



Integral Circular Economy Report 2023

Assessment for the Netherlands

Summary and Main Findings

April 2023

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The Integral Circular Economy Report for the Netherlands was produced in the framework of the Work Programme on Monitoring and Evaluation Circular Economy, 2019–2024. The Work Programme is a collaborative effort of several knowledge institutes under the direction of PBL Netherlands Environmental Assessment Agency.

The Dutch Government is pursuing to achieve a fully circular economy by 2050. The aim of the Work Programme is to monitor and assess the charted path towards 2050 and to provide the government with the knowledge required to design and adjust policies. Further information on the Work Programme on Monitoring and Evaluation Circular Economy can be found at <https://www.pbl.nl/monitoring-circulaire-economie>.

The full Dutch report was drawn up with input from the knowledge institutes that take part in the Work Programme on Monitoring and Evaluation Circular Economy:

- Statistics Netherlands (CBS)
- CPB Netherlands Bureau for Economic Policy Analysis
- Institute of Environmental Sciences (CML)
- Netherlands Enterprise Agency (RVO)
- National Institute for Public Health and the Environment (RIVM)
- Rijkswaterstaat – Ministry of Infrastructure and Water Management (RWS)
- Netherlands Organisation for Applied Scientific Research (TNO)
- Utrecht University (UU)



Colophon

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This publication contains the main findings and summary of the Integral Circular Economy Report 2023. The full Dutch report with results in more detail and further substantiation of the main findings can be found on the PBL website: <https://www.pbl.nl/en/topics/circular-economy>

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Foreword

Several dramatic events have taken place in recent years, adding to the urgency of the global natural resources issue. The COVID-19 pandemic and the Russian invasion of Ukraine have shown that dependence on material resources and products — via long and complex international supply chains — is high in Europe and the Netherlands, which is making us vulnerable. Concerns about the availability of oil and natural gas and the high prices of many goods are now emphatically also impacting Dutch citizens, companies, civil society organisations and government authorities.

Concerns about the availability and affordability of material resources come on top of concerns about further climate change, biodiversity loss as well as soil, air and water pollution, to which our wasteful use of material resources is a major contributor. The need to use significantly fewer of these resources and use them radically more efficiently is therefore evident. This is exactly the focus of the transition towards a circular economy. Security of supply risks and the negative impacts on the environment and nature can be reduced by making products using fewer material resources, extending the lifespan of products and components through reuse and repair, sharing them, applying high-quality recycling methods, and replacing new finite resources with renewable or secondary ones and materials with a lower environmental impact. In addition, a circular economy offers opportunities for Dutch companies when they, for example, succeed in using material resources significantly more efficiently than their competitors.

The Dutch Government intends to achieve a fully circular economy by 2050 and sees monitoring as an important way of tracking the progress of the transition. Therefore, at the request of the government, PBL produces an Integral Circular Economy Report (ICER) for the Netherlands once every two years. This report series shows the situation around the transition towards a circular economy in the Netherlands and offers tools to accelerate that transition. The information in this report covers both physical trends in Dutch resource use, its effects on the environment and security of supply, as well as the activities undertaken by companies, citizens and government authorities to accelerate the transition.

This is the second edition of the ICER series; the first was published in early 2021. The current report comes at a time just after publication of the Dutch National Raw Materials Strategy and shortly before the National Circular Economy Programme (NPCE) for the Netherlands will be sent to the House of Representatives. This timing unfortunately also means that there was no time for this report to address both policy documents in terms of content. These policy documents contain proposals to counter the adverse effects of our resource use and will be worked out in the coming years. The conclusions from the ICER show that policy intensification is needed. PBL will reflect more extensively on the proposals in the NPCE, later in 2023.

The content of this report shows the government's large circular economy ambitions. Achieving them, however, requires strengthening policy commitments with regard to large-scale circular production and consumption. Making the responsible use of material resources a more central issue requires a government-wide commitment. Indeed, changing the rules of the game for production and consumption calls for a broad set of policy instruments from all the Dutch Ministries and also at EU level. Such an approach also enables identifying synergies and frictions between circularity and other policy tasks — such as climate change and biodiversity loss — to reap co-benefits and, where tensions are concerned, to work on joint solutions.

This report is intended as a knowledge base for the societal and political debate on the transition towards a circular economy. ICER 2023 was produced with contributions and input from Statistics Netherlands (CBS), CPB Netherlands Bureau for Economic Policy Analysis, Centre for Environmental Sciences (Leiden University), RIVM National Institute for Public Health and the Environment, Netherlands Enterprise Agency (RVO), Rijkswaterstaat (RWS), Netherlands Organisation for Applied Scientific Research (TNO) and Copernicus Institute (Utrecht University). All these institutions contribute to the multiannual Work Programme on Monitoring and Evaluation Circular Economy, which is coordinated by PBL. The knowledge brought together in this report can offer tools for administrators, politicians and policymakers to make policy-induced adjustments to production and consumption processes. I am convinced that the information in this report will help them to do so. In conclusion, I thank all partners who contributed to this ICER and who continue to work with us in further developing the underlying knowledge programme.

Professor Marko Hekkert

Director-General PBL Netherlands Environmental Assessment Agency

Main Findings

The urgency of resource issues has increased further

The world's current wasteful production methods and consumption, characterised by extensive use of primary material resources, is one of the main causes of climate change, biodiversity loss and pollution of air, water and soil. Without changes in policy, global material resource use is expected to double between now and 2060.

The negative consequences for people and the environment will impose further pressure on the realisation of international commitments, such as for climate, biodiversity and the Sustainable Development Goals. These consequences will increasingly befall poorer countries. In addition, the increasing dependence on imports of primary material resources creates geopolitical and economic tensions. The price increases in Europe due to Russia cutting off their delivery of oil and natural gas are illustrative in this context. These issues are particularly urgent for Europe as a whole and the Netherlands in particular, given their dependence on relatively large amounts of imported material resources, especially fossil fuels and metals. There are growing concerns around the supply of specific metals, such as lithium and rare earth metals that are needed for both the energy transition and ICT products. China plays a central role in these supply chains, creating new dependencies that bear concern.

To overcome the abovementioned challenges, a more efficient and sustainable use of material resources is urgently needed. Adopting circular production and consumption models can significantly reduce the negative environmental impacts of extensive material resource use and mitigating future resource crises. This can be done in several ways, such as by using materials with a lower environmental impact, using fewer material resources by buying less or sharing products, extending the life of products and components through reuse and repair, high-quality recycling of materials, and substituting new finite material resources with renewable resources such as bio-based resources.

Current trends will not achieve the objective of halving Dutch resource use by 2030

The Dutch Government's ambition is to halve primary abiotic resource use by 2030, compared to 2016 levels — which is an intermediate target on the way to a fully circular economy by 2050. Current trends and policies in place will not be sufficient to achieve such halving. Material resource use — in the Netherlands and elsewhere in the production chain — has decreased between 2018 and 2020. This was mainly due to the lockdown period during the COVID-19 pandemic, which resulted in a decrease in commuter and air travel and, therefore, to a decrease in the use of fossil energy carriers. This decrease, however, is not a structural phenomenon, and no clear decrease can be seen for the use of minerals and metals. Furthermore, although Dutch resource efficiency has increased since 2014, these efficiency gains have not led to an absolute decrease in resource use. There are more trends that are not going into the desired direction. Examples include the increasing volumes of incinerated and landfilled waste. In the years leading up to the COVID-19 crisis, slight increases have also been seen for greenhouse gas emissions and land use along the entire production chain related to Dutch production (i.e. the footprint). In addition, the Dutch economy has become increasingly dependent on the import of material resources, and supply risks of critical raw materials, such as tungsten, have increased, which is especially noticeable in the manufacturing industry.

The transition is not visibly accelerating, which is worrisome given the ambitions

So far, there is no noticeable acceleration in the transition to a circular economy. However, compared to the situation assessed in the previous ICER, some progress is visible with respect to the activities and resources deployed by companies, citizens and government authorities in the Netherlands, in more circular production and consumption processes. For instance, the number of circular companies has increased, as has employment in sectors with circular activities, the number of scientific publications on circular economy and the total in government funding of circular projects via the Netherlands Enterprise Agency (RVO). In many cases, however, the

increase is visible mainly in absolute rather than relative terms. Circular companies, for example, still make up no more than about 6% of the total number of Dutch companies, and financial support for circular activities has been constant for years, with about 10% of total support from the RVO schemes surveyed. Many circular initiatives are still in an early phase, without many scale up or breakthrough activities. As yet, substantial market demand for and supply of circular products and services is lacking.

Also, the rules of the game on the market are largely unchanged, leading circular entrepreneurs to experience the same barriers as we identified in the first ICER, two years ago, such as the failure to fully price environmental impacts, the current rules and regulations and enforcement of, for example, waste legislation, limited circular consumer behaviour and a lack of concrete direction and coordination from the part of the government for entrepreneurs to bring about changes in the production and consumption chain. The current system of waste volume targets and instruments, such as the Extended Producer Responsibility (EPR), does not yet provide sufficient incentives to use fewer natural resources in the design, production and use of products nor does it serve to promote longer product life cycles. The associated risk, here, is that short-term efforts to accelerate the transition mainly result in more low-value recycling. This happens, for example, in the civil engineering sector, plastic packaging, laptops and mobile phones.

The circularity strategies that focus on refusing or sharing products and extending their lifespan are lagging behind, even though they are crucial to achieving the ambitions. These strategies offer opportunities for economic reform, but require major changes in the conditions for production and consumption, such as pricing and standardising products, and innovations in revenue models and in EPR design. Therefore, these circularity strategies require more incentives and development. The lack of such radical changes shows that the transition is still in its early stages. Unless more changes in production and consumption methods are made in the short term and market demand for circular products and services grows rapidly, the government's ambition of halving primary abiotic resource use by 2030 will not be within reach, and neither will a fully circular economy by 2050.

Policy focus on targets and links to climate has increased, but needs to be worked out in further detail

In recent years, the government has taken steps in terms of concretising targets and the relationship between circular economy and climate. For example, the Ministry of Infrastructure and Water Management has set up a process to arrive at concrete national circular economy goals and to translate these into targets for various product groups together with stakeholders in the transition themes. A product group-specific approach has the advantage of formulating concrete targets for that particular group and allowing for diversification in the approach. This approach builds on previous PBL advice. The various product groups were proposed by the transition teams. They include, for example, electrical appliances, residential housing and plastic packaging. The chosen product groups are generally relevant given their impact on resource use and the environment. However, there are too many targets and action lines for these product groups proposed by the transition theme for them to be used on a national governing level. Prioritisation in and adoption of a limited set of targets by the national government is still needed.

To strengthen the relationship between circular economy and climate, the government has set a climate target for the circular economy of between 2 and 4 megatonnes in CO₂ reduction in the Netherlands. It is not yet clear to which year this target refers. The focus on the potential contribution of the circular economy to climate is justified, as more circular production and consumption will lead to lower greenhouse gas emission levels. However, an ambitious climate target for circular economy should increase the focus on greenhouse gas reductions throughout the production chain (i.e. also outside the Netherlands) and on product lifetime extension (i.e. over several years). Thus, circular solutions can deliver emission reductions that are complementary to current climate policies. Promoting these circular solutions requires additional instruments, because circular solutions are currently not eligible for funding from the current climate fund.

