NRK Verpakkingen

PlasticsEurope
Vereniging van Kunststofleveranciers

Rethink
EEN NIEUWE KIJK OP KUNSTSTOF

Roadmap towards increasing the sustainability of plastics packaging

July 2018

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Roadmap towards increasing the sustainability of plastics packaging

This roadmap presents a route towards improving the sustainability of material for plastic packaging. This roadmap is based on the 2013-2022 Framework Agreement Packaging (ROII). In this agreement between the packaging industry, the Ministry of Infrastructure and the Environment and the Association of Netherlands Municipalities, various measures are proposed to improve the sustainability of packaged products and packaging materials. For the purpose of its further development, the Knowledge Institute Sustainable Packaging (KIDV) has invited the industry behind each material to draw up a plan to improve the sustainability of its materials. The responsibility for drawing up and implementing a plan to improve the sustainability of material lies with the material organizations.

Within the context of ROII, NRK Verpakkingen (Packaging) acts as a material organization. This plan has been drawn up together with PlasticsEurope Netherlands and in alignment with several other interested parties within the plastic packaging industry, such as the recyclers and producers of biobased materials. The plan can be used by the various industries to support the development and implementation of their plans to improve sustainability. Indeed, the packaging industry is part of the supply chain for the packaging industry and is therefore an important partner for the packaging industry when it comes to improving the sustainability performance of both packaging and packaged products.

The most appropriate way to increase the sustainability of plastic packaging is largely determined by the industry's desired functionality of this packaging. There is no standard "recipe".

This plan therefore takes the form of a roadmap which describes the (parallel) routes our industry is taking. The roadmap helps support the packaging business in choosing the most appropriate options for improvement.

This document also provides a roadmap for the development and implementation of chain projects. A mechanism to control this, is part of this plan.

There is no fixed format for a plan for the improvement of the sustainability of materials. Various consultations with stakeholders have not led to a clear overview either. The plastics industry has therefore decided to use the recent and current developments in respect of increasing the sustainability of plastic packaging as a framework, such as the Framework Agreement II, the government-wide Circular Economy Program, as well as the European strategy for plastics, which is to be published in the course of this year. In the further development of this plan, the following terms 'Re-s' are leading, such as reduce, re-use, recycle, renew and redesign.

Elements of qualitative prevention have been taken into account as preconditions, but have been largely disregarded because very strict regulations already exist for plastics such as for food safety and the use of chemicals (REACH).

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This plan for the improvement of sustainability is made up of four main parts

Sketch of the situation

- Framework agreement
- Circular economy: chains become circles
- Sustainability of product and packaging combination

Motivation

- Why there is a need for further improvement of sustainability:
  - Increasing social pressure
  - Diminishing returns
- Government-wide program regarding circular economy

Improvement directions

- Re-use (I)
- Renew (II)
- Reduce (III)
- Redesign (IV)
- Recyle: collect, sort, mechanical and chemical recovery (V)
- Sustainable combination of product/packaging: combination of actions

Follow-up

- Coordinate and monitor

Document structure

This plan for the improvement of sustainability is made up of four main parts; first, a description of the plastic packaging situation, secondly a description of the reason why a change is required in the current situation. Thirdly, is an overview of directions for improvement that can be followed is provided.
Finally, the improvements needed to achieve the objective are described and a proposal is put forward as to how these improvements should be implemented and how their progress can be monitored.

The plan also contains a large number of pages that elaborate on the matter: as a background and to substantiate the subject. A link to the elaboration has been included on the relevant pages in the main text each time. These links look as follows:

A link from these in-depth pages has also been included, which will return to the starting point. The in-depth pages are not intended to be read independently, but intended as a background and to substantiate the pages in the body text.

Agreements on the collection and recycling of plastic packaging waste have been determined in the Packaging framework agreement.

In the 2013-2022 Packaging framework, agreements are made between the packaging industry (united in the Packaging Waste Fund Foundation), the Ministry of Infrastructure & the Environment (I&M) and the Association of Netherlands Municipalities (VNG) on the collection and reuse of plastic packaging waste from households.

Since January 1st, 2015, municipalities are responsible for the collection, sorting, subsequent separation (if applicable) and marketing of the plastic packaging waste. They receive a fee from the Packaging Waste Fund Foundation per tonne of packaging waste collected from Dutch households and delivered for recycling that meets the agreed quality requirements. In addition, the municipalities receive a fee to support the marketing of the collected plastic packaging waste.

In order to assess whether the quantities as specified by the municipalities are correct and meet the required specifications, implementing organization 'Nedvang', commissioned by the Packaging Waste Fund Foundation, has recently started taking measurements that are aimed at determining the composition of the waste. The composition is important because municipalities will soon only receive compensation for plastic packing waste that they have (had) collected, if it meets the required DKR quality specifications and will actually be recycled.

In the 2013-2022 Packaging framework agreement, it has been agreed that material organizations will take steps toward increasing the sustainability of the product-packaging chain. In order to achieve this, they will draw up plans. These should describe where in the material chain further future environmental benefits can be achieved.

As already indicated, the plastics industry has decided to devise a plan with the characteristics of a roadmap in which various options to achieve more sustainable packaging are explored.

The Netherlands have chosen to divide the collected plastic packaging waste into five groups: PET, PE, PP, foil and a mixture.
The quality is described in so-called DKR specifications, see the link: https://www.nedvang.nl/kunststof-verpakkingsafval for more information

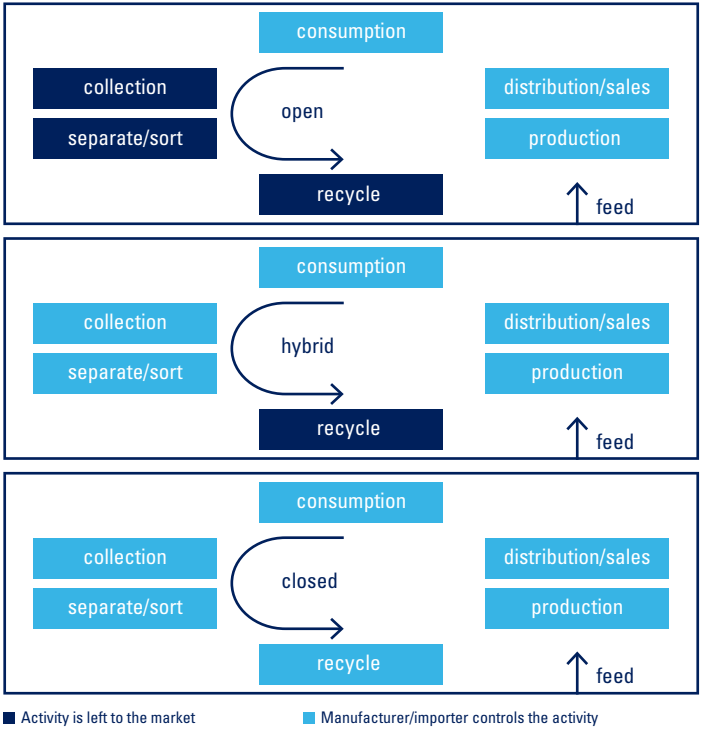
Chains will become circles. The circle of plastic packaging has an open structure, which means among other things that it is controlled by many parties

The bulk of the packaging flows has an 'open' structure. However, this does not apply to returnable packaging (for which a deposit is paid). An open structure means that the producer or importer of the packaged product (the one who markets the packaging) has no, or indirect, control over the recycling flows and leaves the market to parties whose primary competencies are collecting, separating/sorting and recycling. The collection of used packaging in the Netherlands is left to citizens under the direction of the municipalities and waste companies. Separating and sorting takes place at different market parties under the direction of the municipalities, with or without the support of the Packaging Waste Fund Foundation. The same applies to the recovery of the material.

A characteristic of the 'open' circles is that they can only be controlled by agreements with a multitude of parties (producers/importers, citizens, municipalities, collectors, sorters, recyclers). In many cases, this has an adverse effect on changes and optimization.

In a closed system, one party decides how and by whom the collection, separation and recycling will be done. A hybrid model in which recycling is left to the market is also possible.

Open, closed and hybrid organization of a circle



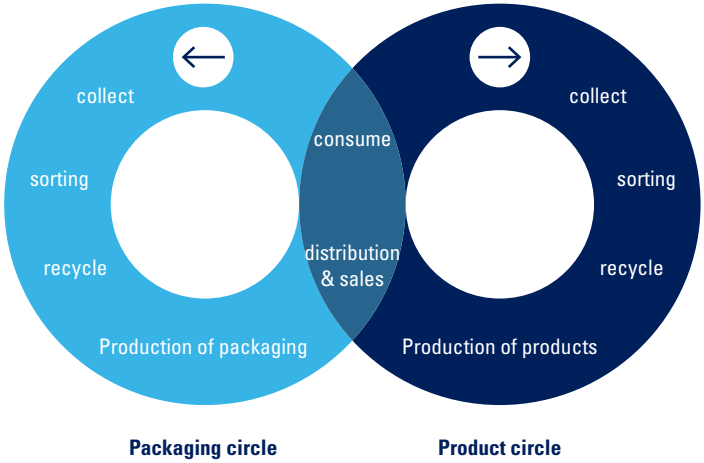
Sustainability of a product-packaging combination is the summation of the sustainability of the product and packaging circle (p/p-c)

Packaging has different functions in conjunction with the product that is covered by the packaging. Somewhere in the production process, the product is packed and until the product is unpacked both circles coincide.

We speak of improving sustainability performance if the net result in the circle of the packaging and product sustainability criteria improves.

This includes, among other things, a reduction in CO_2, energy and material in the packaging and product circle. The combination of both circles must be particularly taken into account; for example, it is conceivable that a higher consumption of material and energy in the packaging circle is compensated or even negated by a smaller environmental footprint in the product circle.

There are three types of packaging; primary, secondary and tertiary packaging and this entails a huge diversity of products



Plastic packaging offers benefits and added value

Packaging ensures that products are protected, stay fresh and that fewer products are discarded.

- The effects of (improved) plastic packaging in reducing food waste are positive and significant. Plastic packaging, including disposables, ensures safety and hygiene and prevents infections.

The plastic packaging industry has a track record in the field of sustainability and dematerialization.

- More and more plastic packaging is recycled, so it can be used for new applications. Compared with the production of virgin, recycling has a significantly lower CO_2 footprint provided the correct recycling techniques are applied to the selected material flows.
- The use of biobased materials is increasing.
- On average, a yearly reduction of 1% in packaging material is achieved through innovation.

Plastics are an efficient material for the packaging and transportation of products.

- Plastic packaging is light and compact; without plastic packaging, approximately 50% more transport would be needed.*

* source: Denkstatt:
The potential for plastic packaging to contribute to a circular and resource-efficient economy

The past few years, steps have been made to collect and recycle plastic packaging separately.

- On average, approximately 50% of the plastic packaging put on the market is used for recycling in the Netherlands.
- Of all the EU countries with a ban on dumping plastic waste, the Netherlands have a leading position when it comes to the recycling of plastic waste (2014).

Increasing social pressure and diminishing returns fuel the need for action to achieve the ambitions regarding the circular economy

Now that the role of plastics and plastic packaging has been highlighted in detail, steps can be taken towards improvements and innovations. Improvements and even innovations are essential, which is why these items will be explored in the following pages. In summary, the main reasons are increasing social pressure and diminishing returns.

Below, the two main reasons have been divided into sub-reasons; and by clicking on a sub-reason, a detailed description will open.

Very recently, an additional challenge has been added: China's decision to dramatically low-qualitatively limit import. This will complicate the route to a circular economy.

Increasing social pressure

- Circular thinking increases the social pressure
- Plastics have a negative connotation due to the effects of litter on land and in the water
- Uncertainty about the effects of collection and recycling

Decreasing economical yields and environmental yields

- The system costs associated with recycling of plastic packaging are increasing
- The collection of plastic packaging in terms of volume is doing well, as more and more plastic is being collected. However, the amount of mixture and residual fractions - at present not profitable - are increasing. This is why there are problems with the quality and ever increasing costs
- The number of applications for which recycled plastics can be used is limited

The sustainability of the product and packaging circle is further increased by simultaneously working on reducing, re-using, redesigning, recycling and renewing. Coordination and alignment are crucial.

The increasing social pressure as well as the industry's drive for innovation are the key drivers for the improvement of the packaging circle's sustainability. At the same time, the diminishing returns as outlined earlier need to be taken into account. Questions that will need to be answered are therefore as follows: which actions will positively contribute to sustainability? How many and which actions must be carried out to achieve these targets? And how can we keep system costs under control at the same time? How should the work be organized, and who will be responsible for what?

As a reference framework, the objective from the government-wide Circular Economy Program is considered: The Netherlands will have a circular economy by 2050 and by 2030, 50% less primary raw material will be used. The production of plastic packaging is therefore – in this case – concerned with reducing the use of virgin fossil materials as raw material to zero. It also takes into account the vision of the Ellen MacArthur Foundation. The plastics industry considers this target to be extremely ambitious. Achieving the target by only using mechanical recycling and the input of biobased raw materials is therefore considered to be impossible.

At present, we have five ways to reduce our dependence on virgin fossil raw materials. These are: reducing the use of packaging, reusing existing packaging, redesigning packaging, mechanical and chemical recycling and the application of biobased raw materials. Hereafter, we will refer to these solutions as follows: reduce, re-use, redesign, recycling and renew. The focus should be on a combination of these five solutions. It is not realistic to achieve independence from primary raw materials solely on the use of a single, or a subset, of the five solutions.

