

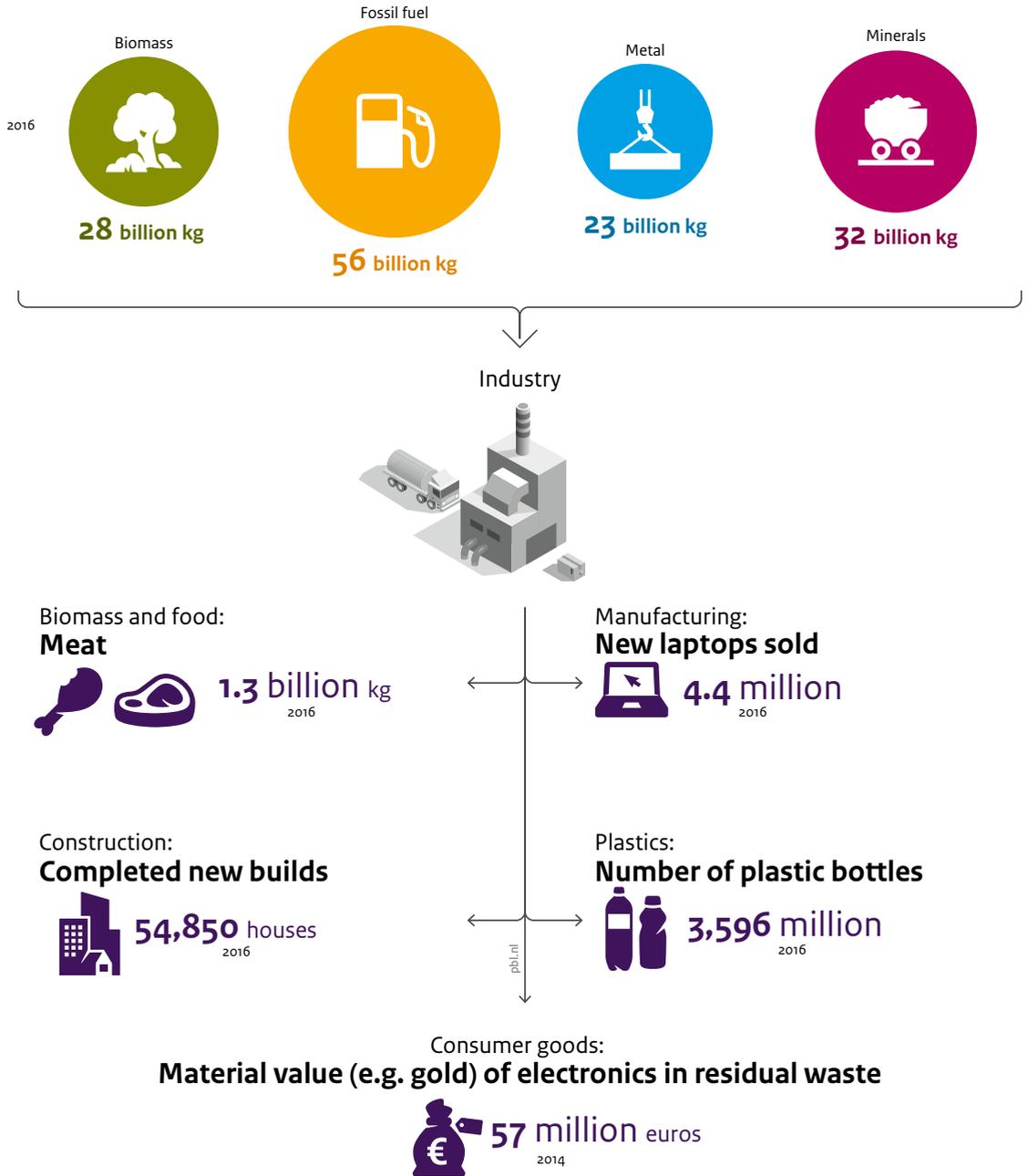


# **CIRCULAR ECONOMY: WHAT WE WANT TO KNOW AND CAN MEASURE**

SYSTEM AND BASELINE ASSESSMENT  
FOR MONITORING THE PROGRESS OF THE  
CIRCULAR ECONOMY IN THE NETHERLANDS

Policy Brief

Raw materials for Dutch consumption, examples per priority



# Circular economy: what we want to know and *can* measure

## System and baseline assessment for monitoring the progress of the circular economy in the Netherlands

José Potting and Aldert Hanemaaijer (eds.), Roel Delahaye, Jurgen Ganzevles, Rutger Hoekstra and Johannes Lijzen



PBL Netherlands Environmental  
Assessment Agency



National Institute for Public Health  
and the Environment  
*Ministry of Health, Welfare and Sport*



Statistics  
Netherlands

**Circular economy: what we want to know and can measure. System and baseline assessment for monitoring the progress of the circular economy in the Netherlands**

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The translation of the full report will also become available in 2018.