Policy intensification will be crucial given the high ambition levels

Halving primary abiotic resource use by 2030 and achieving a fully circular economy in the Netherlands by 2050 are huge ambitions. The current policy approach mainly focuses on supporting and facilitating circular initiatives by parties that are mainly busy experimenting. Various instruments are used in this respect, such as voluntary agreements (i.e. covenants) and innovation subsidies. This mix of policy instruments is relevant, but not sufficient to realise ambitions that extend considerably beyond experimentation. This requires changes in the rules of the game that determine production and consumption behaviour, so that circular solutions can break through, scale up and ultimately lead to 'a new normal'. The recommendation from the previous ICER to expand the current policy mix by using more coercive measures therefore still stands. Standardisation and pricing are important policy instruments in this respect.

- Standardisation could include the use of mandatory shares of secondary materials in products, mandatory provision of product information — so that products can be repaired more easily and their lifespan extended — and requiring circular design when granting subsidies. But also, for example, the tightening and inclusion of specific circularity requirements in the context of producer responsibility and circular procurement.
- Pricing involves, for example, an input tax on the use of fossil resources — as already applies for energy purposes — and broadening the current VAT reduction including labour to repair products, which is not yet the case. Without pricing the polluting and wasteful practices, circular products and services are at a disadvantage compared to those that are non-circular, thus creating an uneven playing field.

The material resource market is very international. Achieving national ambitions and creating an international level playing field for companies requires an active commitment from the Netherlands to further promote circular economy policies in Europe, as well. Normative and pricing instruments at EU level can have a major impact and feed into Member States' statutory rules and regulations. The European Commission has announced specific legislative initiatives for sustainable products and their consumption, such as extending the warranty period of products and extending the Ecodesign Directive to include more products and product requirements focusing on reparability, reusability and a minimum content of recycled material. The Netherlands can anticipate on these decisions, in view of the national ambitions. In this way, Dutch companies can acquire a front-runner position, for example, in the field of reuse and repair, as has been done successfully for recycling, in the past.

From government-wide ambition to government-wide commitment

Accelerating the transition towards a fully circular economy by 2050 requires government-wide commitment, in which the responsible handling of material resources is a priority for the entire government. Such a commitment makes it possible to change the rules for production and consumption with a broad set of policy instruments from all ministries. It also offers the opportunity for connecting the attention for material resource use and circularity to the approach to other societal challenges. In this way, possible tensions and synergies can be identified between policies and linked to joint solutions. Consider, for example, the tension between the ambition of halving natural resource use by 2030 and the sharply rising demand for materials in the housing and energy transition.

Strengthening the government-wide commitment requires at least the following four developments:

1. Drafting a more concrete mission with a clear end point that induces change, so that it becomes clear to what extent the circular economy contributes to solving certain societal challenges, and what a circular economy may look like. This requires the elaboration of goals in conjunction with other challenges, based on long-term ambition rather than primarily on feasibility and vested interests.
2. Defining a change strategy up to 2030 and 2050 and drawing up clear roadmaps towards the goals set, in which ambition and radical changes are paramount. This calls for a substantial intensification of policies, which, in addition to stimulating desirable circular activities, will also rely heavily on standardisation and pricing to compel the achievement of fundamental changes.

3. *Making sufficient structural financial resources available to support the mission. It is striking that, currently, no funds have been made available to continue the government-wide circular economy approach after 2024. Furthermore money is also needed for acceleration and scaling up. The required amount depends on the extent to which use is made of standardisation and other regulatory instruments.*
4. *Strengthening governance with a clear division of responsibilities and powers. This implies a firm and specified mandate from the stakeholders to realise the desired changes. Transition teams and regional authorities need this legitimisation and strengthening of their position to take further steps. In addition, this is helpful in explicating the expectations and roles of the various ministries.*

In brief

The material resource transition is essential in addressing the major societal challenges of our time: climate change, loss of biodiversity, pollution of air, water and soil, and economic vulnerability. This deserves more attention from the entire Dutch Government. The policies deployed have not yet accelerated the transition towards a circular economy in the Netherlands and are not sufficient to achieve the ambition of halving primary abiotic resource use by 2030. A government-wide commitment is necessary to change the rules of the game across the full spectrum of government policy so that circular solutions will become the norm.

Summary and Findings

Purpose and content of this report

Every two years, the Integral Circular Economy Report (ICER) provides an overview of the status of the desired transition towards a circular economy in the Netherlands. This independent information is intended as a knowledge base for the societal and political debate on the transition towards a circular economy. PBL is producing this report at the request of the Dutch Government and in cooperation with the knowledge institutions involved in the Work Programme on Monitoring and Evaluation Circular Economy. This report is part of the annual circular economy policy cycle in the Netherlands. The government has only recently presented its National Circular Economy Programme (NPCE) as well as the Raw Materials Strategy to the House of Representatives. This timing unfortunately also means that there was no time for this report to address both policy documents in terms of content.

It is the Dutch Government's ambition to achieve a fully circular economy in the Netherlands by 2050. The interim target for 2030 is to halve the use of primary abiotic raw materials, compared to 2016 levels (Ministries of IenM and EZK, 2016). This refers to raw materials extracted from nature, primarily from non-living sources (i.e. abiotic minerals, including metals, and fossil resources). To provide insight into the progress of the transition, the ICER 2023 report first presents the trends in international and national resource use and the resulting environmental and socio-economic impacts. It then turns to the transition process in society and the policies government authorities are deploying to promote the transition towards a circular economy.

The first ICER was published in early 2021 (Hanemaaijer et al., 2021). Compared to that first report, this year's ICER looks in more detail, amongst other things, at the relevance of material resources and products for various environmental impacts, at the relationship between circular economy and climate, at consumer behaviour, at analyses of the transition process for certain product groups, at circular design and the target trajectory initiated by the Ministry of Infrastructure and Water Management (IenW).

The content of this report comes largely from knowledge developed in the Work Programme on Monitoring and Evaluation Circular Economy, 2019–2023 (PBL, 2021; 2022). PBL carries out this work programme in collaboration with Statistics Netherlands (CBS), the Centre for Environmental Sciences at Leiden University (CML), CPB Netherlands Bureau for Economic Policy Analysis, the Copernicus Institute for Sustainable Development at Utrecht University, the National Institute for Public Health and the Environment (RIVM), the Netherlands Enterprise Agency (RVO.nl), Rijkswaterstaat (RWS) and Netherlands Organisation for Applied Scientific Research (TNO). For the organisation and results from this work programme, see the PBL website:

<https://www.pbl.nl/monitoring-circulaire-economie>.

A circular economy

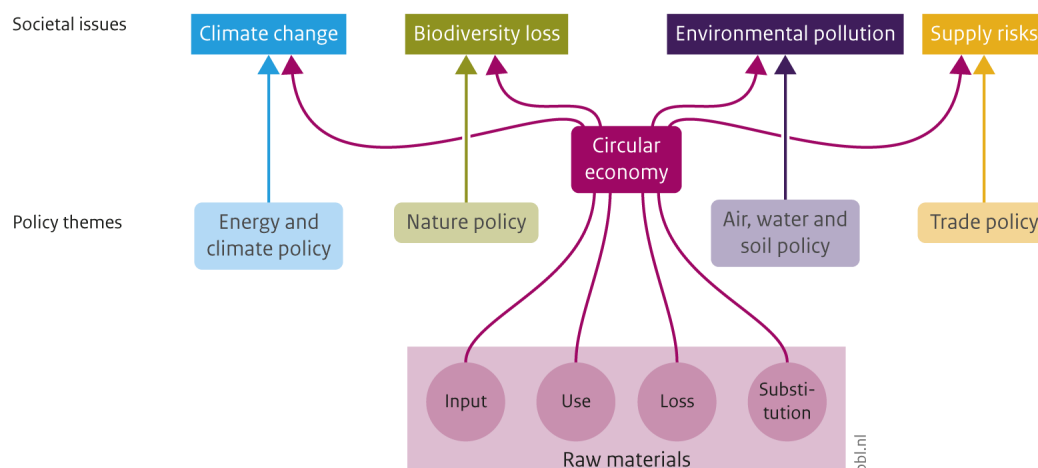
Circular economy is about a radically reduced and more efficient use of material resources

The transition towards a circular economy aims at using material resources more efficiently and in radically smaller amounts. A focus on more circular use of material resources, materials and products can reduce the negative environmental impacts, such as climate change, environmental pollution and biodiversity loss as well as the supply risks (see Figure 1). Recent international developments show how vulnerable an open economy like that of the Netherlands is to discontinuities in the supply of material resources. Radically reduced and more efficient use of resources is possible by applying various circularity strategies (also called R-strategies). Broadly speaking, this can be achieved in four ways:

- *Narrowing the loop*: Using fewer material resources by foregoing products (refuse), sharing products (rethink) or manufacturing them more efficiently (reduce).
- *Slowing the loop*: Longer and more intensive use of products and components through reuse and repair (repair and remanufacturing); this slows down the demand for new material resources.
- *Closing the loop*: Closing the loop by removing leaks and undesirable materials, recycling materials so that only non-reusable waste is incinerated or landfilled, and reducing the need for new raw materials by using secondary materials.
- *Substitution*. Replacing finite raw materials with sustainably produced renewable resources (such as bio-based) or alternative primary raw materials with lower environmental impact.

Figure 1.

Positioning circular economy in relation to societal issues and other policy themes



Source: PBL

How products and services are designed is very important to increasing the circularity of products and services and, thus, to reducing the negative environmental impacts. This largely determines how many raw materials are needed per product, whether products can be reused and repaired, and whether high-quality recycling is possible. Different circularity strategies also require new business and revenue models, such as when offering a product as a service or when sharing products. This presents opportunities for innovative companies that are able to generate added value with circularly designed products, services and business models. Such drastic changes in

products and services also require major changes in consumer behaviour towards more circularity in order to achieve the desired effects.

The urgency of natural resource issues

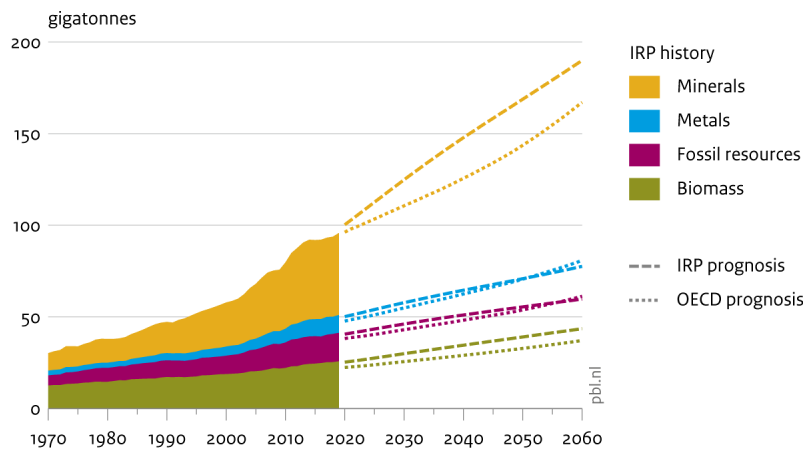
The urgency of natural resource issues has increased

The urgency for radically reduced and more efficient use of material resources has further increased, in recent years. Global demand has tripled since 1970 and is expected to double again between now and 2060 (IRP, 2019; OECD, 2019). For many material resources, however, the urgency is not directly related to their depletion but rather is driven by concerns about increasing negative impacts on the environment and nature, their timely availability and affordability, and increasing dependencies and disruptions of international production chains. The extraction of these resources and processing them into materials and products, for example, contributes significantly to greenhouse gas emissions and also leads to pressures on nature and the landscape. Longer product delivery times due to the COVID-19 crisis, and, more recently, strongly reduced delivery of oil and natural gas from Russia to the European Union and their effect on commodity prices, are illustrative of concerns around security of supply. However, the increased level of urgency around material resources does not mean that this will automatically raise the need in society for more circular production and consumption.