This calls for large-scale and comprehensive action and therefore requires accurate coordination and (international) alignment. The control cycle needed shall be called re-plan, redo, recheck and react.

Rethink
EEN NIEUWE KIJK OP KUNSTSTOF

'Rethink' is a joint initiative by the plastic producing and processing industry in the Netherlands, which also includes the rubber and composites industry, its products and plastic recyclers. Via Rethink, the plastics and rubber industry actively acts as an important (discussion) partner within the Dutch economy and society. The Dutch plastics and rubber industry produces special and valuable products and sees it as its duty to do so in the most sustainable and efficient way possible.
www.rethinkplastics.nl

Interim target of government-wide Circular Economy Program: halving the use of primary raw materials by 2030

elaboration

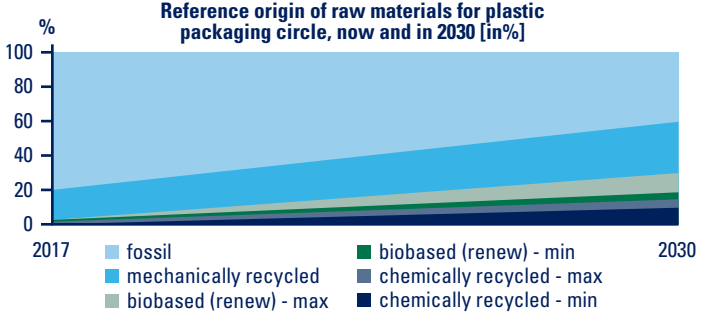
It is estimated that currently about 80-85% of the raw materials used for plastic packaging is derived from primary sources. About 10 – 15% comes from mechanical recycling, and the remaining percentage, up to approx. 1.5%, is derived from biobased resources. The use of recycled plastic in packaging mainly concerns PET from returnable bottles, a few logistic resources and the use of recycled plastic in laminate with virgin to avoid it coming into contact with food.

Recycled plastic leaves the packaging circle due to regulations concerning food contact

The amount of recycled plastic in plastic packaging is higher than the 10 to 15% which will be used as raw material for packaging again. Because of the current regulations concerning recycled plastic and food contact, most of the recycled plastic derived from packaging is used for applications outside of the packaging circle. Roughly two-thirds of all packaging comes into direct contact with food. Increasing the use of recycled plastic for packaging thus requires the elimination of all legal, technical and organizational barriers.

Towards 2030; in addition to fossil and mechanically recycled material, other sources are needed

The government-wide Circular Economy Program's objective is thus that by 2030 approx. 40% of the raw materials for packaging is derived from primary sources (a reduction of 50% compared to the current situation). The remaining 60% must therefore come from other sources. In the optimistic scenario, the obstacles with regard to food contact have been removed and 30%* of the raw materials is obtained through mechanical recycling by 2030. However, the use of



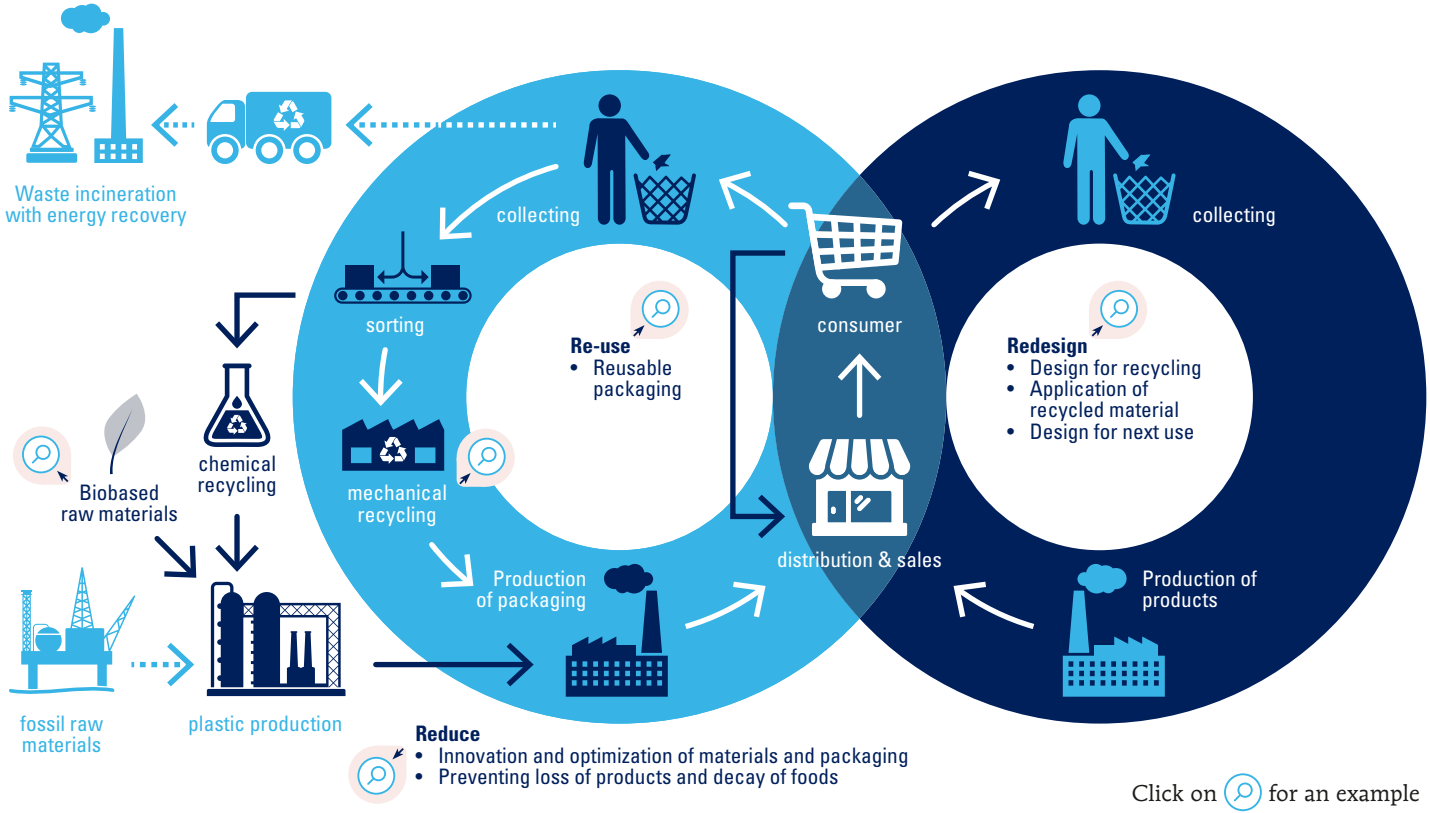
raw (biobased or chemically recycled) materials derived from other sources will still be necessary. Moreover, the figures do not take into account any market growth.

Market growth: need for fossil (or biobased) input

In the period up to 2030, the market for plastic packaging will increase. We are currently using 477 kT (kilotons) of raw materials for packaging. The growth is approximately 1.5% per year. This means the market size will be 596 kT by 2030. Part of the improvement directions are focused on reducing the amount of packaging. By additional focus on reducing and re-using, the growth will slow down to 1% per year, and this results in a market size of 514 kT. To facilitate this market growth, virgin fossil or biobased input will be necessary.

* on the basis of expert appraisal (doubling of current situation basis van expertschatting (verdubbeling van huidige situatie)

Various actions will together lead to further sustainability of the Dutch product and packaging circle (p/p-c); reducing, redesigning, re-using, recycling and renewing



Click on for an example

Actions must be taken in parallel on several fronts in order to make the product and packaging circle more sustainable. Actions must be coordinated and monitored.

At the same time, action must also be taken on several fronts in order to further improve the sustainability of the product and packaging circle. All aspects of sustainability, including resource efficiency, must be taken into account, so that net environmental profit is created.

The plastics industry recognizes the need for and its responsibility in making the packaging chain more sustainable. Improve directions in this sustainability plan therefore focus on consumer packaging. Packaging waste from companies is cleaner, is mixed less with other materials and therefore has a direct route, with fewer intermediaries, to the recyclers.

Coordination between actions is necessary; collecting, separating and recycling are interlinked. The same applies to redesign, re-use and reduce. Furthermore, the number of actors involved is high and interests are diverse and possibly even contradictory.

Monitoring is necessary to assess whether the circular objectives can be met. Monitoring is a precondition for good (adjustment of) control. Control contributes to the efficiency and effectiveness

This plan indicates for each improvement direction what kind of actions to be considered. In most cases, opportunities and instruments are also appointed to enable or stimulate those actions. In all cases, this is a starting point; during the implementation of which it will appear that new, perhaps better, actions will be added, and actions or instruments will be rejected because they turn out to be less effective.

Summary of improvement directions

Re-use
Stimulating the use of returnable packaging and other reusable packaging

Renew
Promotion biobased; taking advantage of the Netherlands' good starting position

Reduce
Let the market do its work, and stimulate if so required

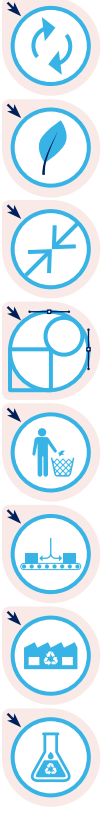
Redesign
Encouraging the design for next use and the application of recycled plastic

Recycling: Collection
Increase response

Recycling: Separating
Increasing the quality and volume of mono-flows. Reducing the volume of the mixed flow

Recycling: Recovery – mechanical
Increase the quality of recycled plastic – more mono-flows. Implementing process improvements

Recycling: Recovery – chemical
Investigating potential and business case studies



Five strategies for improvement: reduce, re-use, recycle, renew and redesign

- **Reduce:** packaging is the search for the optimum between good protection of the packaged product (in order to minimize loss of product) and reducing packaging material (weight and volume). Innovation that focuses on material makes it possible to achieve the same packaging function with increasingly less material. On the basis of a number of examples, it becomes clear that over the past few years around 1% of material was saved in this manner each year. The industry endeavors, through constant innovation, to continue this trend and, where possible, to accelerate it.

- **Re-use:** the re-use of packaging, which in fact concerns recycling at product level. To be able to keep control, e.g. pool systems are often chosen to make the reuse of products possible. Such as, for example, pallets. Besides the advantage that reuse of a packaging provides for the environment, it can also be commercially interesting. Within the industry, returnable packaging is already used in many instances, for example for application in cosmetics, cleaning products and soft drinks. Materials are also often reused within the application of logistic resources: such as pallets, drums, crates, IBCs, boxes and big bags. Our industry will expertly assist the packaging companies with their developments.

- **Redesign:** is often considered an enabler of re-using, reducing and recycling. To enable the reuse of a packaging, the use of less material for a packaging, the application of recycled plastic or increasing the chance that a packaging can be recycled, often implies that its design is to be adjusted. There are many examples available in different markets and applications.

  The yield per example is “clear”, which is why many new actions are required. NRK developed a guideline for designing with recycled plastics in 2016, but it now focuses on support by means of an innovation coach for CIRCO projects and innovation labs (new packaging concepts are developed here with chain partners). Plastics Europe participates in a broad, international study in which eco-design guidelines are being developed. (Completion in 2018).

- **Renew:** replacing fossil raw materials by biobased raw materials. Appealing examples are realized, but the contribution from renewable sources will, as yet, be limited (in particular because of the limited production capacity). The growth of the production capacity for biobased raw materials between 2016-2021 is estimated at about 10% per year; this is more than the remaining plastic market, which has a growth of circa 3-4%. In 2030, which is our estimate on the basis of extrapolation, 5-10% of the raw materials for packaging are derived from biobased sources. Perhaps it is possible and desirable to accelerate this growth. Various plastic manufacturers have now, partly due to active participation in the "Green Deal" green certificates (in cooperation with NRK and Plastics Europe) introduced sustainable, renewable raw materials. Possible new applications are now being explored with market participants.

- **Recycling:** by this we mean closing the circle by: collection, separation and recovery of used packaging materials. These are the partial solutions:

  - **Collection:** launching and continuing actions to make the return as high as possible.

  - **Separation:** actions to maximize the share of mono-flows and to keep the share of the sorting product mix as low as possible, because this currently has a negative economic value.

  - **Mechanical recycling:** should be developed through targeted actions to a demand-driven industry. Great strides have already been made; both in quality and quantity. At the same time, there is still plenty of potential for more recycling and the development of recycled plastic for high-quality applications. Recycling can have a negative impact on the properties of plastics. By finding the right application for recycled plastics, improving the properties by applying additives and the combined use with virgin or biobased plastics, it becomes possible to fulfill a part of its potential.

    In economic terms, there are limitations to mechanical recycling because the costs involved in collection, separation and recycling increase as the plastic packaging delivered for recycling becomes more complex.

This is due to the fact that there is more mixing and contamination of the material. Our industry is increasingly committed to producing and marketing grades in which recycled plastic has been mixed. In addition, NRK is developing a quality standard for recycled plastic. Also, we have launched a "Green deal" proposal for the certification of recycled plastics. Various companies are already marketing these "mixed grades".

- **Chemical recycling:** in order to further close the chain, new supplementary technology must be developed that can also continue to be used from an economic and sustainable perspective in the future. By means of chemical recycling, raw material can be derived from contaminated and mixed plastics in order to create new plastics.