**Corresponding author**

Jose.Potting@pbl.nl

**Authors**

José Potting<sup>[1]</sup> and Aldert Hanemaaijer<sup>[1]</sup> (eds.),  
Roel Delahaye<sup>[2]</sup>, Jurgen Ganzevles<sup>[3]</sup>, Rutger  
Hoekstra<sup>[2]</sup> and Johannes Lijzen<sup>[3]</sup>

<sup>[1]</sup> PBL Netherlands Environmental Assessment Agency

<sup>[2]</sup> Statistics Netherlands (CBS)

<sup>[3]</sup> National Institute for Public Health and the Environment (RIVM)

Lead authors Chapter 3: Jurgen Ganzevles and Johannes Lijzen (RIVM); lead authors Chapter 5: Roel Delahaye, Rutger Hoekstra and Kees Baldé (CBS); lead authors remaining chapters: José Potting and Aldert Hanemaaijer (PBL). Anne Hollander, Lavinda Kok, Joris Quik, Elias de Valk, Manon Zwart (all RIVM) and Guus van den Berghe and Mandy Willems (both RWS) contributed to the research for Chapter 3. Chapter 4 was co-authored by Marko Hekker and Denise Reike of Utrecht University (UU). Patrick Bogaart, Krista Keller, Niels Schoenaker, Adam Walker and Bert Wit (all CBS) contributed to Chapter 5. Denise Reike (UU) contributed to Section 2.4.

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# Contents

Summary	6
Focus on reduction in natural resource consumption	7
Need to monitor circular economy progress	7
Transition process with future effects in mind	8
Reduction goal needs further specification	9
Fewer natural resources needed for ‘higher’ circularity strategies	10
Monitoring at various aggregation levels	11
Action monitoring already possible	12
What we want to know	12
What we can already measure, and therefore know: baseline assessment	12
Monitoring transition dynamics in the start-up phase	13
What we want to know	13
How we are going to monitor, and what this tells us	14
Effect monitoring possible to some extent	15
What we want to know	15
What we can already measure, and therefore know: baseline assessment	15
Monitoring of transition agendas requires further elaboration	16
Growth model	17
The Netherlands internationally at the forefront	18

## Summary

*The Dutch Government has outlined its plans for the transition to a circular economy in the government-wide circular economy policy programme, entitled 'A circular economy in the Netherlands by 2050'. A monitoring system is required to determine whether this transition is progressing as planned, a proposal for which is made in this report. This monitoring system will document 'what we want to know, and what we can already measure' (the latter being the baseline assessment).*

*In the monitoring system, a distinction is made between the desired effects and the transition process that needs to take place to bring about these effects. The most important desired effect of the transition to a circular economy is a reduced consumption of natural resources. This will result in fewer environmental effects (e.g. due to greenhouse gas emissions) and reduce our dependence on natural resource imports, and therefore increase resources supply security. Reducing natural resource consumption requires circularity strategies, for example by extending the lifetime of products and product components, such as for smartphones, or through encouraging the sharing of certain products, such as cars. This will call for efforts to ensure that such circularity strategies are adopted, for example by encouraging cooperation between product chain partners, removing regulatory barriers and designing circular products. This is a complex and, initially, slow process. Furthermore, it will take a while before the effects can be seen. Monitoring of both the transition process and its effects, therefore, is relevant.*

*In this report, we propose indicators for monitoring both the transition process and the effects achieved. We are already able to monitor the effects to some extent, in particular the effects of natural resource consumption, greenhouse gas emissions and waste and waste treatment. These effects are being monitored for the Netherlands as a whole and for the five priority themes of the government-wide programme: biomass and food, plastics, manufacturing, construction, and consumer goods. Transition teams have been appointed for each priority theme and have each drawn up a transition agenda (published at the same time as this report).*

*Not all the indicators proposed in the monitoring system can currently be measured; this applies in particular to those relating to the transition process. The monitoring system described in this report should therefore be regarded as a growth model. The aim is to develop the monitoring system further in the coming years, together with other knowledge institutes and partners involved in the five transition agendas.*

## Focus on reduction in natural resource consumption

In the 2016 government-wide circular economy policy programme, the Dutch Cabinet outlined its plans for the restructuring of the economy to achieve a circular economy that makes optimum use of natural resources. The government specified the following strategic objectives:

1. Extend the lifetime of products and product components and recycle materials to produce high-grade secondary materials (in other words, improve the natural resource efficiency in *existing* product chains).
2. If new natural resources are needed to produce new materials, use renewable and commonly available natural resources as substitutes for critical, not sustainably extracted or processed abiotic resources.
3. Design new products, develop new production methods and encourage new ways of consumption (in other words, invest in *new* product chains).

