakeholders in decision-making processes is noteworthy. Waste management planning is comprehensive, in terms of broad coverage of the issues and the level of detail considered. Roles and responsibilities of the various actors are clear. The periodic revision of the NWMPs means that waste management planning is dynamic and flexible and can respond to emerging trends.

Some of the main challenges relate to setting future objectives, managing interactions among various policy instruments and trade-offs against other environmental and economic objectives, and accounting for regional dynamics. For example, progress in increasing material recovery (including both recycling and composting) during the 1990s stalled somewhat after 2000. At the same time, incineration for energy recovery has taken off, leading to overcapacity in the sector and likely thwarting efforts to increase recycling. The overcapacity in incineration has contributed to the significant increase in trade in residual and non-residual separated waste between the Netherlands and its neighbours. The import and export of residual waste for energy recovery is in line with the EU's proximity principle. But the growing level of imported residual waste, in particular from the United Kingdom, and indeed trade in hazardous waste between the Netherlands, Belgium and Germany, would suggest that regional waste markets are already a *de facto* reality. As such, these cross-border issues should be more fully considered in Dutch waste management planning.

As described in Chapter 3, the Netherlands could consider such an emission-based tax on incineration as an alternative to the input-based tax now in place. This would provide a much more direct incentive to operators of incinerators to limit as much as possible environmental damages related to the combustion process. The coverage could also be extended to include emissions from the combustion of imported waste, which cause the same environmental harm as those from domestic waste. The environmental damage caused by landfilling and incineration varies with the quality of the facilities. While it can be complicated to measure (some of the) actual emissions from a landfill, this is relatively simple to do (and is actually done) at an incinerator. More than ten years ago, for example, Norway introduced a tax on measured emissions of a number of pollutants from each

incinerator.[17] Due to concerns about competition with Swedish incinerators, this tax has since been abolished.

Higher rates of separate waste collection and recycling could be encouraged by expanding Diftar charging schemes or other schemes, such as reversed collection. Large Dutch cities have some catching up to do in this area. The planned benchmarking of municipal performance can help identify and spread good practices. The implementation of the recycling targets could be assisted by a cost-benefit analysis that would support the economic case for ambitious targets.

In the area of EPR schemes, the country has benefited from a significant amount of experimentation and refinement over the years. Efforts to address information shortcomings about the flows of certain important waste streams, such as WEEE, are notable and an example for other countries facing similar problems. These efforts can also be expanded within the Netherlands to improve information on flows of other specific waste streams. In general, EPR schemes can be improved to make them easier to administer and to continue to reduce regulatory burden on firms.

Future challenges concern how EPR schemes can further encourage individual producer and or importer responsibility and promote the circular economy. To support the transition to the circular economy, it will be important to explore ways for EPR schemes to go beyond just waste management and promote systems that have an influence on sourcing, design and consumption phases, as well as improve the quality of recycling. Options to further promote the separation of plastic waste during collection without increasing costs of waste management should be explored. Greater competition between PROs could be considered once EPR schemes have matured.

In contrast with other waste streams, there are no specific targets for reducing hazardous waste in the NWMPs. An explicit objective for the reduction of hazardous waste in the next NWMP could encourage the exploration of cost-effective options to curb the growth on the generation of this waste.

Finally, the third NWMP expected in late 2016 will give greater attention to the quality of outputs from recycled waste. The Netherlands has some experience with encouraging markets for recyclates or recyclables. At the EU level, the development of such markets has been promoted by new rules on “end-of-waste”. Promotion of recycling markets is in line with OECD guidance (OECD, 2007). It remains an open question, however, how recycling markets can be developed in the context of free trade in such materials within the EU and OECD. For example, it may be more effective to promote recycling standards at the EU level or within the OECD, rather than at the national level. Reaching common views on, for example, what is meant by recycling and landfilling and what standards should apply in a multilateral context may help the Netherlands meet its own targets.

5. Towards a circular economy

While the Netherlands has a long, strong record in waste management, policy efforts to move from “end-of-pipe” waste management issues to improving resource efficiency further up the material and product value chain are considerably less developed, as in other OECD member countries.

The concept of circular economy emerged to stimulate a departure from linear economic and industrial processes (“resources to waste”) that deplete finite resources by making disposable products. The circular economy represents a life cycle approach to

maximise value creation in each link of the system. The overarching goals are to enhance the restorative capacity of natural resources, improve the reuse and recycling of products and raw materials, phase out waste and hazardous substances, and transition towards renewable and sustainable energy supplies.