Input for chemical recycling comes from the loss that is incurred during mechanical recycling, the amount of plastic packaging that is not financially profitable at present, and a part that is now processed via the residual waste. Mechanical and chemical recycling can complement one another. The potential for chemical recycling of packaging waste in the Netherlands is an estimated 94 kT for pyrolysis and 13 kT for glycolysis per year. The development, commercialization and further growth of chemical recycling will, due to uncertainties, take place step by step. In 2018, Plastics Europe will strive, along with chain partners, to examine the status, economic feasibility and technological challenges regarding chemical recycling. PlasticsEurope is currently launching a project to investigate the feasibility of chemical recycling of (E)PS packaging.

Coordinate and monitor: mode of organizing within NRK Verpakkingen and PlasticsEurope Netherlands

This roadmap is designed to support industries and companies in their quest for further sustainability, whether this concerns reducing, re-using, recycling, renewing or redesigning. In addition, NRK Verpakkingen and PlasticsEurope Netherlands will assume responsibility, as stated previously. They will propose an annual program of their nuclear activities and, in mutual cooperation, monitor its progress. The boards of NRK Verpakkingen and PlasticsEurope Netherlands will play a key role in this.

The Board of NRK Verpakkingen consists of many experts from all sectors of the plastics industry. Directors of e.g. NRK, NRK Verpakkingen, NRK PVT plastic processors, NRK recycling and NRK foil are part of the NRK Packaging board of directors.

Various major international plastics manufacturing companies are members of the board of PlasticsEurope Netherlands.

Said program will become an integral part of the deliberations of both boards. They will be, in consultation and cooperation with the developments relevant to the progress of the sustainability routes indicated in the plan, monitored and, where necessary, also adjusted. To this end, said boards will deliver experts and budgets for the identification and support of the selected projects for improvement. Via this joint approach of driving and involving companies, synergy advantages are created that have a positive impact on the effectiveness and efficiency of the improvement projects resulting from this plan. Expert groups will be formed from their ranks for implementation and consultation per improvement strategy, and possibly be complemented with people from knowledge institutions.

With respect to the preceding, NRK Verpakkingen will undertake the coordination and function as a primary contact point for any relevant stakeholders.

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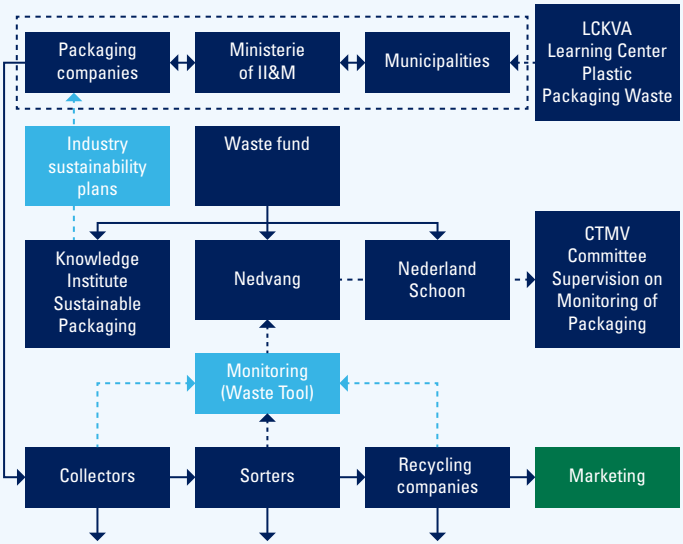
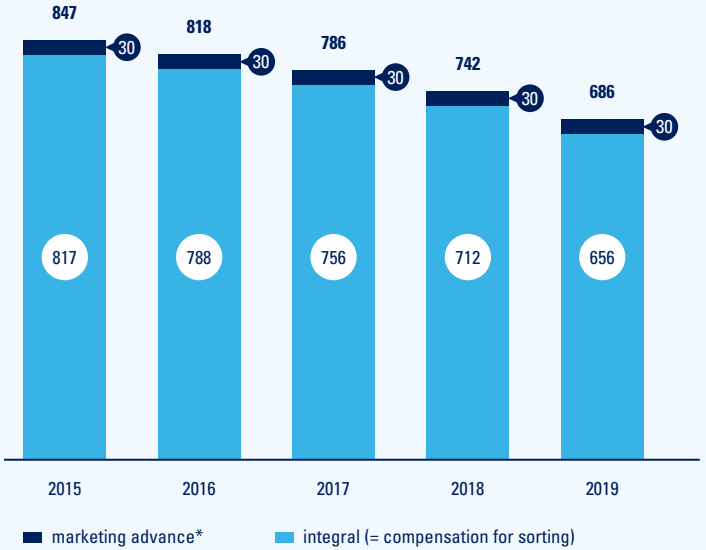
Parties are represented in the Packaging framework agreement. Municipalities receive a compensation for every tonne of plastic packaging waste presented for recycling

Parties represented in the Packaging framework agreement



Compensation for municipalities per tonne of plastic packaging waste, as submitted by households, that is offered for recycling (€)



* Compensation for marketing (its transportation and organization) is determined annually. The advance amount for 2015 has been included.

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All plastic packaging fall within the scope of this material sustainability plan: divided into primary, secondary and tertiary packaging

	SUBDIVISION	MAIN FUNCTIONS	EXAMPLES
Primary packaging	• Food rigids • Food flexibles • Nonfood rigids • Nonfood flexibles	• Conservation • Inform (product) • Sale • Protection	• Bottle/container • Cups/trays • Foil/stand-up pouch • Blister • Trays
Secondary packaging	• Secondary packaging rigids • Secondary packaging flex	• Protection • Bundle • Inform (product)	• Blister • Bags/net packaging • Shrink film
Tertiary packaging	• Transport rigids • Transport flex	• Bundle • Inform (logistics)	• Pallet/IBC • Crates/boxes • Shrink film

read more

The examples illustrate the versatility of plastic packaging. Moreover, large quantities are involved

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Foil packaging

Bottles and bottle caps

Trays

Blisters

Net packaging

Laminate foil

Trays & lids

Shrink film

- In the Netherlands alone, packaging literally envelop a “product value” of 200 billion euro of production goods the value of which (i.e., of the packaging and packaging materials) is estimated at 3.5 billion euro.
- The value of goods that do not reach their destination (e.g., past their sell by date, damaged, broken, etc.) is estimated to be > 5 billion euro
- The waste of all packaging together amounts to 3% of the total waste flow in the Netherlands
- On average, every inhabitant opens seven packages per day, or 140,000 pieces in a lifetime, in the Netherlands.
- 43 billion packages a year are used in the Netherlands, and in Europe 25,000 containers per second.

Source: www.materialdesign.nl/wp-content/uploads/2010/01/Roland_ten_Klooster-Trends-Verpakken.pdf

Schematic overview of the product and packaging circle (p/p-c)

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Plastics are an efficient material for the packaging and transportation of products

The average plastic packing represents 1 to 3% of the total weight of a product. For example for the packaging of 200 gram of cheese, 2 grams of plastic is needed. 1.5 liters of soft drink is packaged in a 28-gram plastic bottle. In the case of a truck filled with products that are packaged in plastic pouches, the packaging takes up 3.6% of the loading volume.

Food service disposables (FSD), which are a series of articles, such as cups, plates and trays, cutlery, but also small bottles, dishes and bowls, are often placed under the same heading. In fact, almost all articles that are used for food and drinks “on the go”, takeaway or bring-it-yourself systems for food/meals, or drinks and food consumed during events, are covered by the term disposables.

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Packaging ensures that products are protected, stay fresh and that fewer products are discarded

Packaging ensures that products are well protected, stay fresh longer and that fewer products are discarded, as research among Austrian retailers revealed. This contributes to a reduction in CO_2 emission. The following are five concrete examples of losses that retailers avoided. The losses avoided at the consumer's home still have to be added on top of this. Plastic packaging, including disposables, guarantees safety and hygiene and prevents infections.

PRODUCT	WASTE INITIALLY	WASTE CURRENTLY	TOTAL CO_2 BENEFITS (GR CO_2)	COMPARISON
Fillet steak (330 gr)	34%	18%	2,100	EPS packaging vs. PS/EVA/PE
Sliced cheese (150 gr)	5%	0.1%	41	Unpackaged vs. APET/PE/PSA with foil
Bread (400 gr)	11%	1%	148	Paper vs. OPP film
Garden cress (100 gr)	42%	3%	186	PS tray vs. PS tray with PP foil

The study shows, among other things, that multilayer-packs deliver excellent performance. In general, however, it is still difficult to recycle this type of packaging mechanically. Therefore, they are usually incinerated. The performed analysis shows that the environmental benefits achieved in the utilization phase of this packaging, due to a reduction in food waste, is several times higher than the emissions incurred during the incineration of this packaging.

Source: Denkstatt 2016, study among Austrian retailers / adaptation by Berenschot

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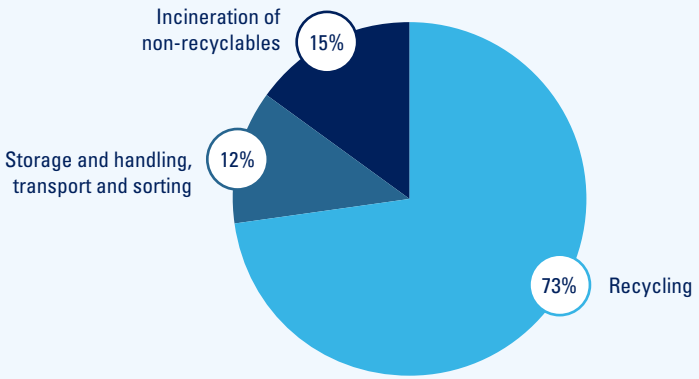
CO_2 emissions within the different phases of the recycling process

CO_2 emission per phase in the recycling process: recycling itself causes the majority of the emissions



Source: Chain analysis plastics SUEZ, TAUW, 2016. Adaptation by Berenschot

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Compared with the production of virgin, recycling has a significantly lower CO_2 footprint; provided the correct recycling techniques are applied to the selected material flows

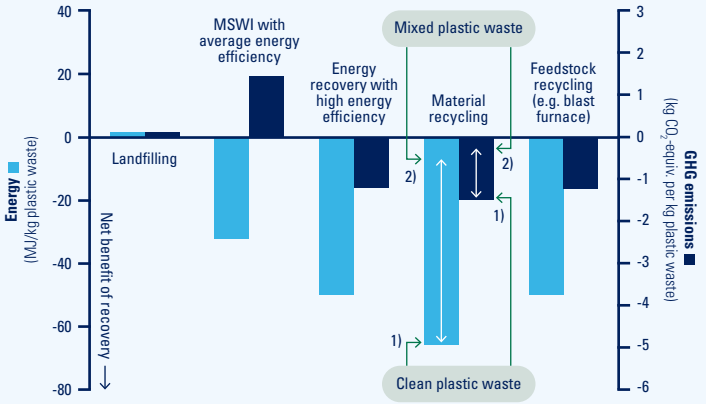
Studies point to a significant advantage in CO_2 footprint reduction for recycled plastic compared to virgin, provided that the waste management is well organized and the correct techniques are applied.

An example of LDPE recycling is shown opposite. Depending on the way in which LDPE waste is delivered for recycling, a footprint advantage is achieved, ranging from 0 kg CO_2 equivalents (mixed (contaminated) plastic consumer waste) up to circa 75% (clean: mainly such as industrial waste). LDPE virgin has a footprint of approximately 1.9 kg CO_2-eq/kg.

Benefits of recycling & recovery for energy & GHG emissions (example LDPE)

Plastic waste is a valuable secundairy resource

Impacts of collection, sorting & recycling processes plus credits due to substituted primary production & substituted primary fuels are already summed up in the figures below



1) Values material recycling assume 10% material losses during recycling process and 1:1 vergin material substitution by mass
2) Material recycle benefits vary considerably decrease with higher material losses and/or if used for inter-material substitution materials, e.g. like concrete or wood (IVV, 1999) – In some instances LCA may lead to a different conclusion.