The government and its societal partners, thus, aim to reduce natural resource consumption while also minimising the risk to humans and the environment in the rest of the resource chain. The preliminary government target for 2030 is a 50% decrease in the use of primary *abiotic* resources (minerals, metals and fossil fuels), while the target for 2050 is a fully circular economy in the Netherlands. It should be noted that the government-wide policy programme does not give a maximum figure for biomass consumption, even though biomass is an important renewable (*biotic*) natural resource with a limited supply.

## Need to monitor circular economy progress

It is important to measure the progress being made in the transition to the circular economy. This helps both the government and its partners make sure the transition is on course, and enables course corrections to be made. At the request of the Dutch Government, PBL Netherlands Environmental Assessment Agency (PBL), Statistics Netherlands (CBS) and the National Institute for Public Health and the Environment (RIVM) have developed a monitoring system and baseline assessment made up of three monitoring components:

- actions from the government-wide policy programme (RIVM in cooperation with Rijkswaterstaat);
- transition dynamics (PBL in cooperation with Utrecht University);
- effects on natural resource consumption, the environment and the economy (CBS).

The aim of this system is to monitor the efforts made by government authorities and other societal partners, and to show the effects of these efforts. In this way, an evaluation can be made of the factors for success and failure in the transition process towards the circular economy. Based on the indicators for each of the monitoring components, the monitoring system can be used to analyse what we want to know, what we can already measure, and which elements of monitoring components require further development. 'What we can already measure' has been established as the baseline assessment. The results show us where we stand right now in the transition to the circular economy. What we *want* to –but cannot yet– measure sets the agenda for the further development of the monitoring system (see 'Growth model').

## Transition process with future effects in mind

Although the transition to the circular economy is a long process, monitoring it as we go along helps us to understand the factors of success and failure, allowing course corrections to be made. Monitoring can also help us assess the feasibility of bringing about the desired effects in the long term. To do this, the monitoring system makes a distinction between *monitoring the transition process* and *monitoring the effects*.

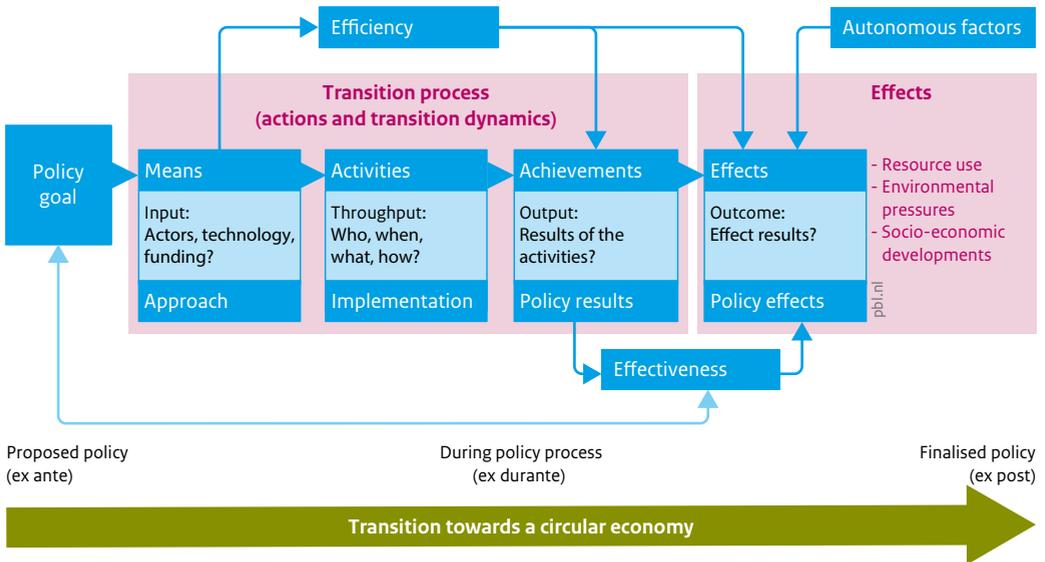
There are two components to the monitoring of the *transition process*: monitoring the transition dynamics and monitoring the actions. Transition dynamics monitoring identifies what is actually taking place in specific product groups, such as in terms of product design, and whether the proportion of circular products is increasing (and therefore the proportion of linear products is decreasing). The action monitoring shows the progress being made regarding the actions in the government-wide policy programme that are to accelerate the transition dynamic.