In recent years, the Netherlands has begun laying the groundwork towards a circular economy. It has formulated its own national policy, while actively contributing to international efforts to promote resource efficiency. This section reviews the main challenges in moving towards a circular economy, recent performance of the Netherlands and next steps that can encourage further progress.

5.1. Main challenges in the move towards a circular economy

The new focus on a circular economy has brought a number of policy design and implementation challenges compared to traditional waste management. First, in traditional waste management, the government has taken the lead in planning, target setting and implementation (at the appropriate level of government) of regulatory and economic policy instruments to meet objectives. While this approach has been very successful, a circular economy requires a different type of engagement with a broader range of actors influencing decisions about resource use. Specifically, it must engage a diverse set of companies, including those producing and selling products to end consumers; this is a much more diffuse group than those typically engaged in traditional waste management. Further, new business models may be required to put the circular economy into operation.

The role of government in a circular economy is also different than in traditional waste management. Since the early 2000s, the Netherlands has gradually shifted its approach to environmental policy formulation. Moving from "command-and-control" style planning, the government is now playing a more hands-off role using incentives and innovation to change business and consumer behaviour. Further, it recognises that the transition towards a circular economy is complicated and novel, requiring a certain amount of trial and error to reach a robust policy.

Moreover, the identification of realistic objectives, development of indicators and the measurement of progress for resource efficiency is complex. The choice of indicators to measure progress is still the subject of debate. In its 2011 Roadmap, the European Commission proposed a three-layered approach to setting performance indicators: one overarching or lead indicator based on resource productivity (DMC/GDP); a dashboard of macro-indicators focused on resource and environmental impacts and a third layer of thematic indicators (European Commission, 2011). However, PBL has criticised the use of the DMC/GDP indicator for a number of reasons[18] (PBL, 2013b). Given that in June 2014 the Commission put forward a proposed EU-wide target to reduce DMC by 30%, the outcome of this debate could have considerable consequences.

The discussion about appropriate targets raises a more fundamental question of what should be the ultimate aim of greater resource efficiency and the move towards a circular economy. While policy makers generally agree on the need to reuse resources and produce more with less, agreement on the extent of the desired change is more elusive. For example, PBL suggests that resource use in the Netherlands may need to drop substantially to reach sustainable levels (PBL, 2013b). Yet, it is difficult, if not impossible, to assess at what stage an economy has reached an "optimal" point in its transition towards a circular

economy. With already relatively high rates of material recovery (recycling and composting), the Netherlands has made significant progress towards becoming a leader in improving efficiency in a linear economy; it still has much further to go in transition towards a circular economy. Potential gains in the transition to a more circular economy are still substantial for the Netherlands with important opportunities for improvement.

Further, existing legislation (in the areas of waste, chemicals) may create barriers in the move towards a circular economy. For example, strict rules exist on the definition of waste and when it can be considered a product. These rules serve to protect producers, consumers and the environment. However, they often cause secondary resources to be regarded as waste, which hampers the development of markets for these materials. The challenge is to facilitate these markets, while still meeting the objectives of the legislation.

Finally, there is also an important political economy dimension to this transition. The move towards a circular economy will result in winners (e.g. service companies and downstream product manufacturers), as well as potential losers (e.g. metal processing companies and primary extraction companies). The challenge for the Netherlands is how to navigate these political economy issues, including developing policies to minimise impacts on potential losers (PBL, 2013b).

5.2. Accelerating the shift towards the circular economy

Even without a formal, comprehensive resource efficiency policy, the Netherlands became more resource-efficient for most material groups over the review period. There was absolute decoupling for all categories except metal, which achieved relative decoupling (CBS, 2013).

Throughout the review period, the government set out a number of policy documents supporting the drive towards resource efficiency. Although the second NWMP continued to focus mainly on post-industrial and consumer waste, it signalled a shift from focusing on waste *per se* to focusing on resources more generally. The plan included a specific "chain-oriented" objective aimed at reducing the environmental impact of seven priority waste streams by 20% by 2015 (Box 5.9). A recent evaluation suggested it is doubtful this target would be met, or that it is even measurable.

Box 5.9. **"Chain-oriented" objectives and targets in the second NWMP**

One of the main objectives of the second NWMP was to reduce, by 20%, the environmental impact of seven priority waste streams in the Netherlands by 2015. These priority sectors included paper and cardboard, textiles, construction and demolition waste, organic/food waste, aluminium, PVC and bulky household waste. By applying the "cradle-to-cradle" (or full life cycle) concept to these waste streams, the policy aimed to achieve the environmental impact reduction target not only at the product's end of life, but also during its manufacture and use.