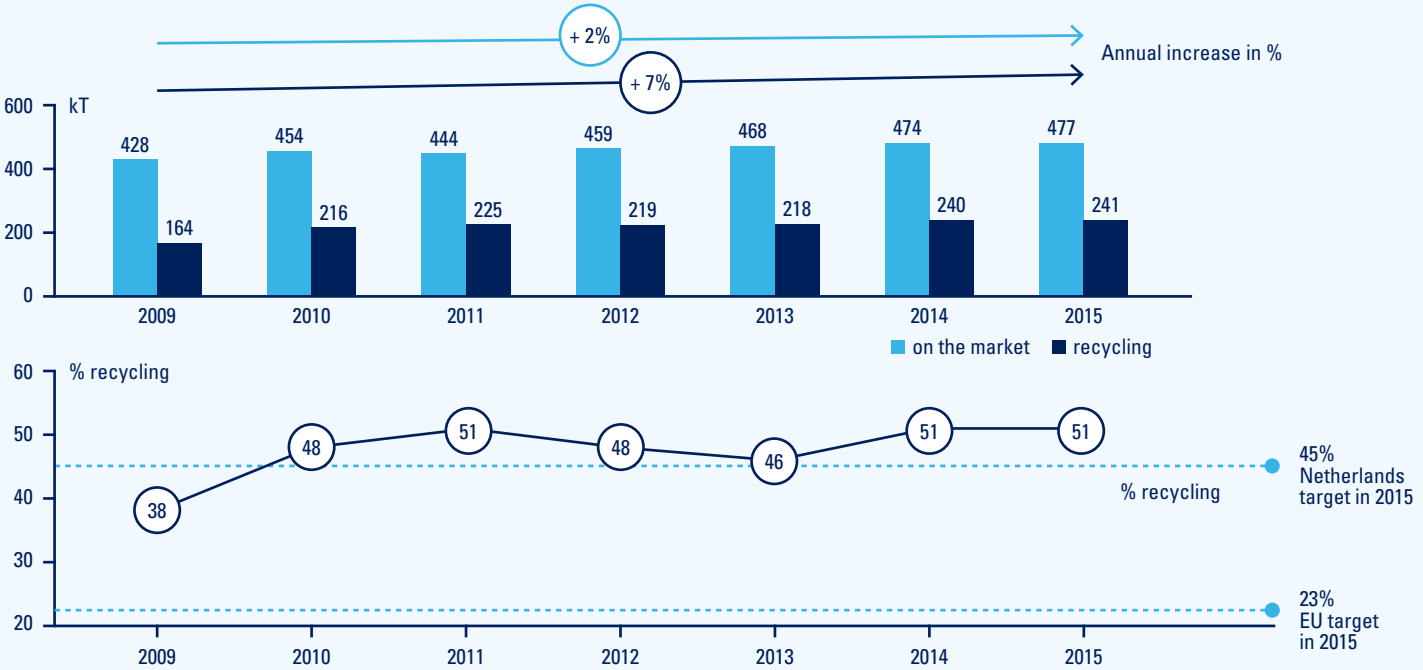
Source: "Eco-Efficient Plastic Waste Management. Fact based findings from 20 yrs of Denkstatt studies".

back to the main story

On average, approximately 50% of the plastic packaging put on the market is put up for recycling in the Netherlands

read more

Plastic packaging in the Netherlands. Quantity on the market, and the amount of recycling in kT and percentage of recycling 2009 – 2015. Since 2009, the amount of plastic packaging put on the market has on average increased by 2% per year. The absolute quantity of recycled plastic packaging has increased by 7% per year since 2009.



Source: Packaging Waste Fund Foundation. Adaptation by Berenschot.

Of all the EU countries with a ban on dumping plastic waste, the Netherlands have a leading position when it comes to the recycling of plastic waste (2014)

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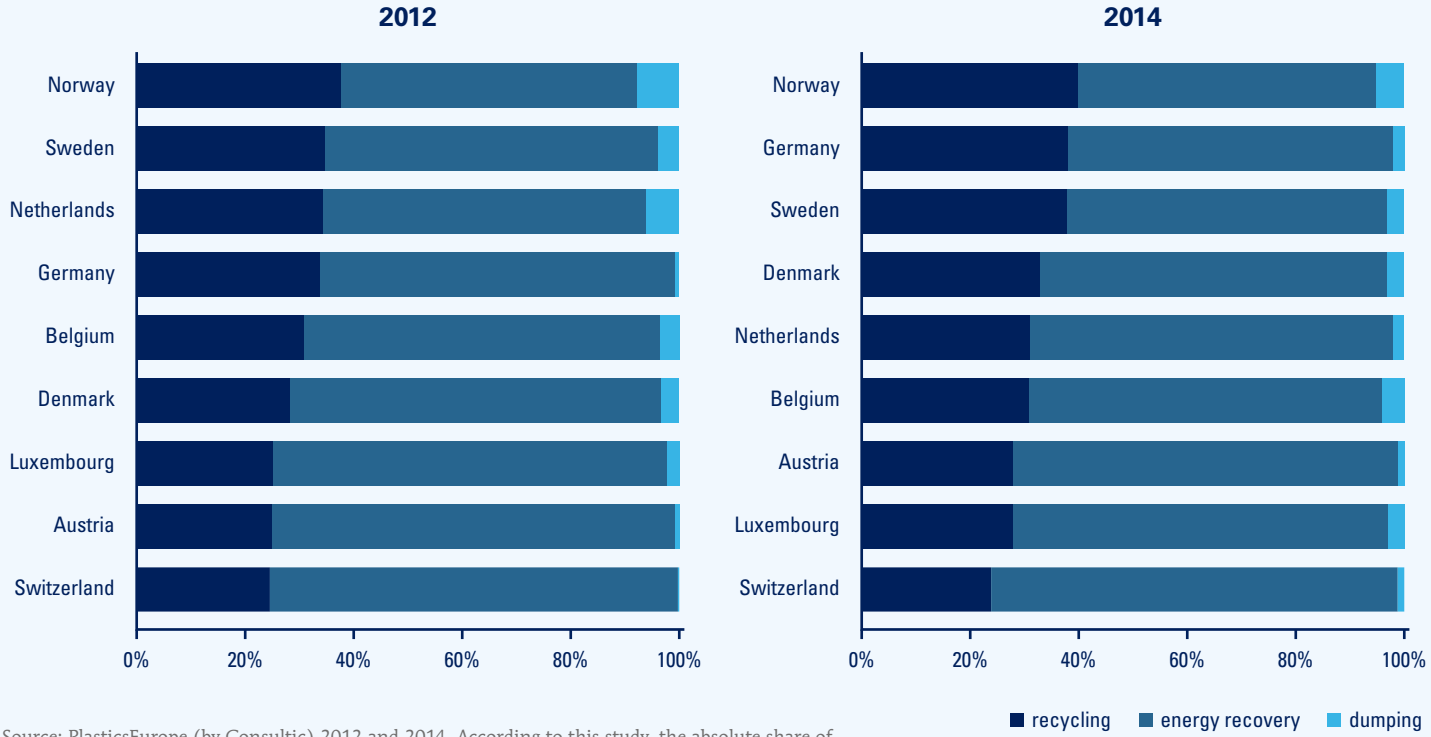

Source: PlasticsEurope (by Consultic) 2012 and 2014. According to this study, the absolute share of recycling is lower than the percentage that is reported by the Packaging Waste Fund Foundation.

Plastics have a negative connotation due to the effects of litter on land and water

The image of plastic packaging is under pressure due to litter on land

"Litter on land and in water causes irritation, attracts vermin and cleaning up costs hundreds of millions of euro per year. Furthermore, litter is bad for humans, animals and nature: it can pollute the soil, animals eat it or get entangled in it, and marine animals such as mussels and shrimp can store micro plastics in their body tissue so that it ends up in the food chain." (Milieucentraal)

The image of plastic packaging is under pressure due to litter in the water

"An increasing amount of plastic waste is floating around in our oceans and seas. Due to weathering, sunlight and waves, this plastic breaks into small pieces. This leads to serious pollution. The oceans cover 72% of the earth's surface and are our main supplier of oxygen. For more than half of the world's population, the ocean is the primary source of nutrition." (plastic soup foundation)

read more

Uncertainty about the results of collection and recycling

'Impact Plastic Heroes embarrassingly small''

The orange 'Plastic Heroes', which is a collection system for plastic household waste set up by the packaging industry, barely contributes to the recycling of plastic. The system, which costs tens of millions annually, works less well than the current use of a deposit on large bottles.

This statement was presented by the Recycling Network; a coalition of environmental and nature conservation organizations, to the Dutch House of Representatives. In a letter to the government, the Secretary of State for Infrastructure and the Environment, Dijksma, stated that in the last four years the recycling of plastic waste increased from 34 percent in 2012 to 50 percent today. In this case, she refers to the total sorted collection of plastics in the Netherlands.

There is often discussion about the attained recycling performance within the 'Plastic Heroes' system. In part, this discussion evolves around the question whether the figures relate to the "front door or the back door" of the recycling plant. In Europe, and also in the Netherlands, it was agreed that recycling percentages will be calculated on the basis of material that has been delivered for recycling (this is referred to as the "front door"). On average, recyclers attain a material efficiency of 70%. This means that of each kilogram of material that is offered for recycling, 0.7 kilo can be used for the substitution of virgin; i.e., at a reported recycling percentage of 50%, approx. 35% can be used for as a substitution for virgin material.

read more

RECYCLING NETWERK

The Recycling Network is a coalition of (environmental) organizations that are committed to creating a better environment by properly taking care of waste and raw materials. The goal is to limit as far as possible the environmental damage that is caused when the production of raw materials starts, right up to the management of waste. Therefore, the Recycling Network also strives to ever increase and continuously improve recycling.

Increasing amounts of plastic packaging are collected separately, but the mix and residuals fractions - that are currently not economically profitable - are becoming larger: costs are increasing and the quality is decreasing

The amount of household plastic packaging waste collected has increased significantly in recent years, thanks in part to the efforts of the municipalities. It is expected that this upward trend will continue for a few more years. However, at the same time the quality of the collected and sorted plastic packaging waste is becoming an increasingly serious problem. Furthermore, the large-scale effects do not result in the expected savings.

Partly as a result of the increased collection, the total costs for the collection and sorting of plastic packaging have also increased. The deficit in 2015 to financially balance the chain was more than € 120 million, and without a change in policy this will increase even further in the coming years.

As an explanation for the increasing costs and decreasing quality, the experts stated that more and more municipalities have transitioned to PMD collection. This has two major consequences: first of all, “clot formation” occurs which cannot be filtered anymore during the sorting process. This leads to a larger fraction of residual waste. Secondly, cross-contamination occurs (mainly due to drink cartons). This leads to a larger fraction of mixed waste.

The collection of PMD therefore has a negative impact on the recycling performance. Our industry benefits from clean waste flows. This can be achieved by various alternative routes, of which deposit (e.g., on returnable bottles) is one possible option. However, our industry does not express a preference for one of these alternatives over another.

On the other hand, the experts mention the VANG objective of limiting residual waste to 100 kg/person/year. In combination with higher rates for the residual fraction, this objective would lead to deviant behavior; causing more residual waste to be thrown in with the PMD fraction.

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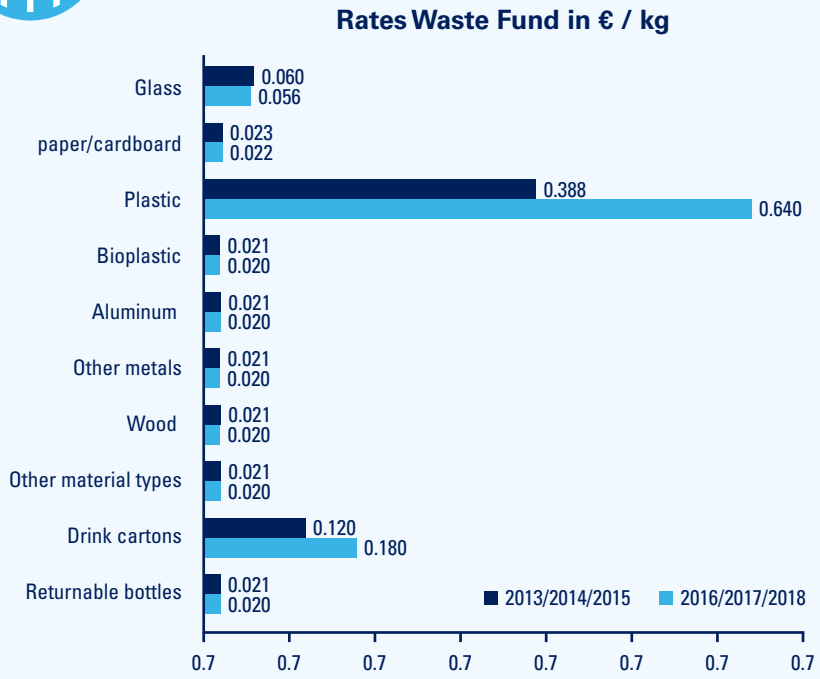
The system costs associated with recycling of plastic packaging are increasing



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Source: Waste Packaging Fund Foundation 2015. Adaptation by Berenschot. NB; the general rate (€0.470 in '13/'14/'15 and €0.770 in '16/'17) and the rate for plastic bottles without deposit (€7.50) have not been plotted in the chart.

The fee for marketing plastic packaging (excl. logistic resources) is the highest compared with other material types and has almost doubled in 2016 in comparison to 2015.

The Packaging Waste Fund Foundation says the following about this issue in the monitoring report:

"The objective for plastics (44% for the Netherlands) has been achieved with a wide margin: 50%. This is a great success, and has a very positive impact on the environment. However, the downside to this success is the development of costs which leads to a higher fees having to be paid by companies. This is a point of great concern."

Source: Public Waste Fund Foundation report Packaging, 2015

The number of applications for which recycled plastic can be used is as yet limited

The sharp increase in the collection of plastic from households does not keep pace with the demand for recycled plastic. Although the demand for recycled plastic for packaging is increasing, the flows with a positive return (PET, PE, PP) are still limited in relation to the collected quantity. Other flows (such as mixed plastics, foils and PET trays) have low or even negative rates for recycled plastic. Another aspect here is that it is not always easy for recyclers to make recycled plastic at the manufacturers' desired specifications. The demand for recycled plastic is, however, increasing, because manufacturers are using more recycled plastic as an alternative for new plastic.