*Effect monitoring* shows the effects of the transition process on natural resource consumption, environmental pressure and socio-economic development (e.g. economic growth and jobs).

This distinction between transition process and effects follows a similar distinction as made in the policy evaluation scheme drawn up by the Netherlands Court of Audit (2005) (Figure 1). In this scheme, the transition process is similarly differentiated according to means, activities and achievements. Utilising means (input) and undertaking activities (throughput) ideally produces achievements (output) that bring about the intended effects (outcome).

Figure 1

Policy assessment framework for measuring the progress of the transition towards a circular economy



Source: Netherlands Court of Audit 2005; adaptation by PBL

## Reduction goal needs further specification

For monitoring to take place, the preliminary goal –to halve the consumption of abiotic natural resources by 2030– needs to be further elaborated. The first point for consideration is the base year. Following consultation with the former Dutch Ministries of Infrastructure and the Environment (IenM) and Economic Affairs (EZ)<sup>1</sup>, 2014 was chosen as the base year against which the 50% reduction goal is to be compared.

The second point concerns whether the 50% reduction goal only refers to natural resource consumption in the Netherlands (direct consumption), or also to the indirect resource consumption during the production of imported materials, product components and products (the footprint). Both can be meaningful, and the monitoring system, therefore, includes effect indicators for both direct consumption and footprints. The footprint indicators relate to the first and third strategic goals of the government-wide policy programme (both focus on closing product chains). The transition agendas for the five priority themes also focus on chain responsibility.

This leads, thirdly, to the question of whether the footprints apply to production or consumption in the Netherlands. The production footprint concerns the effects in the supply chain for everything that is produced in the Netherlands, while the consumption footprint relates to the effects along the entire product chain of products that are consumed in the Netherlands (by consumers, public bodies and business investments). Both approaches can be worthwhile.

Fourthly, specifying the 50% reduction goal in more detail may facilitate better management of the natural resources for which a reduction in consumption is the most urgent. For example, a higher reduction goal could be implemented for critical natural resources (e.g. rare earth metals) and natural resources the extraction and use of which exerts high environmental pressure (e.g. leading to greenhouse gas emissions).

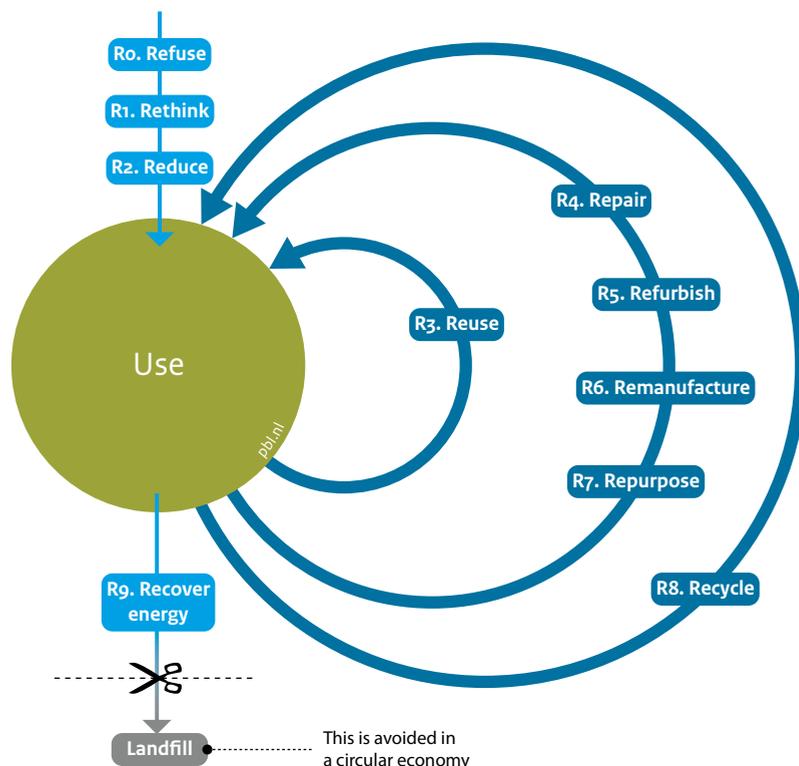
The final and fifth point: does the reduction goal apply to the Netherlands as a whole, or should it be translated into separate reduction goals for each of the priority themes? This requires policy choices to be made. It should be noted that the 50% reduction goal cannot apply to the biomass and food priority theme. This is because biomass is one of the most important 'renewable and commonly available natural resources', to be used to substitute abiotic resources wherever possible (the second strategic objective). As a result, biomass will increasingly be used in the production of medicines, bioplastics, biomaterials, biofuels and other products. However, sustainable biomass is limited in its supply. In a circular economy, we need to make efficient use of *all* our natural resources, including biomass, and therefore produce and process it sustainably.