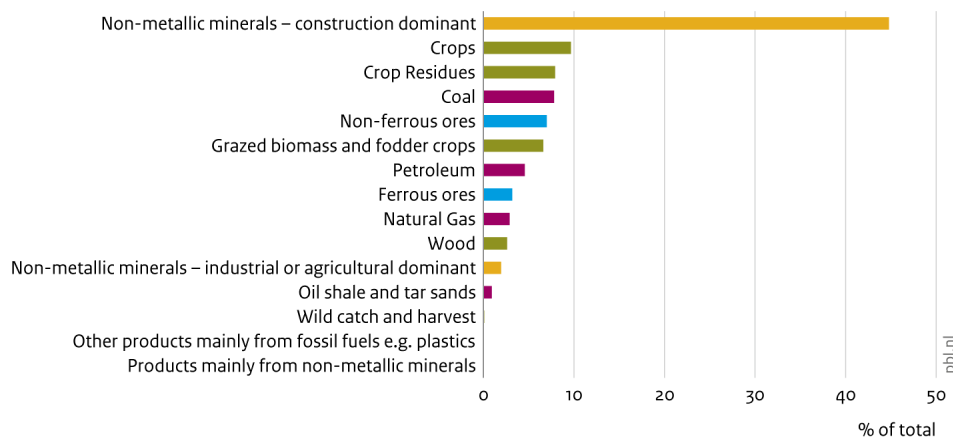
Figure 2.

Global natural resource use

Trend



Share in 2019



Source: IRP 2019, IRP 2022, OECD 2019

Wasteful use of material resources increasingly leads to environmental problems and puts pressure on several international agreements

The world's current wasteful way of producing and consuming, characterised by an extensive use of primary material resources, is one of the main causes of climate change, loss of biodiversity and pollution of air, water and soil. The extraction of natural resources and processing them into materials (such as steel and concrete), semi-finished and finished products accounts for about half of total greenhouse gas emissions, about 30% of particulate matter emissions and over 90% of water scarcity and loss of terrestrial biodiversity (IRP, 2019). In addition, extraction of new material resources leads to landscape degradation from mining and current resource use leads to large mountains of waste on land and plastic soup in the oceans. The expected increase in material resource use and associated environmental impact is putting pressure on several international agreements and ambitions, such as the climate targets in the Paris Agreement and the biodiversity targets of the Convention on Biological Diversity (CBD). Increasing pressure on the environment also makes it more difficult to achieve several socio-economic Sustainable Development Goals (SDGs.), while many of the SDGs actually require additional material resources (UNEP, 2021). These

resources include food to eliminate hunger, building materials for solid housing in fast-growing cities, and minerals and metals to increase access to electricity.

The benefits and burdens of global material resource use are unevenly distributed around the world

The consumption-related environmental impacts of high-income countries, such as the Netherlands, are three to six times greater than those of low-income countries (IRP, 2019). Moreover, the environmental impacts of Dutch consumption are largely felt in low- and middle-income countries where extraction and production takes place, such as the large local environmental impact of mining and the loss of biodiversity from biomass production. While extraction and production generate local employment, the added value to the local economy is often relatively low, especially in low-income countries. Due to low environmental standards and poor working conditions in low- and middle-income countries, extraction and production as well as the processing of waste streams from high-income countries are also often accompanied by negative socio-economic impacts. This is especially the case in the informal sector, which is not subject to official registration and control (Brink et al., 2021a; Brink et al., 2021b). The negative effects of consumption in high-income countries are, thus, partly passed on to low- and middle-income countries.

Growing concerns about the availability of specific material resources for the economy

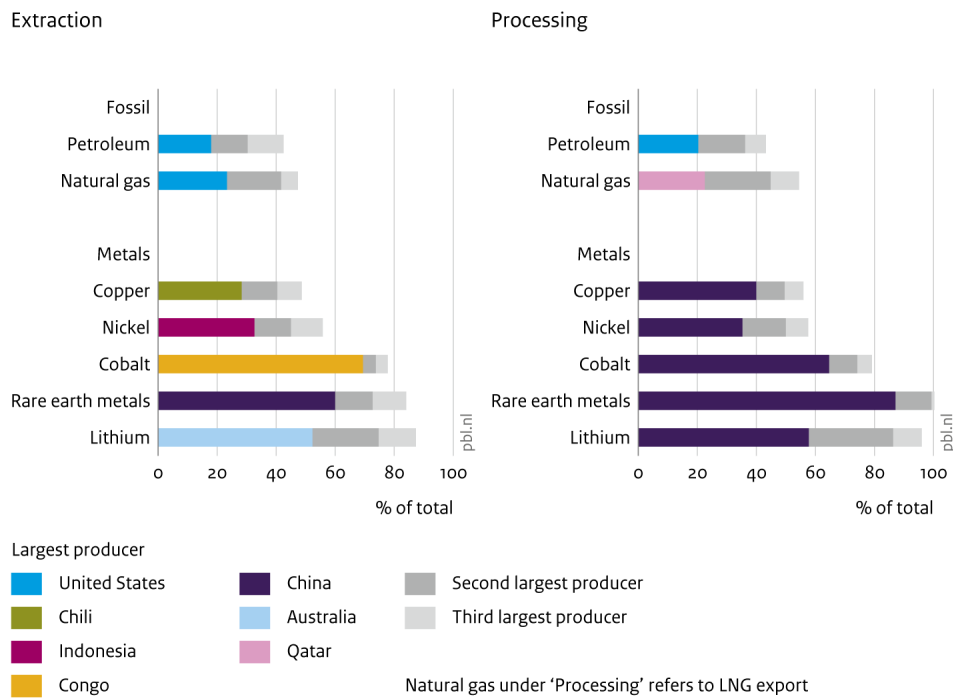
Tensions are increasing on the supply side. Despite assumed large geological reserves of metals and other material resources and expected technological innovation power, there are growing concerns about the timely availability of specific material resources, especially those with high economic importance, which are therefore labelled 'critical'. These include critical metals for the energy transition, such as lithium and cobalt. The supply risks are partly due to long lead times for scaling up existing mines and opening new ones, the concerns around the negative socio-economic and environmental impacts of mining, current extraction and/or processing taking place in a limited number of countries, and the extensive and complex networks of intermediate supplies (Jowitt et al., 2020). These tensions have been further exacerbated by the COVID-19 pandemic and the war in Ukraine.

The energy transition leads to new dependencies

International climate policies have a major impact on future material resource use and international dependencies (IEA, 2021). Although the demand for fossil resources will decrease due to the energy transition, demand for minerals and metals will grow. These include basic materials, such as concrete, steel and aluminium, but especially technology-specific materials such as cobalt, lithium and rare earth metals. This shifts the global dependence, with respect to the energy supply, from countries that supply fossil fuels (e.g. the United States, OPEC countries and Russia) to those that supply specific metals and materials (Figure 3). China plays an important role here, as it not only supplies a large proportion of rare earth metals but also conducts a significant proportion of the global refining of key metals.

Figure 3.

Top 3 of countries in extraction and processing of fossil fuels and metals, 2019



Source: IEA 2021

European concerns around security of supply are increasing

Europe is more dependent than average on raw materials from other countries, especially in terms of fossil fuels and metals. This not only creates major environmental impacts elsewhere, but also makes Europe especially vulnerable to the risks related to the security of supply of raw materials and products. For example, Europe's sustainability ambitions, such as the energy transition, rely heavily on critical materials from outside the European Union (EC, 2020). And Russia's war with Ukraine has forced Europe to source large quantities of material resources from elsewhere, at short notice. These and other recent geopolitical developments have greatly increased the EU focus on security of supply.

The resource challenges call for accelerated action and radical changes in production and consumption

Achieving a good life for all, within the limits of the planet, requires radically reduced and more efficient use of resources and a more equitable distribution within and between countries. For high-income countries, this means an absolute decoupling of economic growth and environmental pressures, or in other words, between the level of consumption and production on the one hand and material resource use and environmental pressures on the other. For low- and middle-income countries, it means at least a relative decoupling between improving living standards, material resource use and environmental pressures. This requires profound changes to current production and consumption systems (Lucas et al., 2020) that go beyond current, generally low-value, recycling of materials. Measures that reduce land use are particularly important for halting biodiversity loss (Forslund et al., 2022). These include dietary changes, reducing food waste, and regenerative agriculture and forestry. Measures targeting resource use in the built environment and around mobility are particularly important for addressing climate change (IRP, 2020). These include building houses and vehicles more efficiently, reusing materials, using renewable materials and

improved design.

Changing consumption patterns and developing and implementing the necessary technological innovations will take a long time. To date, policies have mainly been implemented on the production side, whereas those aimed at consumption are still limited. In addition, special attention is needed for socio-economic challenges (often referred to as a ‘just transition’), focusing on decent work, social inclusion and improving living conditions, in addition to reducing environmental pressures (Lucas et al., 2022).

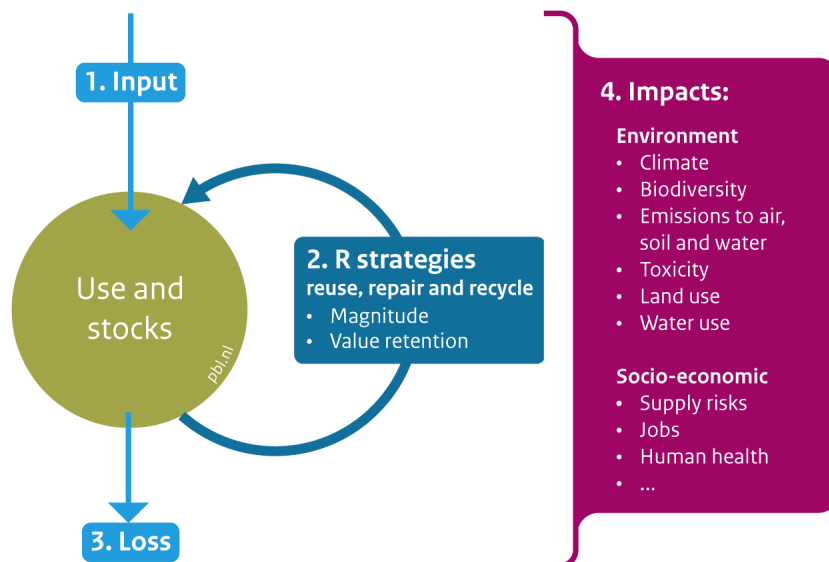
To improve security of supply, the mining, refining and processing capacity needs to increase within the European Union, for both primary material resources and secondary materials (Blondel et al., 2022). In addition, strategic cooperation and integration with parties outside the European Union is very important to reduce supply-side dependencies (Ritoe, 2021). Finally, circular strategies, such as reuse of products and components and recycling of materials, will help to reduce the pressure on the market.