Specifically for packaging, the regulations regarding the application of recycled plastic are complicated, including the requirements regarding food safety of the European Food Safety Agency (EFSA). Food safety is the main issue when it comes to food packaging and careful regulations are therefore indispensable. Although r-PET that has been derived from collected returnable bottles can be applied in food packaging, these regulations are complicated and this makes things difficult for many manufacturers.

In case of a low price for virgin plastics (for example as a result of a low oil price), it is difficult to market recycled plastic as an alternative for virgin material.

"The use of PET trays has increased enormously in recent years. The trays are still difficult to recycle, leading to large stocks at sorting and post-separation companies."

KIDV, October 2016

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Fact check plastic recycling, KIDV and Nature & the Environment, with the support of the research and consultancy firm CE Delft, 2016

The government-wide Circular Economy Program describes the objective of a circular economy for the Netherlands by the year 2050

In September 2015, the government-wide Circular Economy Program was sent to the Dutch House of Representatives, with the following objective: A circular economy in the Netherlands by 2050. It is the government's ambition to cooperate with societal partners to achieve an (intermediate) objective of 50% less use of primary raw materials (mineral, fossil and metals) by 2030. The report entitled 'The Netherlands circular by 2050' offers a promising perspective.

Plastics are one of the five priority themes, for which a 'transition agenda' was drawn up in 2017.

Vision for 2050 – priority flow of plastics
By 2050, where technically possible, 100% renewable (recycled and biobased) plastic materials will be applied, without adverse effect on the environment. The value of plastic is retained, products have been designed in accordance with a circular economy, the production of plastics will no longer be dependent on fossil raw materials, CO_2 emissions are greatly reduced and plastic litter is effectively dealt with.

New markets for innovative plastic recycling and biobased companies are developed, circular business models have been developed and the market for recycled plastics is strong. At an international level there is cooperation to also achieve a closure of the plastics chain elsewhere in the world, and to contribute to the reinforcement of our natural capital.

read more

Circular ambition is confirmed in the Raw Materials Agreement and requires significant system adjustments

In order to grow at a national and international level towards the future idea of a circular economy by 2050, the following should be considered:

1. designing plastic products in such a way that these can be reused and recycled at a high-quality level after have been discarded

2. plastic materials in chains are to be used as efficiently as possible, which leads to a decrease in the demand for raw materials and prevents 'leakage' in the system

3. plastic material flows are applied again as much as possible for the large scale deployment of recycled plastics and biobased plastics.

On January 24th, 2017, a national Raw Materials Agreement was signed. The secretary of State of Infrastructure and Environment Dijksma, and the Minister of Economic Affairs, Kamp, have established a common ambition with business (represented by VNO-NCW and MKB Netherlands), trade unions, Governments and social organizations to achieve a fully circular economy. In the second half of 2017, 'transition agendas' were drawn up for the five priority themes, including plastics.

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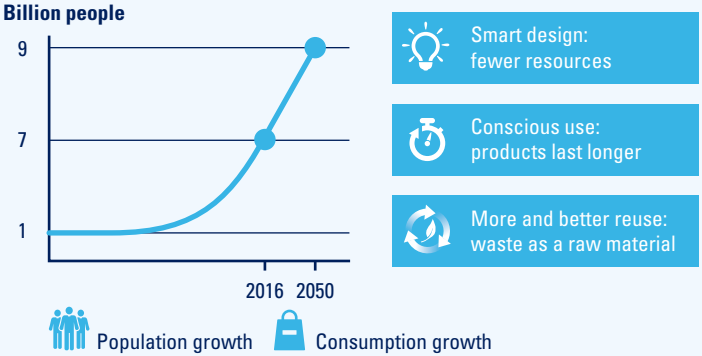
The Netherlands circular in 2050



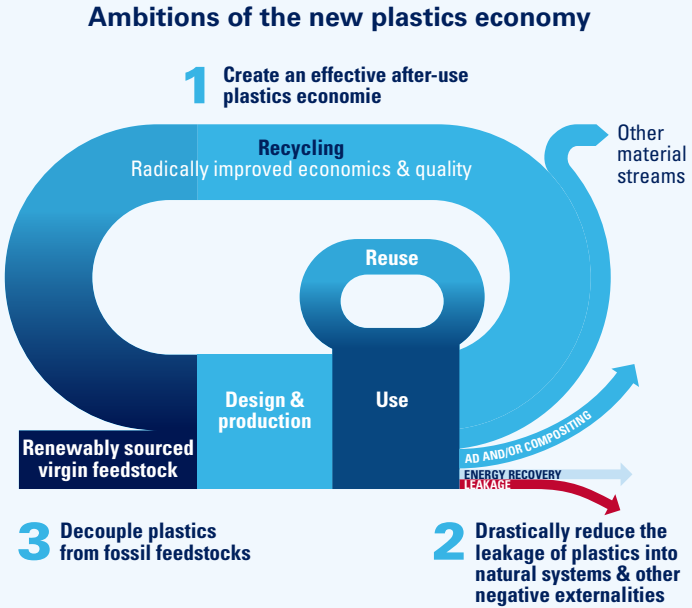
www.circulaireeconomie-nederland.nl / Ministerie van Infrastructuur en Environment

The New Plastics Economy describes what a circular plastic system looks like

The New Plastics Economy is an ambitious, three-year initiative by the Ellen MacArthur Foundation and its partners to initiate momentum in the drive towards a functional circular plastic system. The initiative brings together the key stakeholders, to think about the future of plastics (rethink and redesign), and starts with packaging.

Applying circular economy principles to global plastic packaging flows could 'transform' the plastics economy and 'drastically reduce negative externalities' such as leakage into oceans, according to a report by the World Economic Forum (WEF) and the Ellen MacArthur Foundation (EMF).

The overarching vision of the New Plastics Economy is that plastics never become waste; rather, they re-enter the economy as valuable technical or biological nutrients. The New Plastics Economy is underpinned by and aligns with circular economy principles. It sets the ambition to deliver better system-wide economic and environmental outcomes by creating an effective after-use plastics economy (the cornerstone and priority); by drastically reducing the leakage of plastics into natural systems (in particular the ocean); and by decoupling plastics from fossil feedstocks.



Government-wide Circular Economy Program: A circular economy in the Netherlands by 2050. An intermediate goal is halving the use of primary raw materials by 2030

Government-wide CE Program Objectives

As a reference framework, the objectives from the government-wide Circular Economy Program were examined: In summary, this program states that the Netherlands will have a circular economy by 2050, and that by 2030 the use of primary raw materials will have halved. Below an effort was made to provide an insight into the effects of these objectives on the production and use of plastic packaging. First, we looked at the origin of the raw materials used for plastic packaging.

Circularity and sustainability

In our definition, circularity is related to resource efficiency, with the ultimate goal of being independent of primary raw materials. This is a relevant, but unilateral objective. Sustainability is broader than only resource efficiency, the use of energy, CO_2 emissions and the climate objectives must also be considered in the discussion. No longer having to rely on primary raw materials (in this case fossil oil) is therefore not an end in itself, but rather a means of achieving sustainability.

Current origin of raw materials for plastic packaging

At present, the raw materials for plastic packaging are derived from three different sources: virgin biobased, virgin fossil and mechanical recycling. Biobased currently has a limited share of about 1.5%. 35% of the used plastic packaging is recycled (see the discussion on yield on sheet LXII), because of obstacles with food contact only 15% remains in the packaging circle. The current influx of fossil raw materials is therefore approx. 80% at present.

Using this relative distribution as a starting point, we can fill in the objectives from the government-wide program. We will do this until the year 2030, because the degree of uncertainty becomes too large.

read more

European Bioplastics, 2017 / Berenschot merit order research /
Berenschot's evaluation of the potential for chemical recycling / Denkstatt 2007 – 2012

Interim target of government-wide CE Program; halving the use of primary raw materials by 2030

Halving the use of primary raw materials

Based on the estimated current share of virgin fossil raw materials for plastic packaging of at least 80%, a target of 40% should be pursued for 2030. This means that the other 60% of the raw materials will have to be derived from other sources; mechanically recycled, biobased or chemically recycled. Each of these options is discussed below.

Biobased raw materials

Currently, 1.5% of plastic packaging is made from a biobased raw material. The growth of the production capacity for biobased raw materials between 2016-2021 is estimated at approx. 10% per year; this is more than the remaining plastic market, which will have a growth of circa 3-4%. In 2030, estimated on the basis of extrapolation, 5-10% of the raw materials for packaging will be derived from biobased resources.

Mechanical recycling: not infinite

Each time plastics are mechanically recycled, a loss of quality is incurred. The possibilities for their application therefore decrease as the amount of times the material is mechanically recycled increases. Eventually, a point will be reached where thermal or chemical recycling is the preferred option, or whether virgin material and/or additives should be added to bring the quality back to the desired level. How many mechanical recycling stages are possible, depends on many factors, such as, for example, the product design, the method of collection and sorting and the intended application. Research by Denkstatt in Austria indicates that in the Austrian system, half of the collected plastic packaging material can be recycled in an economically profitable manner through mechanical recycling. The merit order research that was conducted by Berenschot within the context of this plan has arrived at almost the same results. Of course, there are many possibilities to expand the (economic) boundary of mechanical recycling. But it is also clear that there is a limit to this.

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European Bioplastics, 2017 / Berenschot merit order research / Berenschot evaluation of the potential for chemical recycling / Denkstatt 2007 – 2012

Per category of improvements (reduce, redesign, re-use, recycling and renew), opportunities, tools and examples are described

General
On the following pages, the five improvement directions are described one by one. Per direction for improvement, a general introduction is presented first, and after that an overview of the opportunities, instruments and an assessment of their appeal. The direction for improvement is concluded – not exhaustively – with an overview of examples to illustrate the opportunities and instruments.

The action plan concludes with a proposal for the launching and the monitoring of progress per direction for improvement.

Opportunity
By an opportunity is meant an intervention or change that can be embraced and performed by all parties (producers and importers of plastics, processors/converters, packaging industry, collectors, sorters, recyclers and their customers and designers).

Instrument
By instrument is meant a measure, often carried out by the government, to encourage parties to display certain behavior. If the parties do not come to the desired end result themselves or together, the use of instruments may be considered. In this plan, the sector focuses on actions that they can initiate themselves.

Assessment of appeal
It proved to be possible to make an estimate of the appeal for some of the opportunities. It concerns an assessment of the expected returns of the opportunity, set against the required investment in time and money to implement/use the opportunity. The estimates were made by the participants in the validation workshop and/or the team that has written this plan. For a number of opportunities, it was not possible to make an estimate, in that case there is a '-' in the 'appeal' column.

Ideally, a tool/language should be available in the chain to clearly express the appeal: the LCA (life cycle analysis). In practice, there is often discussion about how to interpret this tool. The sector wants to make an effort to take a step in this direction.

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The market already does some of the work, stimulation is possible

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Sustainable packaging is the search for the optimum between good protection of the packaged product (in order to minimize loss of product) and reducing packaging material (weight and volume). It is one of the developments where market forces are already working in practice at full force. Companies are focusing on material saving, because this also often entails cost-reduction.

Reducing is key for the packaging industry and a key element for the innovation sector. The recipes are continuously improved further so that lighter/thinner applications are possible. On average, a reduction of 1% in material is achieved per year. This leads to significant reductions in CO_2. It can thus be concluded that the total CO_2 footprint of plastic packaging in the Netherlands has decreased in the past 20 years as a result of the reduction of more than 200 kT of CO_2/per year.

(Source: Denkstatt/NRK Verpakkingen and PlasticsEurope Netherlands adaptation)

Based on a number of examples, the following sheets shows that there is weight saved by material innovations. In the long term, diminishing returns should, however, be taken into account.

Opportunities

Because there is a clear impetus for companies to reduce material use, a limited amount of instruments has been identified for this category. The number of actions is also limited to one: let the market do its work in the field of material reduction. An important note in this respect is that in case of material reduction the entire packaging and product circle must be taken into account. Only if net profit can be achieved over both full circles, it is wise to apply material reduction.

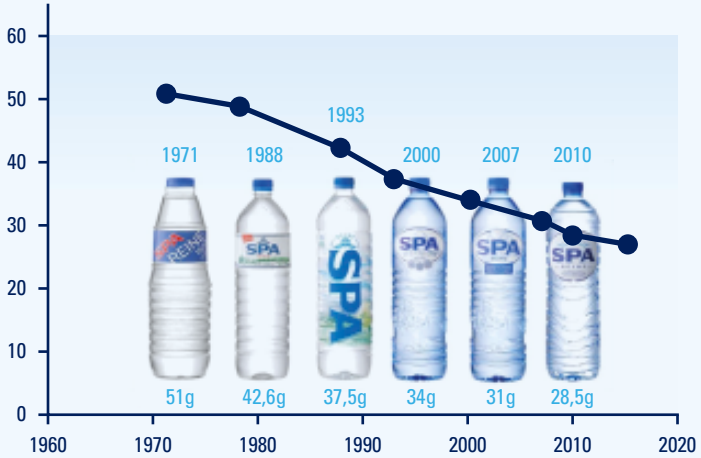
OPPORTUNITY	STATUS	APPEAL
Use of returnable packaging (cosmetics, cleaning products, soft drinks, carrier bags)	Partly in practice	◑
Reuse of logistic resources (crates, boxes, IBCs, large bags, pallets)	Partly in practice	–
Stimulating product use by providing information and/or incentives	Idea	–

● relatively unappealing ◑ relatively appealing ● relatively very appealing – appeal not evaluated

Spadel has achieved a 44% weight reduction since 1971/ Unilever a 17% reduction in five years

The 1.5 liter SPA Reine PET bottle is 44% lighter than it was in 1971 and now contains over 25% of recycled PET.