## Fewer natural resources needed for 'higher' circularity strategies

In pursuing the three strategic objectives of the government-wide policy programme, the aim is to halve the consumption of abiotic resources by 2030, and to achieve a fully circular economy in the Netherlands by 2050. The government aims to substitute abiotic resources for renewable and commonly available natural resources (second strategic objective), and to make efficient use of *all* natural resources in all product chains (first and third strategic objectives). Figure 2 shows the order of priority for circularity strategies; a 'circularity ladder' based on product *function*.

As a rule of thumb, circularity strategies higher up the ladder require fewer materials, and these materials are more often made from recycled (secondary) materials. This means that fewer natural resources need to be extracted to produce new (primary) materials. The environmental effects of this reduced natural resource extraction and primary material production are thus also minimised. This rule of thumb applies most of the time, but not in the case of undesirable feedback effects. For example, people may use a product more often if product sharing makes it easier (e.g. cars used by

Figure 2  
Circular economy: more than recycling



Source: PBL

people who previously travelled by train), recycling sometimes uses more energy than the production of new materials, and existing materials may contain substances that are harmful to humans and the environment and therefore better not be recycled.

Unfortunately, many circularity strategies still lack good indicators for measuring progress. This is an important point, as far as the further development of the monitoring system is concerned.

## Monitoring at various aggregation levels

As said, a distinction is made in the monitoring system between the transition process and its effects. In addition, the Dutch Government wants to use the system to monitor and guide policy at various aggregation levels; for the Netherlands as a whole, for the

priority themes in the government-wide policy programme, and for the specific product groups within these themes. Furthermore, it is useful to measure both the effects in the Netherlands (direct) and in the whole of the product chain (direct and indirect) at each of these aggregation levels. So far, effect monitoring and the baseline assessment have been carried out for the Netherlands as a whole and for the five priority theme levels. Effect monitoring for specific product groups has not yet been completed.

## Action monitoring already possible

### What we want to know

The government-wide policy programme has been translated into almost 200 actions, through which the government and its societal partners aim to bring about the transition to a circular economy. Some actions are highly specific and have been in place for some time; others should be regarded primarily as new policy proposals. The actions relate to the five priority themes and the five types of ‘interventions’ documented in the government-wide policy programme and, ideally, contribute either directly or indirectly to the natural resource reduction goal and the three strategic objectives.

Of course, monitoring should show the progress being made in terms of implementation of the actions, but also the extent to which the actions contribute to the transition dynamics and the intended effects (smart monitoring). This will help the government to ensure that the policy programme remains on course, while also making it easier to anticipate necessary corrections to the actions. The new actions named in the transition agendas have not yet been included in the monitoring system as described in this report, as the transition agendas and the monitoring system have been developed in parallel.

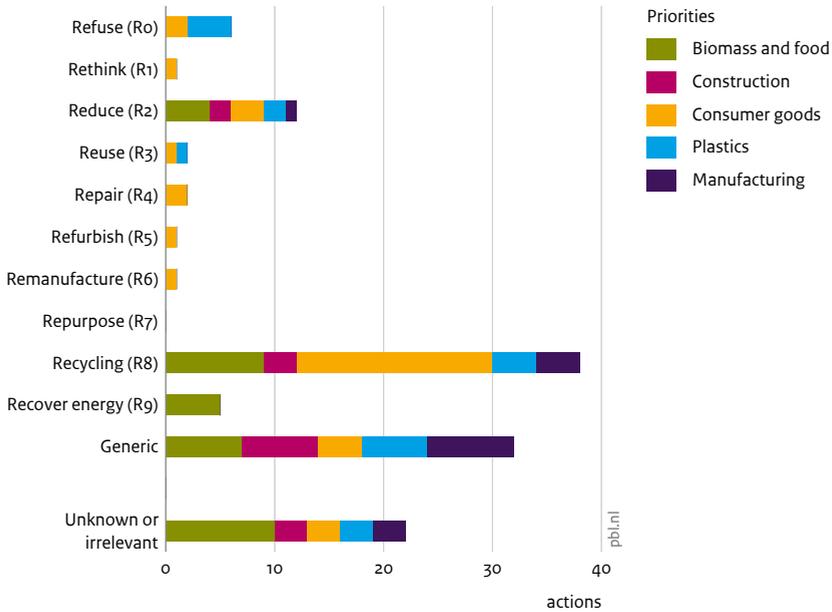
### What we can already measure, and therefore know: baseline assessment