A recent analysis expressed doubt the 20% target would be met by 2015 and questioned the measurability of the target. It indicated the policy had had some positive environmental impact, even if difficult to measure and had promoted good co-operation among stakeholders. The study also noted that more progress was made in certain sectors (e.g. textiles) than in others (e.g. aluminium).

Source: CE Delft (2014a).

In addition to the "chain-oriented" objectives in the second NWMP, green public procurement has been used effectively to promote resource efficiency. In this area, the Netherlands is reputedly one of the best performers in Europe (CEPS, 2012).[19]

Several early voluntary initiatives and agreements have also been used to encourage resource efficiency and the sustainable use of resources. For example, the Sustainable Trade Initiative (IDH) is a private sector-led organisation, supported by the government, which aims to ensure raw material imports have been extracted or harvested sustainably. Another example is the Phosphate Value Chain Agreement (Bastein, 2013), a "Green Deal" concluded between the government and private companies in 2011 (Box 5.10). This agreement is unique in seeking to improve resource efficiency in a key economic sector while addressing the politically-induced security of supply issues, which continue to concern industrial users of raw materials.

Box 5.10. **Phosphate value chain agreement**

With its large agricultural sector, the Netherlands consumes substantial amounts of phosphates, a mineral used to manufacture phosphorus-based fertiliser. Phosphates are primarily mined in Morocco and China. Steep price increases in the late 2000s led to concerns over the potential impacts of a supply shortage on the food industry in the Netherlands and the EU in general, given their dependency on imported phosphates. Further, because phosphate mining is water-intensive, it was recognised that intensifying competition for water resources in a few water-scarce, phosphate-producing regions could disrupt phosphate supply chains.

At the same time, a number of Dutch stakeholders began to promote the possibility of "mining" secondary phosphate, for example from wastewater and manure. This could also help the Netherlands reduce excess phosphate in Dutch rivers and lakes, a source of water pollution.

In 2011, the government brought together 20 water, chemical, food industry and agricultural stakeholders through the "Nutrient Platform" to turn the Netherlands into a net exporter of secondary phosphate. The "Phosphate Value Chain Agreement", a "Green Deal" (see Chapter 2), was signed that same year.

There were a number of challenges to overcome. Success required bringing together stakeholders along the value chain that do not normally work together and promoting trust, even where certain parties might stand to benefit more than others and no government incentives (such as subsidies) were available. Legislation covering the use of recovered material (in particular if it contained heavy metals or other pollutants) also created a barrier. In response, the government set new rules for use of recovered phosphates as fertiliser in the Netherlands, which came into effect as of 1 January 2015.

Another challenge relates to promoting investment in a secondary phosphate market in the context of a highly volatile commodity market. For example, the price of phosphate rock rose from USD 50 to USD 450 in 2007-08 as a result of supply issues in China. The price then fell to USD 100 in late 2009. While price volatility can induce greater resource efficiency, it can also impede investments in alternatives. To this end, the Nutrient Platform aims to facilitate co-operation between innovative companies and financial institutions, with the objective of fostering innovation in the sector.

Finally, an additional factor affecting efforts was the significant drop in use of phosphorus per hectare (ha) in the Netherlands from almost 40 kg/ha in 1990-92 to just over 10 kg/ha on average between 2007-10 (OECD, 2014b). The impact of this decline on the development of the Phosphate Value Chain Agreement is unclear.

Box 5.10. **Phosphate value chain agreement** *(cont.)*

Overall, this agreement is an example of good practice in terms of how to promote resource efficiency through stakeholder co-operation without the promise of large state subsidies. It also illustrates the complexity of developing competitive secondary raw materials markets.

Source: Bastein (2013).

Recently, the government has taken further steps to support the move to a circular economy. It published the first Waste Prevention Plan in 2013 as required in the revised Waste Framework Directive (Directive 2008/98/EC). In the plan, the government outlines how it proposes to move beyond recycling and incineration measures to encourage better reuse of resources.

In January 2014, the State Secretary for Infrastructure and the Environment outlined the details of the Waste to Resource programme. The programme sets out eight high-level objectives and actions (summarised in Table 5.1). Sustainability at the front of the value chain is pursued through sustainable sourcing, ensuring the circular design of products, as well as closing local and global cycles. This consists of designing sustainable products that can be easily repaired and recycled. Closing cycles implies a more sustainable use of natural resources, such as land, water, ecosystems and raw materials.