A saving of 0.5 kT



Unilever Sustainable Living Plan

Result:
In 2015 , the weight per consumer user unit has decreased by 17% compared to 2010.

Example:
By applying the MuMuCellTM casting technique, the amount of plastic in bottles has been reduced by 15% in comparison to the previous bottles.

next example

Stretch film

Example of weight reduction by reducing the thickness of the stretch film with 43% (from 40 to 23 micron).

The foil is a stretch film which consists of (many) micro layers. Using this technology, it is possible to provide excellent stability with a minimal amount of foil to a pallet with soft drink bottles which contributes to a much improved security of the load. Up to 95% less damage during transport has been achieved.

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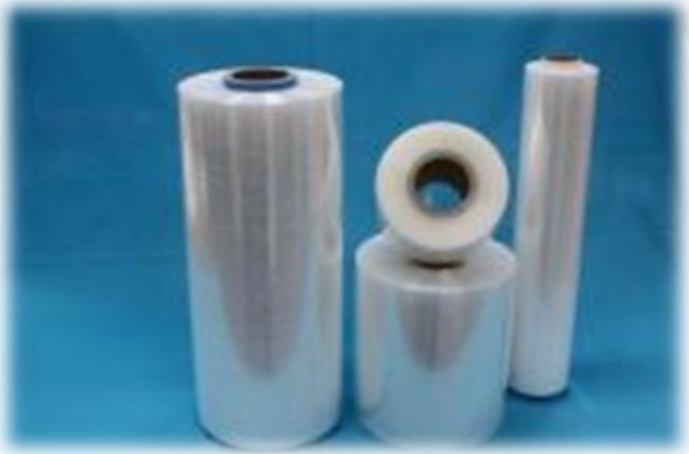

The stimulation of re-use is necessary in order to have an impact

Re-use concerns the re-use of packaging, which is in fact recycling at product level. In order to be able to keep control, pool systems are often chosen, for example, to enable product re-use. Such as, for example, pallets. Re-use can also be encouraged, for example, by prohibiting the free disposal of packaging such as carrier bags.

OPPORTUNITY	STATUS	APPEAL
Use of returnable packaging (cosmetics, cleaning products, soft drinks, carrier bags)	Partly in practice	
Re-use of logistic resources (crates, boxes, IBCs, big bags, pallets)	Partly in practice	
Stimulating product re-use by providing information	Idea	–

● relatively unappealing ◐ relatively appealing ● relatively very appealing – appeal not evaluated

Note: The industry has recently offered a petition to the Dutch House of Representatives in which the pricing of carrier bags of all materials is advocated, so as to achieve an equal treatment/level playing field for all types of packaging.

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Refill systems for consumer products

Example: Ecover / Splosh

There are several examples of refill systems for cleaning products and personal care products on the market. The market acceptance among consumers is a recurring problem. Perhaps e-commerce solutions (such as Splosh) can improve this situation, but as yet it is hard to estimate how much can be saved because of uncertainty about the market acceptance.

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Europe strongly focuses on redesign as a possible solution

Redesign is an important part of the government policy
The government focuses on broadening and deepening of the ***European Ecodesign directive*** for more use of recycled plastics (in pallets, (stretch) foils and other packaging), a longer life and better reparability of plastic products. The programs, focused on circular designs, are also linked to companies in the plastics sector, using the ***guidelines*** for designing with recycled plastic. The ideas behind the concrete approach and the results of these design programs and guidelines are internationally distributed to inspire others to embark upon similar projects.

Redesign is often seen as a precondition for the implementation of re-use, reduce and recycle.

OPPORTUNITY	STATUS	APPEAL
Design for next use: redesigning product and packaging	It is now up to P/Is	
Only apply multi-layers where this is essential	Idea	
Biodegradable packaging if there is a infrastructure for recycling	Idea	
Redesigning e-commerce packaging (part returnable packaging)	Idea	
Specifying recycling grades (quality standards)	Idea, in combination with chemistry	

back to the main story

relatively unappealing | relatively appealing | relatively very appealing | – appeal not evaluated

There are many examples available for different markets and applications. Yield presented per example is clear, therefore many examples are needed

EXAMPLES: TRANSPORT PACKAGING / LOGISTIC SYSTEMS	WHO	YIELD
Application of (more) recycled plastic in pallets (C2CP)	Pallet manufacturers	–
Application of (more) recycled plastic in crates and trays		–
Application of recycled plastic in medical waste containers	Suppliers	2,400 tons/year
Application of recycled plastic in casks and trays for agriculture and horticulture		–
Application of recycled plastic in other logistic resources		–
From take-back commercial packaging and closed loop recycling to new packaging (Bag2bag)	VNCI	–
EXAMPLES: CONSUMER PACKAGING	**WHO**	**YIELD**
Application of recycled plastic in paint buckets / adhesives / sealants	VVVF Sector	–
Application of (more) recycled plastic in chemical products packaging	VNCI Sector	–
Application of (more) recycled plastic in foil – non-food (PE / PP)	Suppliers	–
Application of recycled plastic in drink/food bottles (PET)	FWS Sector	–
Application of recycled plastic in cleaning/cosmetic products (HDPE/PET)	NVZ Sector	–

In certain cases (e.g., medical waste containers), the use of recycled plastic requires an adjustment of the ADR regulations (ADR: hazardous substances packaging regulation)

next example

Application of recycled plastic in logistic resources

Several companies are developing more ways to apply recycled plastic in pallets, crates and other logistic resources.

Savings:

Grolsch crates are recycled over and over again
Source: Schoeller Allibert www.koninklijkegrolsch.nl/pers/persberichten/2016/7/dvo-jaarverslag-online www.koninklijkegrolsch.nl/en/sustainability-csr/co2-and-waste

Re-usable pallet made with recycled plastics (mixed plastics)

next example

Application of recycled plastic in consumer packaging

There are several companies, such as Henkel, P&G, Ecover and Marcel's Green Soap, who are trying to use more recycled plastics in bottles for cleaning products and personal care products.

Example: Procter & Gamble

"Additionally, P&G announced that in Europe by end of 2018 more than half a billion bottles per year will include up to 25% post-consumer recycled plastic. The project will require a supply of 2,600 tons of recycled plastic every year"

See more at: http://news.pg.com/press-release/head-shoulders/pgs-head-shoulders-creates-worlds-first-recyclable-shampoo-bottle-made-#sthash.3yTuGuVB.dpuf

Application: 2.6 kT (EU, 2018)

next example

The application of recycled plastic in other products also contributes to

Several companies are developing more ways to apply recycled plastic in consumer products.

Example: Philips
Objective: 3 kT in 2016 (Philips)

Philips Perfectcare Aqua Eco Steam Generator

Source: www.partnersforinnovation.com/media/Caseguide-Designing-with-Recycled-Plastics-digitaal-spreads-1.pdf

Curver household products made of 100% rPP

Source: www.curver.com/nld/brand/

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Use of biobased plastics: avoiding fossil primary raw materials

The use of plastics derived from natural non-fossil sources is an essential element in achieving the circular ambition. The terms biobased and biodegradable are often mixed up. 'Biobased' here pertains to plastics for which the raw materials are derived from natural, renewable sources. These can be plastics from well-known families such as, for example PET or HDPE. Biodegradability is a feature of plastics. Plastics which are biodegradable, can degrade by biological activity. Under the possible solution 'Renew', only biobased plastics are discussed.

Click on this bar for detailed background information.

OPPORTUNITY	STATUS	APPEAL
Market promotion of packaging from biobased materials	Idea	
Apply green certificates	Already in use	
Bulk chemicals from biobased material	It is now up to the chemical industry	
Creating chain/circle roadmap biobased materials	Idea	–

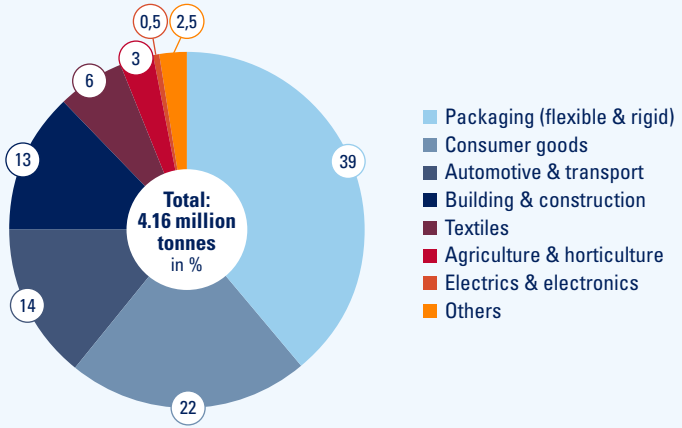
relatively unappealing | relatively appealing | relatively very appealing | – appeal not evaluated

read more

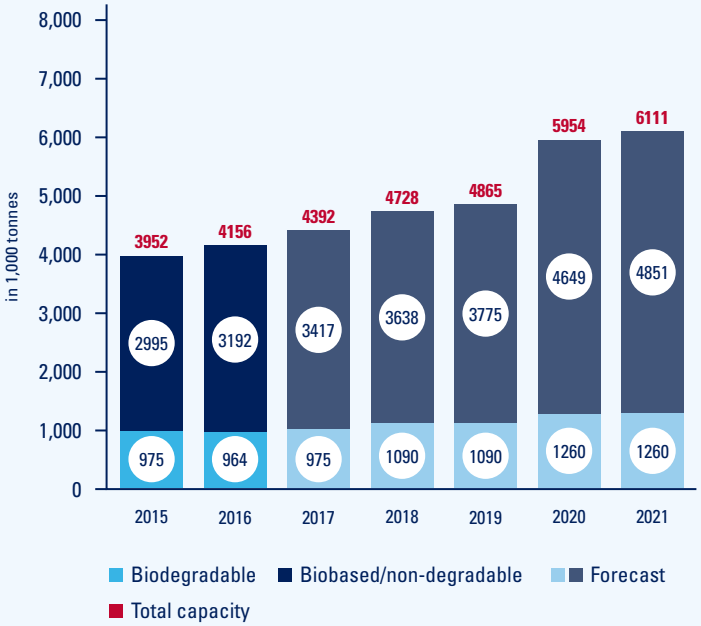
The production capacity for biobased plastics is increasing. The Netherlands is seen as a country with many opportunities for the production of biobased plastics

The production capacity of biobased plastics is currently about 1.5% of the total plastics market. Plastics from biobased sources provides opportunities for the Netherlands. Thanks to its industrial expertise, extensive beet sector, central location and strong infrastructure, the Netherlands has an excellent competitive position in this promising growth market. Companies such as Coca-Cola, IKEA and Unilever are leading the way. For example, IKEA has set itself the target of manufacturing 100% of its products from recycled raw materials or biomass (including biobased plastics) by 2020.

Global production of bioplastics in 2016 (by market segment)



Global production capacity of bioplastics



Source: ABN AMRO report 'The Netherlands can provide the basis for a biobased economy', November 2015.

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Soft drink bottle and foil from biobased raw materials

Coca-Cola plant bottle

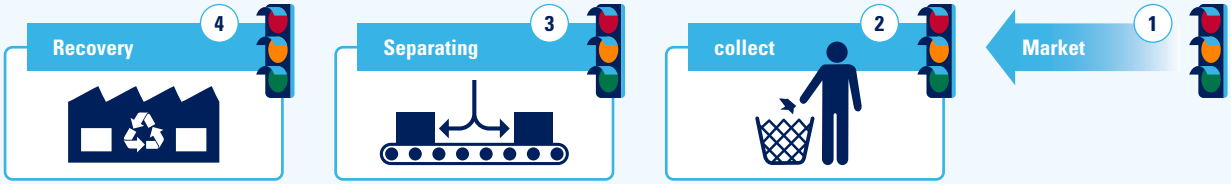
Replacement fossil PET by biobased variant

Bio-PE: Pokon

"I'm green" is a 100% recyclable film, with exactly the same properties as polyethylene, only the raw materials are produced from sugar cane.

back to the overview

Recycling can only be successful if a market demand exists. Collection, separation and recovery need to be in perfect harmony



The success of closing the chain is a summation of a number of traffic lights (conditions) that must turn, as it were, green before a continuous flow of material is created that will find a new destination.

Traffic light 1: Market demand. There must be a market demand towards this recovered product. The buyer of this material will continuously make a decision between this material and virgin material. The price, in particular, fluctuates over time and is to some extent linked to the prices of fossil raw materials used in the chemical industry. In case there is no market demand, the processes of collecting, separating and recovering will never be profitable. This is currently a point of concern for Nedvang. A project has been set up to work on quality assurance and market demand. NRK and PlasticsEurope both participate in this project. In some applications in which recycled plastic can be used perfectly, it is not applied in practice. There are various reasons for this: bad experiences with recycled plastic in the past, unfamiliarity with the possibilities of recycled plastic, price, lack of motivation/innovation etc.

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Traffic light 2: collect. Packaging must be collected / removed from the users. The "disposal" of used packaging must be organized in an easy manner. Preferably, the differences in methodology per municipality are as small as possible.