The baseline assessment for action monitoring consists of preliminary results for 2017. A final assessment for 2017 will take place in early 2018. Data have been obtained for two thirds of the actions, and more than half the actions have now been initiated. Some actions need to wait for the completion of other actions; for example, the implementation of some actions depends on the biomass and food, manufacturing and construction transition agendas.

Not all actions in the government-wide policy programme have been formulated as SMART actions; these therefore need to be clarified in terms of what they involve and what needs to be done and when. This also applies to the definition of the intended effect of the action or policy achievement. Actions that have already been initiated in the priority themes relate primarily to recycling and waste treatment or, more generally, to instrument or network development. Less attention has clearly been paid to circularity strategies higher up the ladder (Figure 3).

Figure 3

Actions government-wide policy programme circular economy, per circularity strategy, 2017



Source: RIVM 2017

## Monitoring transition dynamics in the start-up phase

### What we want to know

The starting point, speed and direction of the transition to the circular economy will vary, depending on the priority theme and its specific product group. Transition dynamics monitoring tracks the means, the activities and the resulting achievements for specific product groups. The three strategic objectives, with the circularity strategies as outcomes of the first and third objectives, represent the key achievements of the transition process that need to bring about a lower consumption of natural resources, fewer environmental effects and an increase in socio-economic development.

Circular innovation in product chains plays an important role in each of the three strategic objectives. Circular innovation could be represented by a smart revenue model, clever product design or a new technology (including materials made from renewable and commonly available natural resources). For these to be implemented in production processes and consumer goods, it is essential to work together both with the business

community (circular production) and with consumers (circular consumption). This involves making changes to written and unwritten rules, customs and beliefs. To achieve this, innovating organisations need to work in a context that supports innovation. Such a context must make it possible for organisations:

- to be *able* to innovate, for example by funding innovation projects, circular knowledge development and experimentation;
- to be *allowed* to innovate, by changing rules and regulations;
- to *want* to innovate, for example by encouraging the development of a vision and cooperation in product chains and by making natural resource consumption financially unattractive through taxation.

This supportive context is primarily forged in the formative phase (pre-development and take-off), making a rapid increase in the share of circular products and services possible in the phase of growth (acceleration and stabilisation). Experience is still limited when it comes to monitoring the progress made in the – often long – formative phase. However, Table 4.1 of the report’s ‘Full Results’ section makes some suggestions for measurable and generic indicators to monitor ‘able, allowed and want’. As part of the continued development of the monitoring system, the decision may be made together with other societal partners to expand or refine this set of generic indicators, using indicators that are more specific to a priority theme or product group.

### How we are going to monitor, and what this tells us

The monitoring system needs to be developed further, over the coming years (growth model). This includes translating the transition dynamics indicators into concrete, measurable indicators. Indicators being monitored are distinguished according to the circularity strategy they contribute to. For example, the ‘number of introduced circular rules and regulations’ indicator will make it clear how many of those rules and regulations relate to materials and energy (R8-R9), how many to extending the lifetime of products or product components (R3-R7) and how many to the smarter production and consumption of products (R0-R2). Recycling (R9) is still very much part of the linear economy, while the higher-level circularity strategies (R7-R0) come closer to the circular economy.

Although assigning an indicator to a circularity strategy helps to interpret the measured indicator, it may not provide all the necessary information. For example, rules and regulations may apply either to a specific product group, or to many product groups (e.g. the Ecodesign Directive). Because of such differences, additional information is needed to determine the level of influence per indicator. This type of monitoring, which produces qualitative information that requires further interpretation, is still relatively uncharted territory.