Dutch material resource use and its impacts

This section describes the main trends in Dutch material resource use and their associated impacts according to the framework below (Figure 4), focusing successively on the input of material resources in the Netherlands, product use phase, and, once products leave the chain, on the losses in the form of waste. This is followed by a discussion about the various environmental and socio-economic effects.

Figure 4.

Framework for targets and indicators of circular economy monitoring



Source: PBL

The Netherlands imports three quarters of its raw materials, products and product components

In 2020, the Dutch economy used 359 billion kilos in material resources (see Table 1, CBS, 2023a). This refers to all material resources, including products and product components used, processed,

traded (including exports) or consumed by companies in the Netherlands. Around a quarter of which through domestic extraction, the remainder came from outside the Netherlands. For the extraction of metals, the Netherlands is completely dependent on other countries, and a large share of fossil raw materials also comes from abroad. In addition to raw materials, the Netherlands also imports many processed materials, products and product components. Half of the amount of material resources processed in the Netherlands (180 billion kilos) is for domestic use, which means for consumers, companies and public organisations in the Netherlands. The other half is exported in products and intermediate goods, such as meat and machine parts. A further 131 billion kilos of material resources are imported and re-exported without any significant industrial processing (CBS, 2023a).

Table 1 Indicators of the required material resources for the Netherlands (input)

	2014	2016	2018	2020	Trend 2014–2020	Trend 2016–2020	Trend 2018–2020
Material resources for the economy, DMI (Mt)	390	386	385	359	-8%	-7%	-7%
Material resources for domestic use, DMC (Mt)	187	185	193	180	-4%	-3%	-7%
Material resource footprint of the economy, RMI (Mt)	596	607	678	618	+4%	+2%	-9%
Material resource footprint of consumption, RMC (Mt)	141	135	150	125	-11%	-7%	-16%
Resource efficiency (GDP in EUR/kilo DMC)	3,6	3,8	3,9	4,1	+12%	+7%	+5%
Share bio-based resources (kilo/DMI, in %)	27	26	27	30	+11%	+16%	+11%
Share renewable material resources (kilo/DMI)	no data	no data	no data	no data	no data	no data	no data
Share secondary materials, CMUR (kilo secondary/DMI, in %)	13	13	13	13	+2%	+2%	+2%

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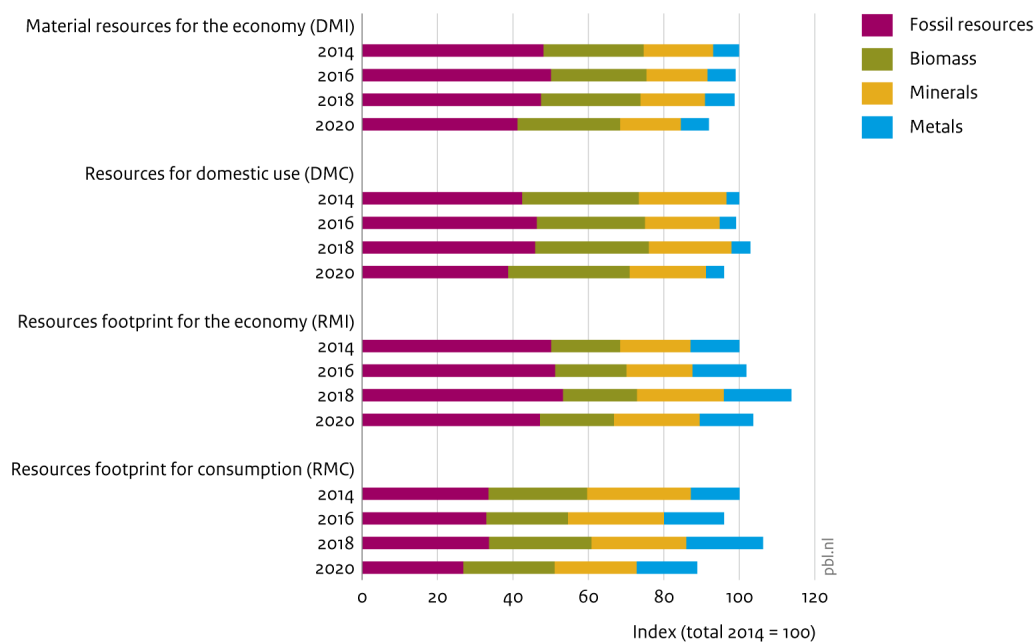
- For sources per indicator, see Appendix 4.
- See Berket et al. (2019) and Delahaye et al. (in prep.) for further explanation of the underlying method.
- The figures in the Material Monitor of Statistics Netherlands (CBS) have been revised from 2014 onwards, and the quality of indicators based on them has improved (CBS, 2023a). We therefore chose to only include the commodity indicators on 2014 and beyond (instead of those starting in 2010). Because of the revision, the data presented here also partly differ from those in the first ICER (2021).

The decrease in resource use between 2018 and 2020 was mainly due to the lockdown of the Dutch economy

Between 2014 and 2018, there were hardly any changes in total material resource use. However, between 2018 and 2020, it decreased by 7%, for both domestic use (DMC) and in the entire Dutch economy (DMI). The material resource footprint of the Dutch economy (RMI) and of consumption (RMC) decreased even slightly more over that period. The footprints include the total of material resources used both within the Netherlands and in the production chains abroad. This also encompasses resources that do not end up in the final product, such as the fuel needed to run machinery. The decrease in material resource use was mainly a decrease in fossil fuel use due to the decline in air travel and commuter traffic, caused by the COVID-19 lockdowns (CBS, 2023a; CE Delft, 2022). For minerals, metals and bio-based resources, the decrease was less pronounced (see Figure 5). The material resource use reductions over the 2018–2020 period are not expected to be structural and, in the coming years, the use is likely to return to pre-COVID-19 levels. However, uncertainties are on the increase as this also depends on several other developments, such as the war in Ukraine and the related energy prices.

Figure 5.

Natural resource indicators



Source: CBS

The policy goal of halving resource use by 2030 will not be achieved under the current trend in resource efficiency

Resource efficiency in the Netherlands increased by 12% between 2014 and 2020; the highest resource efficiency in the European Union in 2020 (CBS, 2023a; Eurostat, 2022). Resource efficiency is determined by relating the use of material resources (by weight) to economic output (in GDP). The European Commission considers this one of the key indicators for a circular economy. The caveat with this indicator, however, is that it mainly looks at the economic structure and does not necessarily indicate a reduction in the use of resources. Indeed, the high resource efficiency in the Netherlands is mainly related to the relatively large share of services in the total Dutch economy. The improvement in efficiency between 2014 and 2020 was mainly due to the expanding services sector in the Netherlands and increase in the added value of certain industries, such as machinery, construction, and power companies. However, since 2014, this has not led to an absolute decoupling in which resource use would structurally decrease, even under growing production levels (CBS, 2023a). An analysis based on current trends and implemented policies shows that resource efficiency is not increasing rapidly enough to achieve the government's ambition of halving resource use by 2030 (De Koning and Van der Voet, 2022).

In addition to improving resource efficiency, there are also other circularity strategies that can reduce abiotic resource use, such as replacing primary abiotic resources with secondary materials and bio-based resources, lower consumption levels, using products more intensively and extending their lifetime, and recycling materials to the greatest possible degree. These issues are discussed below.

Limited possibilities for further substitution using secondary materials

In 2020, secondary materials provided about 24% of material resource demand for domestic use in the Netherlands and 13% of total demand in the Dutch economy (CBS, 2023a). In other words, the demand both for domestic use and in the economy is about 4 to 8 times the currently available amount of secondary materials, respectively. Secondary materials consist of discarded products and by-products that, after their release, collection or pre-processing, are reused as materials in the production process. The share of secondary materials in total material resource use (both for domestic use and the economy as a whole) has not changed substantially since the 2018 data presented in the previous ICER.

Further substitution of primary abiotic resources by secondary materials is currently only possible to a limited extent. This is because not enough materials are becoming available from present stocks (in products) in the Netherlands to replace a substantially larger share of needed material resources with secondary materials. In construction, for instance, the demand for material resources in 2019 was about 2.5 times greater than the supply of secondary materials (EIB, 2022). In addition, a certain part of the total amount of material resources will always be lost and not become available again as secondary material, such as those burned for energy generation or used as food. There are also other challenges that complicate substitution, such as preventing the loss of recyclable materials and achievement of high-quality recycling.

Substitution using bio-based resources is not an overall solution

In 2020, bio-based resources accounted for around 30% of the total material resource use in the Dutch economy, and this share has been fairly stable since 2014. Between 2018 and 2020, the share of bio-based resources in the total amount of material resources increased by 3 percentage points from 27% to 30%, but this was mainly due to a decrease in fossil fuels over this period. The absolute increase in the amount of bio-based resources is only small (CBS, 2023a).

Substitution of primary abiotic resources by sustainable bio-based resources is only possible to a certain extent, due to limited availability. This is because the land available for growing sustainable bio-based resources is only limited and a large proportion is used for food supply. In addition, substitution with bio-based resources will not necessarily reduce environmental impacts. It may lead to a shift in impacts, with fewer emissions on the one hand, but more land and water use and thus more pressure on biodiversity, on the other.

Use of circularity strategies in the utilisation phase is still limited

In addition to substituting material resources, their use can also be reduced by lowering consumption levels and more efficient and longer use of products, and by sharing, repairing, reusing and refurbishing them. There is still little reliable and comprehensive information on circularity in the use phase of products, and those on which information is available are not yet moving into a circular direction. For example, the lifespan of furniture is becoming shorter, and 38% of smartphones show technical problems already within the first year (Intven et al., 2022; Consumentenbond (the Dutch consumers association), 2021). Repair is hampered by the complexity of product designs, limited availability of spare parts and insufficient standardisation of parts (RepairCafé, 2022). Ten per cent of consumers have a smartphone that has been previously used (second-hand or refurbished) and 3% bought their most recent small electrical appliance or item of clothing second-hand. Only 1% rent rather than own their washing machines, clothes or furniture and another 1% hire out tools or clothes to third parties, via a platform (Koch and Vringer, 2023). In the mobility sector, sharing is slightly more popular, but decreases car ownership and use

only to a limited extent (Jorritsma et al., 2021, 2015; Liao et al., 2020). Currently, there is no overview of the use phase of products, such as about sharing, repairing, reusing and refurbishing products, and therefore there is also no overview of the reduction in resources and environmental impacts that this results in. More information is needed on the use phase of products and on the effects of using them for longer, in order to devise policy to promote such longer use.

Recycling is not always high-quality, despite the Netherlands' front-runner position

Waste policy is an important part of the transition towards a circular economy. With a 78% recycling rate of waste processed in the Netherlands (CBS, 2023), the country is amongst the front runners in Europe and only a relatively small amount of waste is being landfilled. There is still progress to be made in recycling by reusing the available materials at a higher quality. That is, in original or similar types of products or in an application with as much environmental gain as possible. A study at provincial level indicates that a third to half of the provincial waste streams could be put to higher value use (geoFluxus, 2022). A higher value use of secondary material requires improvements in product design, proper separate collection, opportunities for high-value application and incentives to manage this. Some products today are designed in such a way that recycling for application as a secondary material is difficult or the recovery of materials takes a large amount of energy. This is especially true for specific metals.