Traffic light 3: Separating/disassemble. At this point in the chain, the flows can be organized into mono-flows or mixed flows with value. This process should be organized at a national level in such a way that the residual fraction is as small as possible. In consumer flows, we often speak of pre-separation when the separation is actually combined with collection.

Traffic light 4: Recovery. This process must ensure that the material is brought back to specification. Our scope not only includes post-consumer recycling but also post industrial waste, which is often pure and clean and therefore easy to recycle.

Collect: response should be as high as possible

For residents, separating and delivering waste is a multifaceted and sometimes complex process, especially if a change is introduced to the collection system. Nevertheless, it is important for both the cost and the quality of the plastic packaging that the amount of plastic waste collected per person (response) is as high as possible, according to research by LCFCVA in 2016. Different psychological, social and spatial characteristics play an important role.

The two main points of concern that collectors and recyclers put forward are:

- Facilitating customized collection systems: by setting up a collection system in consultation with collectors and residents, the needs can be better attuned to each other.
- Unambiguous communication: by focusing on unambiguous and clear communication, enforcement and the use of waste coaches, the quality of plastic can be positively affected, which leads to less loss and lower sorting costs.

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Opportunities to stimulate collecting

In the field of collection, there are a number of opportunities and instruments enumerated; as listed below.

OPPORTUNITY	STATUS	APPEAL
Use other means of collection, focus on citizens' needs: means of collection is 'fit for purpose'	Idea	
PR campaign – give information to consumers on how to deliver waste and provide insight	Idea	
Collecting in a different way: cherry picking. Rigids through source separation, flexibles via post-separation	Idea	
Setting up central control over collection. Governance topics: optimal large-scale collection systems, security of fees, maximizing quality – reduction of fragmentation in systems between municipalities.	Idea	
Entering a closed system for disposables	Idea	

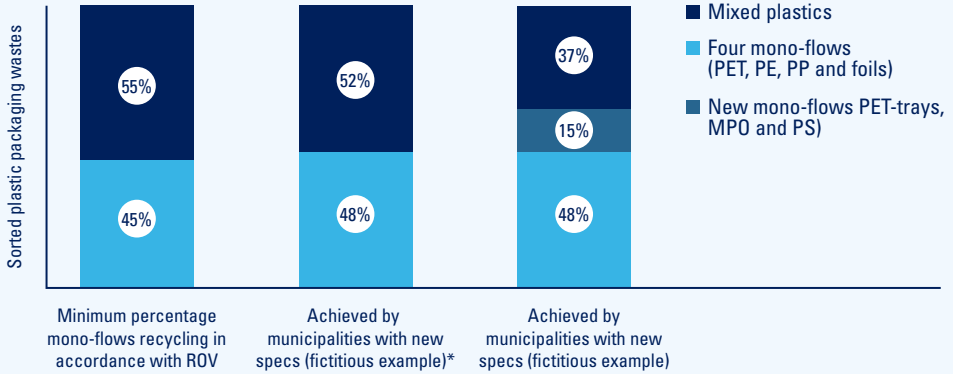
● relatively unappealing ◐ relatively appealing ● relatively very appealing – appeal not evaluated

back to the main story

The quality of the single mono-flows should be increased. The mix-flow should be reduced

In the field of separating, the step after gathering efforts must focus on at least two things: on the one hand, improving the quality of the mono-flows, and, on the other hand, reducing the size of the mix flow. To achieve this, action is needed by the entire chain; from design to recycler. So the citizen also has an mayor role to play in this.

Interesting is a development in this area which is introduced recently by the KIDV. When sorting the collected plastic waste, a considerable improvement can still be achieved by going from four to seven waste flows. This reduces the mix. Of course, it is important that there is a market demand for the sorted flows.



* Adding the specification for Mixed Polyolfinen (MPO) is explicitly meant to sort the additional PE and PP out of the plastic mix. When implementing the new standards, it must be ensured for that reason that the MPO fraction can only be sorted and marketed by a sorting machine if it also keeps sorting the mono-flows PE and PP in the sorting process.

Source: KIDV / Berenschot adaptation

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The amount of collected plastic increases, but the quality decreases. As a result, the costs increase

The amount of household plastic packaging waste collected has increased significantly in recent years, thanks in part to the efforts of the municipalities. However, at the same time the quality of the collected and sorted plastic packaging waste is becoming an increasingly serious problem. Recycling companies in The Netherlands and Germany have been indicating for quite some time that the quality of the sorted fractions are falling short of standards. Now, sorters are also reporting that measures are needed to improve the quality of their input flows. The low quality of the collected plastic has a negative influence on the sorting quality, and leads to further increase the cost. Recycling companies also incur many additional costs because of the low quality. Municipalities run risk the of not receiving full compensation from the Waste Fund, due to the insufficient quality.

The current system is supply-driven. An important conclusion is to reverse this: only collection and sorting if there is a market for it. NRK Verpakkingen and PlasticsEurope are in favor of achieving the cleanest possible material flows, but do note that the current PMD system seems to be working in the opposite direction.

LCKVA (=Learning Centre Kunststof Verpakkingsafval) Factsheet: Communicatie Verbetering kwaliteit inzameling kunststof verpakkingsafval / PMD door gemeenten

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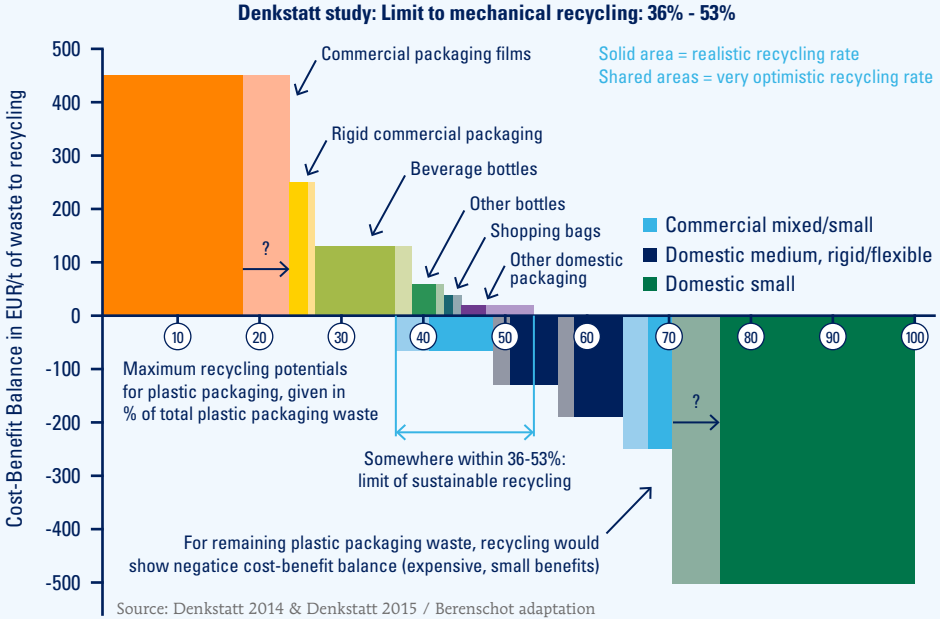
"Sorters have notified municipalities about the fact that the quality of the collected plastic packaging waste from household is decreasing and that measures are needed to improve the quality. The observe an declining quality due to an increase of non-packaging, contamination and moist in the plastic offered for recycling. This has a negative impact on the separation of the plastic and leads to an increase of the costs. In addition, municipalities run the risk of not receiving full compensation from the Waste Fund, due to an insufficient quality."

At the time of the packaging tax, the other packaging materials also contributed financially to the collection system for plastics. The starting point for the Packaging framework agreement is that each material sector is responsible for its own system, including funding. The collection of PMD, however, runs counter to this agreement. Contamination of the plastic flows with other plastic materials increases the costs and also does not improve its circular nature. Our industry therefore objects to this.

Current system performance: merit order research

There are no comprehensive data available for the Netherlands on the costs and benefits of the (mechanical) recycling of plastics. In that context, a study by Denkstatt from 2007 is often referred to; including a number of updates in the following years. In this study, which relates to the situation in Austria, the recycling of various types of used plastic packaging is set against its costs / benefits. To the expenditures are included the collection, sorting and recycling costs, and the yield is included in the production of virgin which has been monetized via the CO_2 price.

We now know that the CO_2 prices which were used at the time for making the calculations, are not the current ones. In addition, the collection system in Austria does not compare with that in Netherlands. The relevance of this study for the Netherlands is therefore limited. For this reason, it was decided to conduct similar research into the Dutch situation.



Source: Denkstatt 2014 & Denkstatt 2015 / Berenschot adaptation

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A merit order is a model-based and simplified view of the economic performance of the recycling of plastic packaging in the Netherlands in 2015

Methods, restrictions and definitions

The merit order for recycling of plastic packaging has been established with the cooperation of 14 Dutch recycling companies. These companies were asked to provide an estimate of the purchase prices, processing costs and yields for the flows they process or of which they have expert knowledge (including yield) for 2015. Costs for collection and sorting are therefore taken into account in the purchase prices.

Based upon the figures of these companies, combined with data from Nedvang, for some sorting of plastic packaging waste in the Netherlands the net result for recycling is calculated in €/tonne. Recycling is the processing from used plastic packaging to regranulates (with the exception of the domestic mix). The Nedvang figures indicate per quality and/or range how much has been collected and delivered to the recyclers for recycling. As a rule, the amount which was offered for recycling equal is not equal to what is actually recycled. Only economic factors have been taken into account for the calculation. Environmental benefits achieved through recycling are not monetized and not included. All prices are adjusted to the recycle process' yield; so an assessment of the loss has been made continuously and this has been incorporated into the price. The exact amount of recycled material can therefore not be established through the graphic.

In the graph a distinction has been made between packaging from companies and from households. Within this division, a further breakdown, as detailed as possible, was established each time, without disclosing data from individual companies.

The merit order is a model that represents a simplified overview of the reality of the recycling of plastics. In reality, for example, no distinction is made between packaging and non-packaging, or whether it has originated from the Netherlands or another country. Also, the variety of types, qualities and applications is in reality many times greater than has been represented in the merit order. On the basis of band widths and volumes, the model continually tries to construct a reliable and recognizable overview that reflects reality.

The merit order can be used to prioritize actions to improve the recycling performance. Moreover, the model provides insight into the (financial) situation of the Dutch recycling system in 2015.

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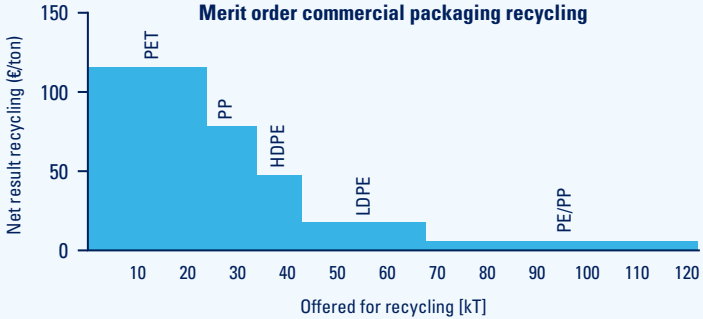
Result merit order: half of the packaging material delivered for recycling can be recycled with a positive business case

Collection and recycling of plastic packaging originating from households is as yet unprofitable. The merit order shows that recycling of the circa 122 kT of plastic packaging from households in 2015 has a negative value. Based on the cumulative surface of the graph for the flows that originate from households , this value is - m €9.0. Processing of the domestic waste mix fraction shows the largest negative net worth. For the various fractions one should think of: DKR324: shampoo bottles, buckets / DKR329: bottles and cans / DKR310: foil / DKR328: dishes, trays. DKR350 is the domestic waste mix fraction.