Some of the information about transition dynamics, such as that relating to investments, networks and knowledge exchange, is already available in knowledge and implementing organisations. An example is the information contained in the databases of government-subsidised projects run by the Netherlands Enterprise Agency (RVO.nl). This information still needs to be extracted from the databases, which means that the baseline assessment for transition dynamics is not yet complete.

## Effect monitoring possible to some extent

### What we want to know

Effect monitoring measures the consumption of natural resources and materials (various indicators), resource supply security, environmental effects (water and land use, greenhouse gas emissions), growth in the circular economy and employment levels, for the priority themes and for the Netherlands as a whole. Some of the required indicators cannot yet be fully quantified. For example, the footprint indicators for natural resource use and environmental effects would ideally measure both the direct effect in the Netherlands and the effects in the product chain elsewhere. However, it is currently only possible to measure effects in the whole of the product chain (the footprint) for natural resource use and greenhouse gases, and not for water and land use. Possibilities for measuring the effects due to all manufacturers or all consumers are also limited. The measurement of such 'sub-sections' will enable further development and specification of the natural resource reduction goal in the government-wide policy programme. Monitoring the priority themes and the Netherlands as a whole makes use of the CBS databases. It is also interesting to know whether effects are the result of the implemented circularity strategies, or of other autonomous factors, such as population growth, economic growth or economic structure. Methods are being developed to determine how important each implemented circularity strategy or autonomous factor is for natural resource consumption, environmental effects and socio-economic development (decomposition model).

### What we can already measure, and therefore know: baseline assessment

It is already possible to monitor some of the effects for the Netherlands as a whole and for each of the priority themes, in particular in relationship to natural resource consumption, greenhouse gas emissions and waste, waste treatment and recycling. The direct use of 314 billion kilos of natural resources in Dutch manufacturing in 2016 remained roughly constant, compared with 2014, but decreased by about 7% compared with 2010, mainly due to a decrease in mineral imports and natural gas extraction. However, the use of natural resources in the product chain increased by 3% compared with 2010, mainly due to increased imports of semi-manufactured goods and final products. This, however, may not represent a structural trend as it concerns a relatively short and economically turbulent period (i.e. the economic crisis).

Natural resource consumption in the product chain – the natural resource footprint – showed a slight decrease in 2016 when compared with 2014, but a 26% decrease compared with 2010. This is mainly due to decreased mineral imports for the construction sector during the economic crisis. However, economic recovery in the sector will again cause an increase in the consumption of natural resources.

The Netherlands has been at the forefront of recycling in Europe for many years, with over 80% recycling and material productivity (euros/kilos material). However, the use of secondary materials in the Dutch economy is just 8%. This huge difference can be explained by the fact that much more material is required as input than can be produced through recycling. This is because many materials are physically ‘stored’ in products with a long service life, such as buildings. In addition, a large proportion of natural resource use in the Netherlands is for food and energy (which can never be based for 100% on secondary materials). The goal to halve the use of abiotic resources, therefore, represents a considerable challenge.

The Netherlands’ greenhouse gas footprint is smaller than direct greenhouse gas emissions in the Netherlands. The reason for this is that we export energy-intensive products. Although only a limited number of companies in the environmental sector currently focus on reducing natural resource consumption, this number did grow between 2010 and 2016. The same also applies to employment levels in this sector. However, these macroeconomic effects are difficult to measure; partly because the share of circular activities in these organisation is difficult to determine.

## Monitoring of transition agendas requires further elaboration

The national natural resources agreement (*Grondstoffenakkoord*) gives a large role to societal partners in the transition to the circular economy. In parallel to the development of the monitoring system described in this report, five transition teams have worked hard to define transition agendas for the five priority themes of biomass and food, plastics, manufacturing, construction and consumer goods. The transition agendas include starting points for monitoring the agendas and their effects. The transition agendas are written in the context of the day-to-day work of the transition teams, influenced for example by the activities of the business community and environmental and consumer organisations. However, a more theoretical approach has been taken to the development of the monitoring system, and work needs to be done to reconcile the two.

The transition agendas and interviews with the transition teams make it clear that there is a need for unambiguous, controllable and independent methods to determine the environmental pressure caused by a product chain (life-cycle assessment). There is also a need to measure the preservation of value in specific product group chains. A method

for calculating environmental pressure has been developed for the construction sector: the environmental performance of buildings and civil engineering works (*Milieuprestatie gebouwen en GWW-werken*), making use of the national environmental database (NMD). This requires further development to evaluate the different circularity strategies. Similar methods and databases could be developed and implemented for other product groups.