Moving along the value chain, another key element of the programme is promoting more sustainable consumption patterns among consumers. This would be achieved through promotional campaigns and other methods, which need to be informed by a solid understanding of consumer behaviour. Another key element concerns more traditional waste management objectives. These include improving waste separation and collection by minimising the quantity of residual waste and simplifying laws related to reuse and recycling. Finally, the programme would be supported by financial and market initiatives (such as redesigning the landfill tax and other fiscal measures to promote circular economy objectives); by improving information about waste streams; and by developing indicators.

As the vast majority of actions are in progress or planned, it is too early to evaluate their impact. Nevertheless, some general observations can be made. Notably, the objectives and actions in the Waste to Resource programme directed at the early phases of the circular economy cycle are generally less detailed and concrete than those for waste management. For example, while there are time-bound targets for waste management, the proposed lines of action for the circular economy are generally less specific and lack time-bound targets. In certain cases, more analysis and exploration of options are proposed. In collaboration with stakeholders, the next steps will need to include developing more specific goals for each line of action.

While exploration makes sense in the early stages of development, the programme could elaborate more detailed measures for areas that are particularly important, such as promoting reuse and repair options. This area could bring a number of benefits in comparison with recycling. While the Waste to Resource programme encourages "reuse by strengthening the role of the retail sector, thrift stores and repair companies", it is not clear how this will work in practice and which actors will be needed to engage (e.g. electricians). This area is now part of an action programme (RACE), part of the Waste to Resource

programme. As consumption patterns are often influenced by the relative difference between the cost of buying a new good and servicing an old one, the role of the services sector and the economic implications need to be further elaborated. Moreover, issues relating to product lifetimes, such as planned obsolescence and warranties, as well as the role of bring-back/product leasing schemes, are only mentioned for chemicals, but not other areas.

Aside from considering the design of the landfill tax, limited attention is paid to waste and resource taxation. Indeed, a resource tax could be unpopular and difficult to apply, even if its impact on heavy industry may not be as great as often claimed (PBL, 2014). Still, the Waste to Resource programme could elaborate more on how environmentally related taxes could support resource efficiency. The forthcoming progress report on the programme should shed further light on this.

Given the highly open nature of the Dutch economy, the programme could further incorporate trade considerations. For example, there is a specific reference to the "True Price Platform" in the programme. In this initiative, the environmental impact of Dutch consumption of imported cotton has been factored into actions to promote sustainable textiles. The general approach taken in such initiatives could be more broadly applied. Likewise, the influence that economic and security of supply issues can have on resource efficiency goals, such as those which came to light during the formulation of the Phosphate Value Chain Agreement, should also be considered.

In summary, putting the vision for the circular economy into action in a cost-effective way will require realistic targets informed by cost-benefit analysis. It will also require overcoming challenges presented in this new area, such as the need to develop new business models and approaches for working across whole product chains, dealing with commodity price volatility and defining a new role for the government. The development of a coherent roadmap for implementation, as well as indicators and monitoring, would be important next steps.

Recommendations on waste and materials management

- Maintain absolute decoupling of waste generation from GDP to avoid a potential rebound as the economy recovers by reinforcing efforts to reduce waste generation in the next iteration of the National Waste Management Plan. Consider an objective for the reduction of hazardous waste in the next iteration of the National Waste Management Plan, which was not done in previous plans.
- Consider the design of an emission-based tax as an alternative to the input-based tax now in place for the waste tax. This would provide a much more direct incentive to operators of incinerators to limit the environmental damages related to the combustion process as much as possible. Since environmental damages occur regardless of the origin of the waste treated, removing the exemption on imported waste could also be considered.
- Encourage broader uptake of schemes, such as "Diftar" charging schemes and reverse collection, which have been shown to promote greater separation of waste and lower the cost of treatment. There is significant scope for uptake in medium and large cities. Encourage measures to promote further separate collection of plastic waste, without increasing waste treatment costs.