Without additional policy, several national targets for waste will be achieved at a later point in time or not at all

By 2020, Dutch waste supply had decreased to 59 megatonnes. The target of 61 megatonnes by 2023 is therefore likely to be achieved (RWS, 2022a; 2022b). The other seven overarching national waste targets (see Chapter 3 of the full ICER report 2023) are not expected to be achieved under current trends and policies. For instance, the amount of residual household waste and that from businesses and organisations is still almost double the target levels for 2020 and 2022. The 2023 target of halving the amount of incinerated and landfilled Dutch waste is also still far out of reach, with an 8% reduction between 2012 and 2020. The overarching national waste targets are strongly interrelated and require commitment from both the national government and municipalities. As long as the amount of residual waste from households and businesses is high, there is a large amount of it that remains difficult or impossible to recycle. This makes it difficult if not impossible to achieve the goal of halving landfill and incineration; these practices are still the reason why large amounts of material resources leave the system, every year.

However, there are also many other targets — for specific waste streams — and EU targets that have been achieved. For example, the Netherlands has already achieved EU targets ahead of the deadline for the recycling of construction and demolition waste, municipal waste and various packaging materials.

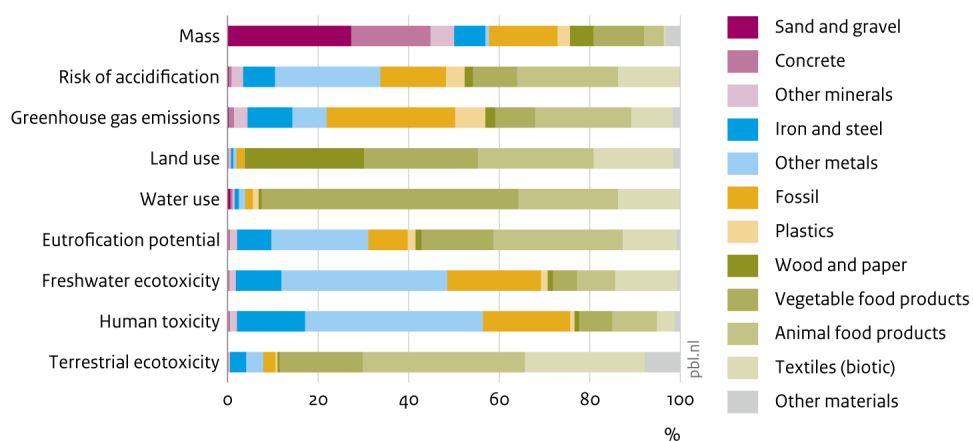
Environmental impacts vary widely between the different types of resources

The impact of material resource use on the environment varies greatly per type of resource. The material resource streams that are the largest when measured in tonnes are not necessarily also the most relevant for environmental impacts. Figure 6 shows that sand and gravel, concrete and fossil resources are the largest streams but contribute little to the various environmental impacts compared to other types of material resources. In contrast, plant and animal food products comprise a much smaller share in the total, with about 16%, while they are largely responsible for the impact on land and water use — and thus also on biodiversity. Greenhouse gas emissions are mainly caused by fossil fuels (for transport, energy use throughout the production chain and as a

material for plastics and textiles), animal products and metals. For toxicity, the extraction and production of metals, such as aluminium and copper, are responsible for a particularly large share of environmental impacts. In addition, metals also contribute to eutrophication through phosphate, for instance, and acidification through emissions of particulate matter and nitrogen. Finally, the impact of textile production stands out, contributing over 10% to almost all environmental impacts, even though textiles account for only 0.5% in tonnes. Taking only the weight of material as an indicator for policy is thus not the most effective way of reducing environmental impacts.

Figure 6.

Relevance of various resources and materials for environmental impacts from a Dutch consumption perspective, 2018



Data do not include use phases, such as diesel combustion in transport.

Source: CBS 2021, CML 2021 and EcoInvent 3.4; adaptation by PBL

No visible structural reduction in environmental footprints

Greenhouse gas emissions in the Netherlands and the greenhouse gas footprint of Dutch consumption decreased by a respective 22% and 24%, between 2010 and 2020. This footprint reflects the total greenhouse gas emissions resulting from entire production chains, both domestic and abroad. Much of the reduction took place between 2018 and 2020 and was related to the closure of coal-fired power plants and reduced use of fossil fuels due to less aviation and commuter traffic during the COVID-19 period. This reduction is not expected to be structural. In fact, the production-related greenhouse gas footprint and production- and consumption-related land footprints actually increased, slightly, over this period (between 2010 and 2018/2019). The Dutch Government’s ambition to halve the ecological footprint by 2050 is thus still far out of reach, and the environmental footprint of the Dutch economy is not within the calculated planetary boundaries (Lucas et al., 2019).

Dutch resource use also leads to environmental pollution, such as a too high nitrogen deposition in about three quarters of the total area of terrestrial nature in the Netherlands as well as an increase in litter, which is a source of microplastics in air, soil and water (CLO, 2020; Hagemeyer, 2022). A radical reduction or more efficient use of material resources can help counter these effects. This can be done, for example, by reducing the extraction of primary raw materials and reducing the amount of litter.

Impact of Dutch material resource use is mainly in other countries

Because the Netherlands imports three quarters of the material resources needed for its economy, the related environmental impacts are felt mainly abroad. Consider Brazil, where soya is grown as feed for livestock in the Netherlands, which requires large areas of land with corresponding impacts on biodiversity. More than half of greenhouse gas emissions and more than 80% of land use related to the Dutch economy and consumption take place abroad. Reducing the environmental impacts of material resource use therefore also requires efforts in the foreign parts of production chains.

Negative environmental and socio-economic impacts in low-income countries

In several production chains, raw material extraction and manufacturing take place in low- and middle-income countries. In addition, the Netherlands exports discarded items and waste to other countries, especially in Eastern Europe, Africa and Asia. In 2018, for instance, some 20% of all electronics discarded in the Netherlands was exported. In addition to the positive effects on employment and access to high-quality and affordable items in the importing countries, the processing of discarded items is often associated with low wages, poor working conditions and pollution of air, water and soil, with negative consequences for local public health (Brink et al., 2021a, 2021b).

Compared to other countries, the Netherlands scores poorly in terms of various ecological, social and economic effects on foreign countries in relation to the United Nation's Sustainable Development Goals (SDGs) (SDSN, 2022). Creating more transparency in the entire production chain, including its foreign parts, is a necessary step to consciously consider all impacts throughout the production chain when taking decisions. A transition towards a circular economy, in itself, will not solve negative socio-economic effects, although it may help to reduce them. Creating positive effects requires understanding the links between material resource use, environmental and socio-economic impacts (Brink et al., 2021a; Lucas et al., 2022).

Supply risks have increased for the Dutch economy

The Dutch economy has become increasingly dependent on material resources and products from abroad (CBS, 2023a). The global COVID-19 crisis and the war in Ukraine have shown how dependent the Dutch economy is on international production chains. Think, for example, of the global shortages of face masks and laboratory testing equipment during the COVID-19 crisis or disruptions to the supply of oil and natural gas from Russia. There is definitely a tension here between striving for the lowest costs — often via long and complex global production chains — and the large dependencies and risks that these may entail. Reducing these dependencies tends to make products more expensive. Other examples of resources and materials for which supply risks exist include fertilisers in agriculture, bitumen in road construction and so-called 'critical materials', such as indium, cobalt and rare earth metals that are essential in the production of, for example, electronics, motorised vehicles, solar panels and wind turbines.

For many critical materials, the security of supply risks increased between 2018 and 2020. This has increased the risk to the Dutch economy and is particularly noticeable in manufacturing (TNO, 2022). Companies, organisations and citizens face risks not only from the extraction of raw materials but also because of stagnating trade in material resources, materials or semi-finished products. Delivery times and prices of raw materials and components have increased sharply since 2020 (NEVI, 2022). Over time, the transition towards a circular economy offers opportunities to reduce security of supply risks by keeping critical materials in the system for longer through product

life extension and recycling. In addition, the circular economy transition can contribute to a better understanding of the whole chain from resource extraction to waste disposal, allowing more anticipation of supply risks.

Progress in the transition process

This section looks at the activities various stakeholders in society are undertaking to make their production and consumption processes more circular as well as the resources they are deploying to do so (i.e. the transition process). The framework in Figure 7 shows the eight key processes underlying the analysis (see Hanemaaijer et al. (2021), for a more detailed description of the framework).

Figure 7.

Elements of a successful transition to a circular economy



Source: PBL 2013; based on Hekkert et al. 2021

Limited progress on parts of the transition process can be observed ...

The activities and resources deployed in the transition towards a circular economy by companies, citizens and government authorities in the Netherlands, overall, have increased slightly. For example, by early 2022, there were about 130,000 circular companies (i.e. those implementing a circularity strategy as a business activity), representing a clear increase of some 30,000, compared

to two years ago (Royal HaskoningDHV, 2022). Most of these are traditional businesses (around 75%), such as automobile, bicycle and clothing repair shops, focused mainly on repair activities. Employment in selected industries carrying out circular activities has increased from 254,000 full-time jobs in 2001 to 327,000 in 2020 (CBS, 2022b). Furthermore, the number of circular innovation projects monitored by the Netherlands Enterprise Agency (RVO) increased from 373 in 2018 to 475 in 2020 (RVO, 2022). The strongest increase can be seen in the number of scientific publications that explicitly deal with the circular economy. About 75% of Dutch publications on this subject appeared in the last four years (2018–2021) and about 55% in the last two years (Türkeli, 2022). A final example is the increase in financial resources. The total government monetary contribution to circular innovations and business assets provided by RVO has grown from 236 million euros in 2018 to 295 million in 2020 (RVO, 2022).

... but there are no clear signs of an accelerated transition

In many cases, however, progress is only present in absolute rather than relative terms. For example, circular companies still account for only 6% of the total number of Dutch companies. And although funding from RVO has increased in absolute terms, financial support for circular activities has been at a constant level for years, with around 10% of total support from the RVO schemes that we investigated. In other cases, progress can be seen, but no acceleration as yet. Although many individuals and companies have been reached through the *Versnellingshuis Nederland Circulair* (organisation to accelerate the Dutch circular economy) and CIRCO, these groups are not yet large enough to provide a critical mass through which experiential knowledge on circular practices is automatically exchanged and disseminated.

Accelerating the transition process will be crucial, given the high ambition level

Achieving the targets for 2030 and 2050 requires accelerating the transition process, as substantial changes in material resource use and associated impacts will not occur unless major changes are made to the production and consumption system. In other words, circular activities will not scale up until the transition gains momentum, after which not only motivated pioneers and early adopters will become involved but they will also be followed by the majority. That is the phase in which circular will become the new normal. Currently, however, the transition process is still in its early stages and will not simply develop further without additional actions and policy measures.