## Growth model

The monitoring system helps us to analyse what we want to know, what we can already measure, and which monitoring system components require further development. It is, therefore, not yet complete. It seems sensible to continue its development in collaboration with societal partners and other knowledge institutes in the Netherlands, and the following steps are advised, for the coming years:

### **Decide on the reporting structure**

- Identify a finite set of key indicators for a quick overview and dashboard indicators for a more detailed analysis (layered monitoring structure).
- Publish information online (continuous reporting) and regularly produce progress reports to interpret figures and trends.
- Aim for a circular equivalent of the National Energy Outlook that shows how the transition is progressing, including an evaluation of implemented policy.

### **Continue to develop existing monitoring components**

- Enable monitoring of not-yet-measurable effect indicators (e.g. footprints and critical natural resources) using the materials monitor and other CBS data.
- Enable monitoring of the circularity strategies at various aggregation levels, such as for the Netherlands as a whole, per priority theme and sector, and for specific product groups.
- Enable monitoring of not-yet-measurable transition dynamics indicators by extracting data from information that is already available, for example from RWS, RVO, provinces and municipalities.
- Continue to develop action monitoring: cluster actions for a better overview, link actions to transition dynamics and effect indicators, and make a connection with new actions generated by the transition agendas.
- Develop a decomposition model to analyse the relationships between effect and circularity strategy monitoring results and autonomous factors.
- Extend the monitoring system to explore the relationship between the role of societal partners and the various phases in the transition towards the circular economy.
- Find out how the transition to a circular economy will contribute to a healthy and safe physical environment and therefore minimise risks to humans and the environment. This includes the development of a better analysis of the toxicity of substances in material flows that are candidates for recycling.

- Enable comparison between the monitoring system with two transition phases described in this report (the formative and growth phases) and the four-phase monitoring system for the energy transition (pre-development, take-off, acceleration and stabilisation) by adjusting one or both monitoring systems accordingly.

#### **Ideas from the transition agendas**

- Include monitoring of transition agenda actions
- Develop unambiguous, controllable and independent methods for determining environmental effects (life-cycle assessment) and value retention for specific product groups.
- Develop specific indicators for the priority themes and include these in the monitoring system where necessary.

#### **Important developments for the medium to long term**

- Continue to develop the monitoring system to include scenario studies of future natural resource demands within global limits.
- Coordinate the Dutch monitoring system with those of other EU Member States and the European Commission.

## The Netherlands internationally at the forefront

The European Commission first published the *EU Resource efficiency scoreboard* in 2013; this shows the resource efficiency of individual Member States and the EU as a whole. Another set of 10 indicators for the circular economy was proposed in mid 2017, primarily for natural resource consumption, waste production and recycling. Other aspects of the transition to the circular economy receive only limited attention. Furthermore, the 10 indicators have been developed to measure progress in individual Member States and in the EU as a whole, and are therefore less suited to monitoring the progress made in the priority themes and specific product groups.

The monitoring system described in this report goes beyond these 10 EU indicators. It systematically and comprehensively analyses what the current effects of the transition process are, and which conditions the transition process should meet to bring about the desired effects. It has also been developed to enable monitoring of the progress made, not just in the Netherlands as a whole, but also within the priority themes and the specific product groups. Furthermore, the aim of the monitoring system is to measure effects in the Netherlands (direct effects), as well as in the whole of the product chain (direct and indirect effects). The product chain approach is important, because many natural resources, semi-manufactured goods (materials and product components) and products used by Dutch manufacturers and consumers are imported from other countries (indirect effects).

The Netherlands is at the forefront, internationally, with this comprehensive monitoring system. Monitoring progress towards the circular economy includes monitoring the transition process (action monitoring and transition dynamics monitoring) and effect monitoring. The transition dynamics monitoring represents an innovative contribution that may provide additional options for course correction in policy development. Regarding the further development of the monitoring system, it is important to bear in mind the balance between the administrative burden on companies and the value of the information that the indicators provide.

## Note

- 1 Under the current, new government: Ministry of Infrastructure and Watermanagement (IenW) and Ministry of Economic Affairs and Climate (EZK).



PBL Netherlands Environmental  
Assessment Agency



National Institute for Public Health  
and the Environment  
*Ministry of Health, Welfare and Sport*



Statistics  
Netherlands

**PBL Netherlands Environmental  
Assessment Agency**

Mailing address  
PO Box 30314  
2500 GH The Hague  
The Netherlands

[www.pbl.nl/en](http://www.pbl.nl/en)

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