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

- Explore ways for EPR schemes to support the circular economy by going beyond just waste management and promoting systems that have an influence on sourcing, design and consumption phases; improve the quality of recycling within EPR schemes.
- Continue to support and reinforce efforts to minimise illegal waste trade, such as through the use of the risk-based approach to identify possible waste shipments, as well as to ensure that such waste is properly handled once identified. This may call for further increased investment over the coming years to strengthen efforts to enforce EU and international laws on waste shipments.
- Develop a roadmap for specific actions to promote the circular economy and a timeline for implementation; strengthen product policies to deliver stronger incentives for designs that are conducive to the circular economy, such as through product labelling and information, as well as specific design criteria where appropriate; promote reuse and remanufacturing, including through fiscal incentives (such as lower VAT for repair services), minimum quality standards and warranties, legal requirements on the availability of information and spare parts for repair and facilitating (as appropriate) recycling, refurbishment, reuse and repair in the relevant legislation.
- Encourage innovation through the Green Deals approach; develop policies that can support the emergence of new business models conducive to the circular economy, such as those based on services rather than the sale of goods; explore dynamic standard setting that can spur innovation; use green public procurement to support the circular economy.
- Put in place policies and measures that help to overcome information barriers and issues with access to finance, in particular for SMEs where the capacity to identify and implement resource efficiency opportunities is more constrained.
- Prioritise the development of indicators to monitor resource productivity and progress towards a circular economy; consolidate and further develop material flow accounts by industry and improve the coherence between waste and material flow statistics (especially for secondary raw materials and recycling rates); encourage the inclusion of circular economy and resource productivity indicators (physical and financial data) in reporting by businesses and financial institutions.

Notes

1. The second National Waste Management Plan (2009-21) contains 84 sector plans.
2. In addition to the EMA, a number of other laws, decisions and regulations govern waste and materials management.
3. MSW is comprised of household and other municipal cleaning services/other waste. The vast majority of the latter comes from litter and similar organic waste.
4. DMC is 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).
5. DMC per capita declined from 12.6 to 9.2 kg per capita in 2000-13 (OECD Environmental Statistics).
6. For example, accounting for indirect use of raw materials (for instance in a "material footprint" indicator) could increase average materials consumption per capita significantly, as compared to the DMC measure. One recent study estimates the Netherlands' "material footprint" to be closer to 26 tonnes per capita or 427 Mt in total (Wiedmann, 2013), around two and a half times the DMC figure.
7. From 1998, the tax was linked to the landfill ban and differentiated according to whether the waste being landfilled was combustible or non-combustible. Combustible waste with a density under

1 100 kg/m^3 was charged at the high tax rate while non-combustible waste with a density over 1 100 kg/m^3 subject to the lower tax.

8. Initially, the landfill tax was set at just under EUR 30/tonne in 1996-98, but was more than doubled in 2002 to EUR 65/tonne. In 2005, it was raised further, to EUR 85/tonne (Oosterhuis, 2009).
9. Incineration gate fees subsequently fell as low as EUR 50/tonne in 2014.
10. The Netherlands did have an incinerator tax in place with the rate was set at EUR 0/tonne.
11. These projects were often established as not-for-profit organisations, whereby profits generated were redistributed back to municipalities. Public ownership of incineration by municipalities remained high until recent years.
12. The landfill tax rate was EUR 13/tonne in 2015. Landfill costs are estimated to be about EUR 18 million per year, including the maintenance costs of closed landfills. Together, the landfill and incineration taxes are expected to generate EUR 100 million per year.
13. For example, guaranteed prices were put in place for recycled paper, glass and other types of packaging.
14. A mix of policy instruments can be used, including product take-back requirements, economic and market-based instruments (e.g. deposit-refund schemes, material taxes, etc.), regulations and performance standards (e.g. minimum recycled content) and information-based instruments (e.g. product labelling requirements) (OECD, 2014a).
15. While competition in the area of EPR may have benefits from both an eco-design and cost perspective (OECD, 2014a), it is difficult to determine if competitive or centralised EPR schemes are more cost effective given the lack of comparable information on the performance of various EPR approaches (BIO, 2014).
16. According to the European Commission, "backfilling" means a recovery operation where suitable waste is used for reclamation purposes in excavated areas or for engineering purposes in landscaping and where the waste is a substitute for non-waste materials.
17. For a description of the Norwegian tax on waste incineration, see OECD (2004).
18. Among the criticisms of using a lead aggregate indicator is that it may have a cancelling out effect where a negative performance in one area is countered by a positive performance in another, even when the two variables are not strictly comparable. Second, since DMC is based on tonnes and not on the environmental impact of using the constituent materials, the indicator may discriminate against countries that use large amounts of certain material (e.g. gravel), which do not have a large environmental impact. Finally, DMC does not account for the materials and other resources used to make imported semi-processed and processed goods.
19. In 2009, the Netherlands, alongside Austria, Denmark, Finland, Germany, the Netherlands, Sweden, and the United Kingdom, were considered as the most advanced in the EU in terms of green public procurement.

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