Current rules of the game hamper both circular entrepreneurs and an acceleration of the transition process

Circular solutions do not simply fit into current routines, habits, business models and regulations. The barriers for circular entrepreneurs as identified in the previous ICER still apply. Think of the difficulties that SMEs are experiencing when looking to attract external financing for circular business models, and the insufficient pricing of environmental impacts. Current enforcement of rules and regulations also hinders circular activities, such as whether or not materials with a legal waste status can be used as secondary materials. In addition, entrepreneurs are still calling for more direction and coordination. Government authorities and sectors could, for instance, set more specific targets, encourage uniform measurement methods, and organise collaborations between all links in a production chain to enable change throughout the chain. The current system contains such large obstacles that circular entrepreneurship is not yet sufficiently profitable.

Circular consumer behaviour is not yet the new normal

Another obstacle is the lack of substantial market demand for circular products and services. Such a demand is crucial for realising the transition towards a circular economy. However, before such

market demand can emerge, changes in consumer willingness and behaviour are needed. Currently, circular behaviour is not the standard. Barriers to circular behaviour vary, and include financial costs, inconvenience, social norms and habits. For example, many consumers are not interested in buying second-hand products, because they consider them of inferior quality, less hygienic, harder to find or they feel ashamed of using second-hand products or do not see the point of it (De Gier and Nieuwenhuizen, 2019; ABN Amro, 2018; Van Wolf et al., 2022). Most consumers — although open to certain circular behaviour — in practice, exhibit such behaviour only to a lesser extent. For instance, part of the Dutch population would like to buy food without excessive packaging material, but this is difficult to find in supermarkets. Others would be interested in having their broken products repaired, but high costs and a lack of standardised parts stand in the way (Wolf et al., 2022; RepairCafé, 2020; PROMPT, 2021).

Most environmental gains can be achieved by consuming less and foregoing certain products and services that have high environmental impact. This type of behaviour includes buying fewer items, eating less meat and dairy, driving and flying less often, not owning a car, and/or living in smaller properties. There is currently only a small proportion of consumers who would like to make these types of choices or who are already doing so (Koch and Vringer, 2023).

The main direction of the transition is that of low-grade recycling

Many of the activities undertaken by civil society actors are still focused on low-grade recycling. This can be seen, for instance, in innovation projects, innovative companies and financial support from RVO. As a result of decades of waste policy with a strong focus on limiting waste volume and reducing landfill, the recycling industry in the Netherlands has been very successful, for many years. It is therefore not surprising that recycling, currently, is the dominant strategy, although how it is implemented and organised mostly leads to low-quality recycling, due to the long-standing focus on waste volume reduction. The targets aimed at reducing the waste volumes that producers are presenting to the recycling companies do not provide incentives for those producers to improve the quality of recyclates or their high-quality reuse. For example, in civil engineering works, much of the recycled material is used as sub-base in road construction and only a very small share is used as a secondary material, for example, in new buildings or other high-value applications that would yield the most environmental gains (Bours et al., 2022a). Plastic packaging also lags behind when it comes to using recyclate in high-quality applications (Bours et al., 2022b). In several sectors, a quality boost of recyclate is possible and necessary so that secondary material can be used in the same or similar products. A circular economy requires the highest-quality application of recyclate so that materials retain their usability for high-value applications, which will minimise the pressure on the environment.

Other circularity strategies require further development and increased policy guidance

The focus on low-value recycling does not provide any incentives for companies to change current circularity strategies. As mentioned earlier, the use of secondary materials can only be part of the solution. Circularity strategies aimed at reducing the use of new raw materials or extending product lifetimes still receive relatively little attention, although some national indicators show that this is increasing; for example in scientific publications, by innovative companies, and actions in implementation programmes. However, there are still barriers and sometimes even perverse incentives in the current system when it comes to circularity strategies other than recycling. For example, the targets that focus on reducing waste volumes do not promote a reduction in raw material use or longer product lifespans. Quality control through standardisation is also lacking and environmental impacts are not yet sufficiently incorporated in prices, resulting in insufficient

incentives to become radically more resource-efficient, and investments in resource-saving products and services currently do not pay off or only to a certain degree. In the absence of policy attention for and management of alternative circularity strategies, there is the risk that short-term efforts to accelerate the transition will mainly result in more low-grade recycling.

The wide variety in product groups requires a differentiated approach

Further accelerating the transition towards a circular economy requires a differentiated approach. This is because the transition process can vary greatly between domains. For instance, the transition to circular plastic packaging builds on the already existing extended producer responsibility (EPR) system, while circularity in car batteries is still in its infancy. As described above, the pre-existing system (and thus the stage of transition in a specific domain) influences the opportunities and existing barriers. But other differences also are important. For example, products used in civil engineering last for decades, while packaging has a very short lifespan. Differences in types of products create specific opportunities and challenges for circularity. This calls for a policy approach that can respond to the specific phase, challenges and opportunities per product group. Here, a positive policy development can already be observed, as such a differentiated approach with targets per product group is currently being elaborated with regard to the specific targets for 2030.

The ambition for 2050 needs guidance and coordination to make the next step in the transition

The ambition formulated by the Dutch Government to be fully circular by 2050 has mobilised parties in the initial phase and put the circular economy on the agenda of many stakeholders. However, this ambition has not yet been worked out in detail; this is perceived by entrepreneurs as a lack of direction. As a result, the objective for 2050 currently creates little urgency or pressure to change, and there is uncertainty amongst entrepreneurs and investors about the long-term goals and how they could contribute to achieving them. Circular entrepreneurs need a concrete framework of goals and robust policy instruments, allowing circular activities to grow. The design of the current system means that the radical circular changes that are needed are not being properly set in motion. In several sectors, such as plastic packaging, bio-plastics, civil engineering and consumer electronics, there is now a focus mainly on low-grade recycling, while this is not sufficient to achieve the government's circular ambitions. And even under a large focus on circularity, it is still difficult to show the practical side and the level of urgency. For example, the government has a great deal of attention for a circular civil engineering sector, but the sector nevertheless is finding it very difficult to draw up a roadmap that will result in a circular civil engineering sector by 2050 (Bours et al., 2022a). The pathway is difficult to define if the end point is unclear. What will the system look like in 2050? What problems will have been solved? What activities will become the mainstream and which will not? And how will everyone contribute to this?

If the Dutch Government considers the transition towards a circular economy important, it has a critical choice to make about the short-term strategy for change. For instance, will the transition be accelerated by a greater focus on experiences of learning and experimentation and scaling them up, or should the ambition for 2050 and the halving target for 2030 be paramount and fundamental changes be imposed in the short term to force circular developments?

Circular economy policy

Achieving a circular economy in the Netherlands calls for policies at European, national and regional scales. These three levels of government also influence each other. The national circular economy policy approach pays attention to these different scales. This section elaborates on the importance of and commitment to these scales. It discusses the instruments deployed and recommends follow-up steps. The emphasis here is on the relevance for circular economy policy in the Netherlands.

Concrete national objectives

National policy focuses on concrete targets for the circular economy

The government's ambition for the Netherlands is to be fully circular by 2050 and to halve its use of primary abiotic material resources by 2030, compared to 2016 levels (IenM and EZ, 2016; IenW, 2021). In recent years, the Ministry of IenW has worked on making these goals more concrete, in particular by asking the five circular transition teams to come up with proposals for:

1. relevant product groups for material resource use, environmental effects and security of supply;
2. objectives for relevant product groups with a focus on circularity and the related impact;
3. *roadmaps* — ways of achieving targets — with performance targets and points of action.

This has led to concrete proposals from the transition teams on construction, consumer goods, plastics and manufacturing (IenW, 2022), for example, on electrical appliances (consumer goods) and housing (construction). In its national circular economy programme, the Dutch Government intends to propose concrete targets (IenW et al., 2023), using the proposals from the transition teams. In general, the product groups proposed by the transition teams are relevant, given their current contribution to material resource use and the environmental impacts this entails. However, the number of targets and action lines in the proposals by the transition themes is too large to serve as a guidance on a national level.

The Ministry of LNV has not proposed any targets for the transition theme on Biomass and Food. Instead, the ministry refers to the further elaboration of plans for circular agriculture. This lacks attention for some relevant topics that were included in the transition agenda on Biomass and Food, such as food and effects in the chain, but are not reflected in the plans for circular agriculture.

Start with national targets for circularity as well as the footprints of greenhouse gas and land use

To monitor and guide progress towards a more circular economy on a national level using a few targets and indicators, ministries can formulate national circularity targets focusing on the input, use, output and substitution of raw materials (Hanemaaijer et al., 2021). These targets ideally concern all of the material resources in the Netherlands. In addition, targets are needed for the intended effects, as well, to begin with the setting of national targets for two footprints: the reduction in greenhouse gas and land use in the consumption and production chains. These targets are complementary to existing national energy and climate targets and focus on the impacts of resource use throughout the production chain. In addition, these two footprints are important components of the overall ecological footprint which the government aims to halve by 2050.

It is also relevant for national policy to indicate the roles of existing targets on material resources and waste, and to include them in the system of targets for circular economy. Consider, for example, the current halving target for primary abiotic material resource inputs and the intended halving of waste incineration and landfill. Existing targets for the circular economy can also create tensions with respect to other societal tasks. For instance, the halving target for the input of primary abiotic material resources is at odds with the Coalition Agreement's ambition to accelerate housing construction to around 100,000 houses per year. And if circularity is paramount, a waste policy target for recycling could be replaced by a target for a certain share of reuse and/or share of recycle in products. And ideally, a circular standard would allow efforts aimed at using fewer raw materials for products and services, (prevention), reusing products and high-quality recycling to be added together, with the standard level as a lower limit. This lower limit could be raised in announced steps as part of dynamic standard-setting. In doing so, if the status of the target or standard should always be indicated: are they guiding or accountable targets? And what is the timeframe for moving from the former to the latter type of target?

The Dutch Government may consider setting up additional transition themes

The five transition themes (Biomass and Food, Construction, Consumer Goods, Plastics and Manufacturing) potentially cover by far most raw material use, waste, land use and impact on biodiversity. This applies to both production in the Netherlands and domestic consumption. However, about two-thirds of direct greenhouse gas emissions are not within the scope of the transition themes, because energy supply, refineries and transport and services, are not part of the circular economy policy domain. That is, these industries are not included in the agendas and plans for the five transition themes, and therefore the associated emissions cannot simply be attributed to any of the five themes. There are also certain product groups that, as yet, are not included in the transition themes; such as vehicles in mobility and the infrastructure in energy supply. The material needs for these product groups are not automatically covered by existing policies focused on energy, climate and mobility. There may be a strategic policy gap, here — the raw material needs for the energy transition and for the mobility sector are extensive, cause substantial environmental pressure and are of great strategic importance. Consideration could be given to creating additional transition themes for these subjects, in close connection with what is already happening in policies on energy, climate and mobility.

First focus on directional targets for relevant product groups and then evaluate them

For many product groups, the information on environmental impacts is often still surrounded by large uncertainties (Hanemaaijer et al., 2021). Therefore, when further elaborating on circularity and impact targets for product groups, the government for the time being could take them as guiding or desired objectives, to be converted into measurable targets only when there is more clarity. Periodic evaluation of the agreed targets, the resources needed to achieve them, and the parties involved in taking the appropriate actions (division of responsibilities and powers), can lead to the agreed goals being made more specific or them being adjusted after a few years. Clarity in advance about the criteria on the basis of which targets can be adjusted reduces surprises and uncertainty amongst the parties involved.

Policy instruments used in the Netherlands

Current implementation of policy measures will not be enough to achieve ambition

About three quarters of all the instruments that were deployed by the national government in the period from 2020 to April 2022 concerned communication and research and supporting and

facilitating initiatives by parties (Het Groene Brein, 2023). Examples include stimulating knowledge development and making voluntary agreements, such as the City Deal Circular Building, pilot projects in the packaging chain and research into new protein sources.

Compared to two years ago, the numbers and shares of mandatory instruments, such as pricing and standardisation, have decreased. Furthermore, it appears that, over the past two years, there have been hardly any preparations for deploying more mandatory instruments in the near future (Het Groene Brein, 2023). A qualitative analysis of the currently implemented combination of policy measures shows that, while it is a helpful mix to encourage parties with subsidies and other forms of support, it does not lead to the next stage in the transition towards a circular economy (Het Groene Brein, 2023).

Intensification policy with more mandatory instruments will be crucial

The previous ICER report recommended greater use of 'pressure and coercion' (Hanemaaijer et al., 2021). To date, the use of more coercive instruments through national policy has been limited. Implementation of more coercive instruments may have been hampered, recently, by a lengthy Cabinet formation period. There is also an ambitious European circular economy agenda focused on legislation. This EU track generally involves a long lead time and uncertainties about the final elaboration in detail.

Intensifying policies are needed to realise circular economy ambitions for 2030. New rules of the game and substantial market demand for circular products are key. This involves regulation, in addition to stimulating circular initiatives and activities through innovation and knowledge development and a conducive business climate. Regulatory instruments, such as standards, statutory rules and regulations and pricing, are needed to transform the existing economy into a circular economy. Various instruments are available to reduce material resource use and polluting emissions, such as greenhouse gases, within the chain. These instruments create incentives in favour of circular products and services. Pricing could include an input tax on the use of fossil resources, as is already applied when fossil fuel is used for energy purposes, and expanding the current VAT exemption on product repair. Without pricing polluting and wasteful practices, circular products and services are at a disadvantage compared to existing products, and there is an uneven playing field.

Examples of normative instruments include the mandatory use of certain shares of secondary materials in products, requirements regarding the reparability of products, extending the minimum warranty period of products and mandatory provision of product information. For several of these policy instruments, an EU approach is preferred, as this would ensure a level playing field for the business community. In addition, circularity requirements in circular procurement and producer responsibility could be adjusted gradually and focused on the use of secondary materials in the same or similar products instead of on collection and recycling targets. Also, when granting subsidies for circular activities, circular design could be one of the preconditions.

Furthermore, the government is considering some more binding national policy measures, such as encouraging and standardising circular procurement in civil engineering; imposing a tax on plastic; and promoting a reduction in overcapacity at waste incineration plants (IenW, 2022). Estimating the effects of these policy intentions requires more detailed elaboration.

Text box 1: Stronger commitment to circular product design

Product and services design largely determines their potential circularity and environmental impact. Design, furthermore, is also very important for the related revenue model. This requires large-scale availability of knowledge. As the Dutch Government intends to accelerate the circular transition, it therefore makes sense to continue supporting organisations such as CIRCO and CIRCONNECT. In doing so, it is relevant to distinguish between various product groups. Complex products, such as printers, need a different circularity strategy from that of single-use packaging. Product design should therefore be aligned with a circularity strategy that is appropriate to the related level of complexity and value of the particular product. This should take into account the relative power of entrepreneurs in the value chain, and how users interact with given products during and after their use phase. Given the importance of circular design and the challenges for medium-sized and small entrepreneurs in particular, it is up to policy to not only encourage circular design, but also demand or reward it. For instance, government can require circular design when granting subsidies.

The Dutch Government's circular ambitions require additional funding

The Coalition Agreement made funds available for circular policies that contribute to CO₂ reduction. The policy measures mainly focus on recycling and are financed from the Climate Fund and Urgenda. The Coalition Agreement gives limited attention to circular economy as a cross-cutting policy approach. Also, no financial resources have so far been made available to continue the government-wide circular approach after 2024. This carries the risk of parties involved in the transition themes dropping out and/or being insufficiently equipped to realise the transition and the related plans. Therefore, to continue the existing programmatic approach of the national government, a more structural commitment of resources is needed to implement a national circular economy programme after 2024, including process-related funding for the parties involved. A substantial change towards a circular economy and the realisation of the policy targets for 2030 and 2050 require acceleration and scale-ups. This will take significantly more and structural resources to promote circularity (PBL, 2021; SER, 2022)). How much more cannot be indicated with currently available knowledge. The amount of money needed partly depends on the policy instruments chosen. For instance, subsidies require a larger budget than the setting of standards. Continuation, acceleration and scale-ups are needed to achieve a fully circular economy in the Netherlands by 2050.

Encouraging circular consumption requires more than disseminating information

Although awareness alone can only bring limited change in consumer behaviour, current policies on this subject focus mainly on information and awareness (e.g. through information campaigns and eco-labels). Less attention is paid to other determinants of consumer behaviour, such as costs, infrastructure, convenience, consumer values and beliefs or social norms (Travaille, 2022; Zibell et al., 2021). Circular behaviour can for example be made easier and more attractive to consumers by providing tax benefits and subsidies for circular products and services, or by setting product standards, in addition to information provision.

Most consumers are not yet reducing their consumption by foregoing or reducing the purchase of certain products (Koch and Vringer, 2023). To encourage them to consume fewer products and services that have a high environmental impact (e.g. buying less, eating fewer meat and dairy products, driving and flying less or living in smaller houses), it is necessary to reduce existing

barriers and make other consumption patterns more attractive. Such barriers include the limited availability and affordability of product alternatives with a lower impact, as well as status and comfort levels that are related to new products and consumer habits. The European Commission's new measures around lifetime extension of consumer products can promote more circular behaviour, but there is scope for more than that. For example, changes could be made that help make railway travel and meat substitutes more attractive than air travel and meat products, and that support business models with a focus on second-hand sales, sharing and swapping platforms, repair services and products as a service (Heyen et al., 2013; Niessen and Bocken, 2021).

Circular economy and climate

The Coalition Agreement is particularly focused on the circular economy's contribution to climate

The Rutte IV Government has indicated in the Coalition Agreement that there will be an ambitious climate target for the circular economy. The Dutch Government wants to strengthen the relationship between climate and circular economy. The additional funds made available for circular policies in the Coalition Agreement are aimed at CO₂ reduction and are included in the budget of the Ministry of Economic Affairs and Climate Policy. The policy programme of the Ministry of IenW explicitly states that the transition towards a circular economy will contribute to solving several societal challenges, such as climate change, pollution, biodiversity loss and supply risks related to natural resources. In both the Coalition Agreement and the policy programme, the contributions by the material resources transition are most concretely elaborated for climate. The challenge is to do the same for the other policy tasks. To seize the opportunities offered by a circular economy with respect to those tasks, policy needs to be further worked out into concrete instruments.

The national climate target for the circular economy should mainly focus on chain-related emissions and product lifetime extension

The current government assumes a potential of 2–4 Mt in CO₂ reduction through the use of circular policy instruments (IenW, 2022). The focus on a circular economy's potential contribution to climate is justified, because fewer material resources and products, longer lasting products, high-quality recycled materials and alternative material resources means that fewer new material resources need to be extracted, and fewer materials and products need to be produced, which in turn will reduce greenhouse gas emissions.

The opportunities offered by a circular economy for reducing CO₂ emissions under current climate policies are being utilised to a limited degree. This is because current climate policy focuses mainly on the annual emissions from the country's chimneys, while circular economy policy has the potential to also take into account the effects throughout the production chain (i.e. also outside the Netherlands) and over the entire lifetime of products. Indeed, some of the effects of circular measures will have an impact outside the Netherlands or, due to product lifetime extensions, will not occur until later. It would therefore be better to focus an ambitious climate target for a circular economy on reducing emissions 'anywhere' in the world, rather than on a national scale only. If the climate target for a circular economy focuses on emission reductions along the entire chain and in the long term, then it will complement existing national energy and climate targets.

Additional instruments needed to better exploit the circular economy's potential for climate

Current climate policy design, such as setting annual reduction targets for CO₂ emissions within the Netherlands, does not encourage companies to take circular measures that yield emission reductions elsewhere along the chain or those that will occur only in the long term. Positioning circular economy under climate policy has the risk that the greenhouse gas reductions that could be achieved by more circular production and consumption will only be achieved to a limited extent and that various circular options will not receive sufficient attention or resources. At present, there are hardly any incentives for Dutch companies to use fewer primary material resources elsewhere along the production chain to reduce CO₂ emissions. Encouraging circular solutions requires additional instruments, as they are not eligible for funding from the current climate fund. The policy challenge is to look for ways to identify these 'scope 3 effects' abroad and to encourage companies to do so (SER, 2022).

Dutch governance approach to a circular economy

Achieving major circular ambitions requires strengthening governance

To achieve a fully circular economy in the Netherlands, the government has opted for a public-private approach. This recognises that governments, businesses and citizens are all needed to realise the transition towards a circular economy. To this end, the government has identified five priority transition themes — Biomass and Food, Construction, Consumer Goods, Plastics and Manufacturing — and created transition teams that include representatives from government authorities and businesses. For each of these themes, plans have been made by the teams in so-called transition agendas. In addition, 10 priority cross-cutting policy themes were chosen, including statutory rules and regulations, producer responsibility, circular procurement, circular design and market incentives. Implementation programmes, subsequently, included concrete actions and projects for transition and policy themes. With this approach, the government together with other stakeholders has laid a foundation to advance the transition towards a circular economy.

In its circular economy approach, the government places the emphasis on 'personalised representation, non-commitment, pluralism, consensus, following and achieving short-term goals that are easy to achieve' (NSOB, 2022). This approach can be recognised in the organisation and working methods of the transition teams that differ widely in composition, working methods and strategy. A strategy of experimentation and scaling up is also a general team characteristic, with members often actively contributing from their own resources to the drafting of transition agendas, proposals for goals and the roadmaps to achieve them. Members usually participate in a personal capacity, and have no formal representative role to speak or make agreements on behalf of the entire constituency, while they are expected to ensure the implementation of the agenda for the whole transition theme. In short, they lack the decision-making powers to fulfil the broadly assigned responsibilities.

This is typical of the start-up phase of a transition; enthusiastic and benevolent parties working together on the basis of what is possible. However, this does not fit well with the government's grand ambition to be fully circular by 2050. In spite of the current enthusiastic commitment of the willing parties involved, the ambition to become fully circular will not be achieved (NSOB, 2022). Thus, experimentation and scaling up are expected to deliver handsomely, but this will not automatically lead to the necessary radical changes and systemic interventions that will break the

status quo. There is therefore a fundamental policy choice to be made: is collaboration and experimentation paramount for the time being, or is it about realising the stated ambition for the Netherlands to be fully circular by 2050? To date, this question has remained unanswered and no explicit choice has been made, but the time has come to do so.

If achieving the ambition is paramount, this requires strengthening the existing governance structure. At a minimum, this requires that the parties involved, such as the transition teams and regional authorities, are given clear responsibilities and related mandate and possibilities (i.e. people and resources) to fulfil their responsibilities. This is also reflected in a joint letter by the Chairs of the transition teams to the State Secretary for Infrastructure and Water Management, in early 2022 (Rakhorst et al., 2022). The governance side of realising the ambition requires that more attention is paid, amongst other things, to representation of the support base, detailed targets, to formalising agreements in procedures, indicating the elements and timeframes for which parties can call each other to account.

EU circular economy policy and Dutch interests

EU proposals for sustainable products may have a major impact

In its second Circular Economy Action Plan, the European Commission announced concrete legislative initiatives on sustainable products and their consumption (EC, 2020). These initiatives should ensure that products last longer, are easier to reuse and repair, and contain as many recycled materials as possible. The proposed plans focus on closing the chain for specific product groups (e.g. batteries, packaging, e-waste) and sectors (e.g. construction, textiles, chemicals and waste treatment) and on developing processes and mechanisms to promote the circular economy (e.g. monitoring). In addition, the European Commission plans to introduce a digital product passport so that producers, consumers, repairers and recyclers are better informed about product composition and assembly. The new policy can help ensure that consumers also receive reliable and relevant information about the lifespan, warranty period and repairability of products (EC, 2022).

What is striking is that the proposals from the second EU Action Plan for a Circular Economy focus on legally binding measures (EC, 2020). These include, for example, expanding the Ecodesign Directive to include more products and more product requirements and the initiative to move towards sustainably designed products. These requirements address circularity and environmental impact across the product life cycle and include product longevity, reusability and repairability, recyclability and the use of a minimum quantity of secondary materials in products (EC, 2022). An increasing number of EU initiatives are aimed at reducing material resource use in products and at reusing products (Watkins and Meysner, 2022). The potential impact of the proposed instruments is high because they cover almost all products and sectors and are binding proposals. It is a regulation with a direct impact on national policies. The final impact depends on the concrete elaboration and design of the instruments. Such a process usually takes several years.

Dutch ambitions benefit from active involvement in EU CE policy

An EU-level approach has the advantage of ensuring a level playing field for companies across the European Union. EU policy is therefore crucial to achieving a circular economy in the Netherlands; especially in terms of EU internal market rules. This involves not only product and trade policy, but also waste policy and the prevention of harmful substances in products, reporting obligations, possibilities for pricing environmental damage and sustainable financing. For example, in the case of waste policy, binding targets for recycling specific waste streams could be considered. Examples of reporting obligations are the Corporate Sustainability Reporting Directive (CSRD) and the Corporate Sustainability Due Diligence Directive (CSDD), which require companies to be transparent in their annual reports about the environmental and human rights impacts of their production chains. This provides opportunities, for example, to link variable remuneration systems at companies to sustainability performance and helps to move investors more towards sustainable investments.

Pricing could include the European Emissions Trading Scheme (ETS) and low VAT rates for sustainable products and services. In addition, mandatory recycling shares have been in place for years for specific materials and products, there are European Directives for Extended Producer

Responsibility for various products (e.g. for batteries and electronics), there is a taxonomy for sustainable financing, and there are EU policies regarding the authorisation and use of substances under the REACH Regulation.

Each of these pathways largely determines the room for manoeuvre in the Netherlands. A continued active input in the further elaboration of these EU policy lines is therefore of great importance to achieving a circular Netherlands. On certain subjects, the country could work ahead of actual policy implementation decisions. Examples include expanding the infrastructure for recycling and product sharing, VAT reduction on labour for repairing products where this is not yet the case, factoring environmental damage into product prices, extending and expanding warranties, data collection on raw material flows and stocks, product lifespan and impacts, and banning advertising on certain products and services with a high environmental impact. By being at the forefront, Dutch companies would have the opportunity to become leaders in reuse and repair, as they have been for recycling in the past.

Safeguards needed to include the effects of circular economy policies for low- and middle-income countries

Circular policies in the Netherlands and the European Union create opportunities, but there are also risks for low- and middle-income countries. For example, if the Netherlands and the European Union increase the use of bio-based resources, there is the risk of increased pressure on food supply and nature in low- and middle-income countries. Another risk is that of job losses in low- and middle-income countries due to stricter circular product standards in the European Union.

These risks come on top of existing adverse effects, such as poor working conditions and pollution in the processing of discarded products. To counter these risks, EU and Dutch circular economy policies should be well coordinated with development cooperation and trade policies, and provide guarantees about, for instance, good working conditions, a living wage and sustainable production processes. This then would not only strengthen the transition towards a circular economy in the European Union and the Netherlands, but would also contribute to achieving the Sustainable Development Goals (SDGs) in these countries. This requires, amongst other things, improving the traceability and transparency of international production chains, integrating circular economy into trade agreements and covenants on International Corporate Social Responsibility, and supporting low- and middle-income countries in adapting their economies to changing trade flows and product requirements (Lucas et al., 2022).

Regional circular economy policy and the national objective

Regional differences call for region-specific agreements between national and regional governments

Many regional authorities do not yet have a clear roadmap for a circular economy. Front-runner provinces, municipalities and water boards have formulated ambitions, while others have documented close to nothing in this respect. The lack of a clear joint task and individual role for the region is an inhibiting factor in this respect. As a result, many administrators feel hardly any sense of urgency when it comes to a circular economy (Kruk et al., 2020; RHDHV, 2022). Many regional authorities also find it difficult to draw up a targeted circular programme with projects, because roles and responsibilities are not clear and there are no concrete regional objectives (RHDHV, 2022). Of the front-runner authorities, many have formulated policy, but without an elaboration of associated targets. Similarly, these authorities often lack an overarching strategy, a coherent action plan, sufficient structural resources or thorough monitoring of the results.

To realise national ambitions on a circular economy, it would be helpful for both national and regional government authorities to jointly issue a clear mission for regions with specific goals and achievements. This would also involve agreeing on roles and responsibilities of regional parties (Kruk et al., 2021). It is important for tasks to be region-specific and aligned with regional comparative advantages. Because of the Dutch regional geographical and economic diversity, this calls for an approach that makes the most of the local situation and specific regional characteristics. After all, regions differ in size and growth of the local population, degree of urbanisation, economic sectors, economic development, use of material resources and available stocks of materials in, for example, buildings, infrastructure and goods in the region.

Utilise regional potential and promote scale-ups

Regions have companies and other societal actors who can accelerate the transition with circular activities. Within regions or areas, various parties can experiment together with innovative ideas, setting up new chains, new business models or new process technologies. Regions differ in types of strength, for instance, in the expertise of their companies, colleges and other societal parties. For instance, the Amsterdam Metropolitan Region has had a joint programme with the Amsterdam Economic Board for more than seven years now and Friesland has created a strong bottom-up movement. This has led, amongst other things, to a mattress-recycling system in the Amsterdam area and a bio-based insulation pact by Circular Friesland.

Regional authorities (municipalities, provinces, water boards) have an important role to play. They can share experiences and promote the circular economy, for instance, regarding land allocation, area development, housing construction and tenders. And, through the regional development companies and environmental services of which they are the client, they can play a crucial role in licensing and encouraging businesses. However, initiatives taken in one region are not automatically followed in others. It is precisely this cross-regional element where the national government can play a role, for instance in legislation and coordination, as a 'transition broker' connecting companies and authorities around a product group or region. In this way, the

government can help scale up promising regional innovations. Scale and market possibilities are important factors in getting initiatives off the ground on a structural basis and scaling them up.

National government may promote the further exchange of regional knowledge and experiences

The general picture is that regional authorities are still at the beginning of the transition towards a circular economy. However, there are major differences between them. Several, for example, still hold the view that a circular economy is about waste policy and recycling. Others already actively encourage more circular production and consumption, particularly by facilitating regional knowledge networks and through circular procurement (RHDHV, 2022; Kruk et al., 2021). Compelling the use of circular methods, for example, regarding housing construction or business parks, is still happening on only a very limited scale.

Provinces, water boards and municipalities could increase the success rate of initiatives if they were to apply more coordination and cooperation. For instance, each region has to deal with household waste and the new housing policy task, and is able to exert influence on companies through the issuing of permits and setting of establishment conditions. To date, regional knowledge and experiences are only shared to a limited extent, which is why mutual learning and building on those experiences hardly ever takes place (Kruk et al., 2021). The added value of cooperation and knowledge sharing, however, is being recognised (Mul et al., 2022), and regional authorities realise that a learning knowledge infrastructure requires a joint investment plan (Kruk et al., 2021). Recently, the first steps have been taken, for example, in the creation of a 'strengths map', the establishment of a provincial monitoring system (IPO 2023), and the provision of inspiring policy examples for regional authorities (<https://www.deverschilmakers.nl/kennisplatform>). A strong follow-up of these initiatives with adequate capacity and budget may accelerate the transition towards a circular economy. Strengthening the regional knowledge infrastructure will be necessary in sharing knowledge and gaining more insight into the possibilities for concrete actions. The national government also has an interest here, for instance, to obtain insight into policy gaps and learn from circular initiatives in order to accelerate the transition. The national government has a coordinating responsibility and can also contribute financially to strengthening the knowledge infrastructure. In doing so, it can build on current platforms, such as those of Rijkswaterstaat and Circularities. In this way, the government will be able to stimulate the transition by officially recognising the regional knowledge infrastructure and, together with regional authorities, arrive at an acceleration pathway that also accommodates these authorities in a way that is similar to the role of *Versnellingshuis Nederland Circulair* for companies.

In conclusion

A fully circular economy requires government-wide commitment

Accelerating the transition to a fully circular economy by 2050 requires government-wide commitment. For the Circular Economy Policy, a joint approach by stakeholders was chosen to make the Netherlands circular by 2050. While there is a government-wide ambition and approach to circular economy, there is no government-wide commitment, yet. For instance, although the organisation is the responsibility of the Ministry of IenW, the financial resources for circular economy are mainly provided through climate funds at the Ministry of EZK. In addition, the Biomass and Food Transition Team was disbanded after the Ministry of Agriculture, Nature and Food Quality took over the organisation and narrowed the goals to circular agriculture. As a result, there is no focus on food and the effects in global chains. It is also not always clear what the Ministry of IenW expects from other ministries, transition teams and regional authorities. Transition teams and local authorities explicitly ask for clarity with respect to their tasks. There is as yet no tightly directed, government-wide policy process, compared to what is already happening on climate policy. As a result, a circular economy does not currently seem to have much political or policy priority.

In order to achieve a fully circular economy in the Netherlands by 2050, the responsible handling of material resources must become a priority for the Dutch Government. The transition deserves more attention from the entire government, given the scale of the task, the stated ambitions and the significant contribution that the circular economy could make to addressing other challenges, such as climate change, loss of biodiversity, pollution of air, water and soil, and security of supply risks.

This calls for a shared mission that will elicit change and contains a long-term ambition rather than being based on what is achievable according to common activities and vested interests. It also requires more concrete goals and roadmaps. By working on this in a government-wide approach, it will be possible to address the synergy and tensions between the circular economy transition and other societal issues. Such a government-wide effort is also necessary to create a coherent policy mix, in which, in addition to facilitation and stimulation, a strong focus is placed on standardisation and pricing in order to radically change the guidelines for production and consumption. In doing so, it is important to arrange sufficient financial resources, solid coordination and an adequate implementation structure. In this way, all parties — including companies, consumers and regional authorities — will be able to carry out their tasks with a sufficient mandate and range of possibilities.

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