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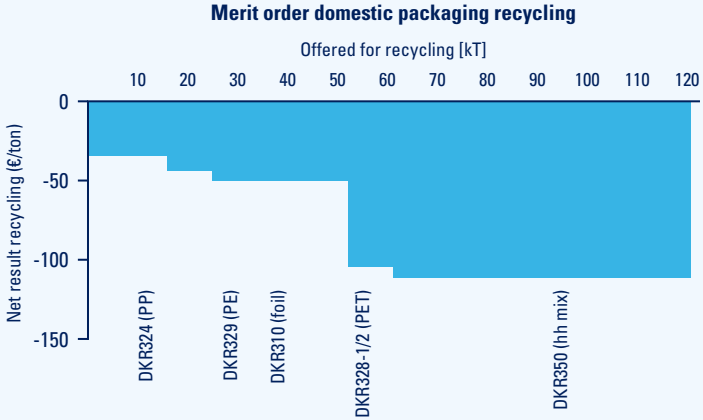
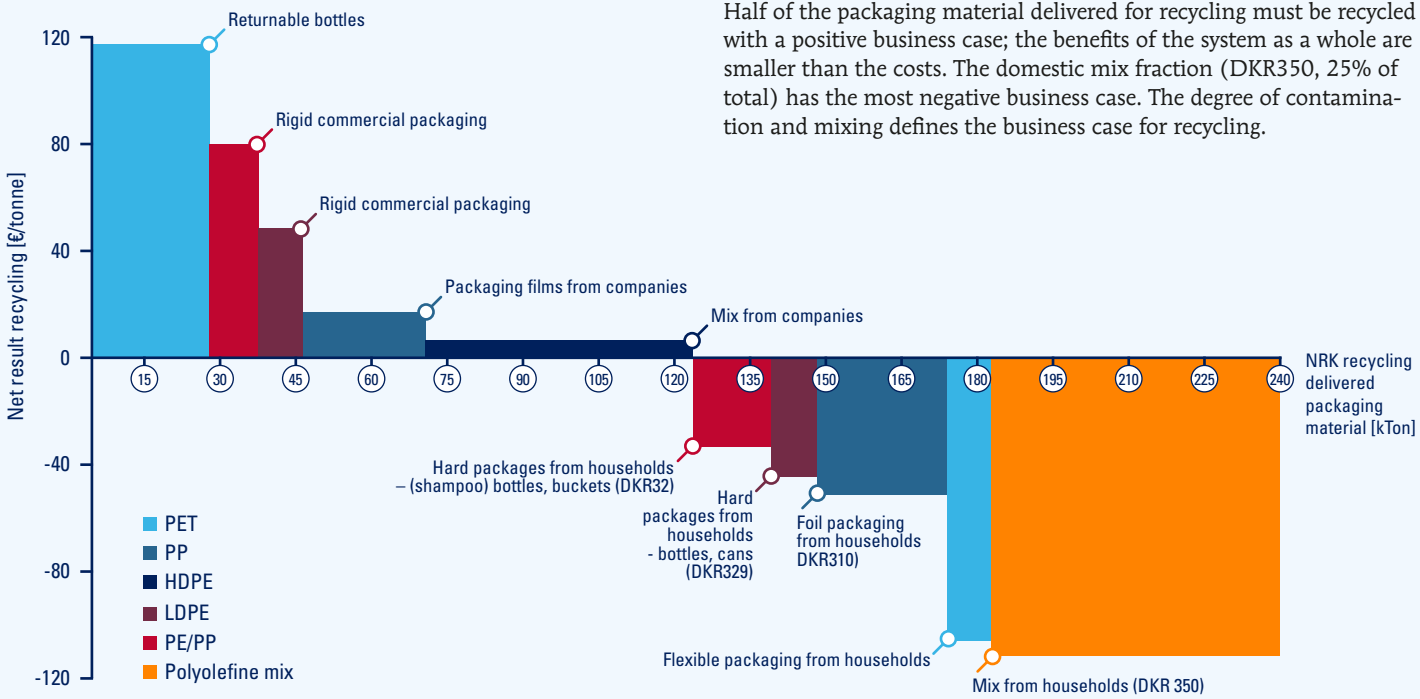


Collection and recycling of plastic packaging originating from companies is profitable

The merit order shows that recycling of the approximately 120 kT plastic commercial packaging in 2015 has a positive value. Based on the cumulative surface of the graph for the flows that originate from waste plants, this value is + m €4.8. This shows that a profitable (self-sustaining) system is possible. The following applications can be considered for the various flows: PET: returnable bottles (with a deposit), PP and HDPE: hard packaging, LDPE: (stretch) foils. The PE/PP mix is a mixture of hard and soft packaging.



Half of the packaging material delivered for recycling must be recycled with a positive business case; the benefits of the system as a whole are smaller than the costs. The domestic mix fraction (DKR350, 25% of total) has the most negative business case. The degree of contamination and mixing defines the business case for recycling.

read more

Source: Waste tool Nedvang / TAUW Chain analysis plastic recycling SUEZ / research Berenschot at fourteen plastic recyclers / Berenschot adaptation / data on 2015.The merit order is calculated on the basis of economic factors. Prices are adjusted for the yield of the recycling process.

The degree of contamination and mixing defines the business case for recycling

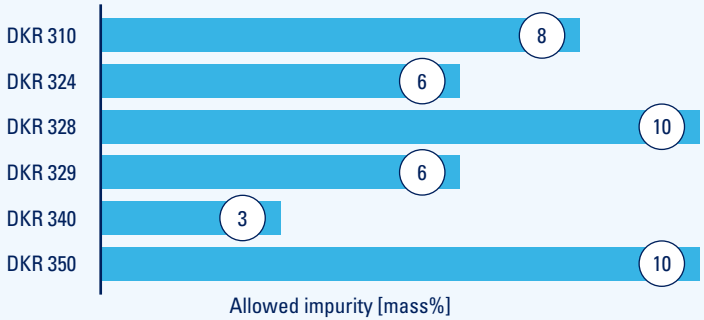
In volume, half of the flow of packages has a positive business case

About half the packaging material in volume delivered for recycling must be recycled with a positive business case. This concerns flows of used packages that come from plants or from a deposit system. These flows are usually characterized by a low degree of contamination, relatively low variety of types of plastic and relatively simple collection. Post-industrial flows also meet those characteristics.

The type of plastic is not defining for the business case. The degree of dirt and mixing, is

The type or family of the plastic packaging does not determine the net value of recycling in euros. Something that does determine this, is the degree of contamination and mixing with other (plastic) materials. The flows with a negative net worth are marked by strong contamination and mixing. Solutions must be sought in different means of collecting and the use of other sorting and processing technologies. Concurrently, action must be taken at the source, in the concept.

Requirements for cleanliness of different sorting methods of household plastic packaging wastes



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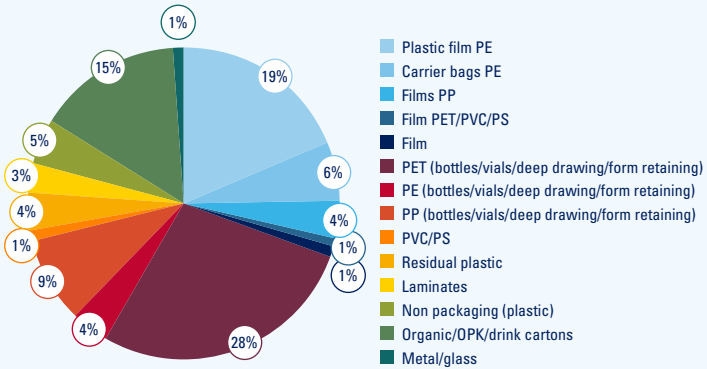
Composition of a separated flow DKR350 (domestic mix)



Source: TNO market research mixed plastics and foils 2017-R10139

Chances

By implementing improvements it is possible to further optimize the mechanical recycling process. The use of residual heat in the cleaning process is an example. This concerns relevant, but limited, improvements. The focus must then be on improvements in the collection and sorting process and on radical improvements in the recycling process.

One of the radical improvements should be chemical recycling, in particular pyrolytic process.

OPPORTUNITY	STATUS	APPEAL
Increase the quality of recycled plastic – more mono-flows	Already in use	
Identify and apply improvements in mechanical recycling	Already in use	
Examine opportunities for chemical feedstock recycling	Idea	
Management of the collecting/sorting- and recycling system based on the demand for recycled plastics	Project start	
EPS trays/dishes offerfor chemical recycling	Idea	–

relatively unappealing relatively appealing relatively very appealing – appeal not evaluated

back to the main story

Closed loop recycling can make food-grade to food-grade recycling possible

With closed loop recycling, the material will be used again for a similar application. Opportunities to achieve this are, especially in the food industry still very limited. This is due to the high requirements placed on packaging for food. However, parties do manage to overcome this obstacle such as by the 100% rPET bottles of Bar-le-Duc. Others have come to partial replacement by recycled material.

Following this path ensures that the products /importers manage the direction of this chain/circle themselves and thus accomplish a closed loop recycling.

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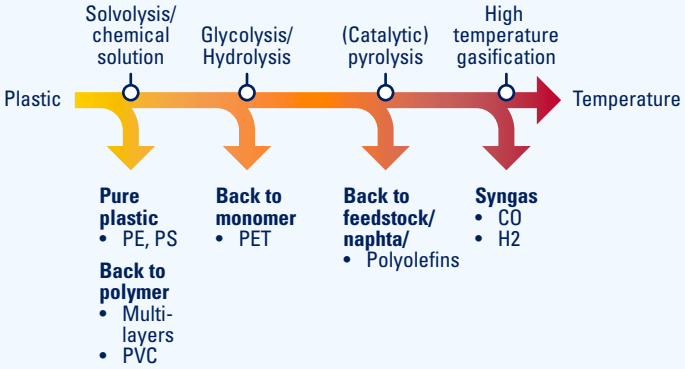
By means of chemical recycling, raw material can be derived from contaminated and mixed plastics in order to create new plastics

Chemical recycling is a generic term for a number of chemical technologies to separate molecules. These technologies have a progressive range of processing temperatures. Every technology has other end products.
Here we consider processes where the end product is used for the production of new plastics. Thus not for the production of fuels. Pyrolysis, the gas synthesis route solvolysis and depolymerization are discussed in subsequent order.



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What are the benefits associated with chemical recycling?

1. Delivers pure material and properties and makes it possible to remove additives.
2. Suitable for flows of mixed plastics, including laminates.
3. Can be a solution for REACH legacy materials.
4. Accurately control quality output material; delivers higher share for recycling and makes upcycling possible.
5. Mix of contaminated packaging is processable! Afterwards, Food grades are possible again.

At this time, a good environmental analysis (for example, by means of a LCA) of these technologies is still unavailable.
Economic viability depends on many factors and is uncertain.

By means of chemical recycling, raw material can be derived from contaminated and mixed plastics in order to create new plastics

Solvolysis

Because it concerns a solution, technically speaking it is a physical process, not a chemical one. The advantage is that plastics and additives can be separated from each other. Both can be reused, just as the solvent.
Solvolysis is a niche development that has already been used by the market, among other things for PS, and a good example is Polystyrene Loop – a cooperation with fifty participants from eight European countries – rolled out with a demo plant for construction-related PS in Terneuzen. https://polystyreneloop.org/. This process is also being developed for the recycling of multi-layer products. Unilever is considering placing this process in Indonesia to recycle sachets. PVC is now chemically recycled (back to polymer) via solvolysis in Ferrara (Italy), (Vinyloop).

Depolymerization (glycolysis)

Through heat and chemicals are polymers converted into monomers. Impurities are removed. Ioniqa uses depolymerization in Eindhoven for the processing of used PET. (www.ioniqa.com).

Pyrolysis

Pyrolysis is a technique for heating plastic waste without oxygen. The process temperature remains below 700°C. The use of catalysts is possible to influence the composition of the product. The end product of this technique depends on the input-composition: functional molecules if there is a lot of biogenic pollution in the input, more olefins and monomers for large amounts of plastics. It is also possible to produce (transport) fuels from used plastic packaging through pyrolysis. That is expressly not intended here – this does not do justice to the cascading principle and does not fit the circular thinking principle.
Pyrolysis has a varied input flow: all polyolefins such as PE, PP and PS. There are various market examples worldwide, especially in Japan and now in Canada too.

Gas synthesis (gasification)

This route to derive basic chemicals from (carbonaceous) waste, is also called the C1-route in organic chemistry. This route will undoubtedly play a role in converting the petrochemical industry to other feedstocks, but does not specifically concern plastic to plastic. The route is technologically proven but is also economically dependent on the oil price.

read more

Chemical recycling, such as pyrolysis, has advantages over mechanical recycling. Drawback is the required amount of energy. Mechanical recycling and pyrolysis complement each other

Benefits of mechanical recycling

- Using the existing molecular structure of the material:
  - Low cost
  - Energetic better use of content material.
- Low technological barrier.
- To be profitable on a small scale, but also to be able to be set up on a large scale.
- Supply chain relatively simple and already existing.
- Relatively inexpensive.

Benefits pyrolysis

Pyrolysis produces as output material with the same properties as virgin. Additives and dyes can be removed. Also multi-layers can be processed in the same way. In addition, heavily mixed and contaminated flows, such as for example the mix fraction (excluding PET and PVC) from households, are processed.

From a technical point of view, it is therefore a very suitable solution for the recycling of contaminated and mixed flows. The process makes no distinction between packaging and non-packaging: plastic is plastic.

Mechanical recycling and pyrolysis complement each other. As long as a flow remains separate and relatively clean, mechanical recycling is probably the best option. Only upon a high degree of mixing and pollution, does pyrolysis become interesting.

read more

The Netherlands has a good starting position regarding chemical recycling, because knowledge and companies are available. Moreover, we have a strong ambition regarding a circular economy

STRENGTHS

- Presence of chemical companies and (knowledge) clusters that can process raw materials efficiently and can offer synergies.
- Good collection of plastic waste flows.
- Available R&D knowledge and capacity.
- New sorting technology delivers better flows.

WEAKNESSES

- Economic profitability problematic; cost-efficient scale is hard to achieve logistically.
- Premium for chemically recycled products is too low in the value chain.
- Much of this technology is only available on lab-scale (TRL<5).></5).>

OPPORTUNITIES

- Selling licenses by developing technologies.
- Achieving an even higher recycling percentage.
- Chemical recycling is an important driver for innovation, and unique selling point for rubber and plastics industry.
- Realizing a circular economy: new feedstock source besides virgin and biobased.

THREATS

- Cheap raw material for plastic production (low oil price).
- Technologically significant differences between lab-scale and plant.
- Incineration of plastics.
- Lack of consistent regulation.

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Berenschot, chemical recycling workshop, July 2, 2015

The potential for chemical recycling in the Netherlands is an estimated 94 kT for pyrolysis and 13 kT for glycolysis per year. The input comes from three sources

Based on the amount of used plastic packaging that qualify for chemical recycling, it is possible to assess its potential. We limit ourselves now to used plastic packaging, but in theory plastic material of different applications can be processed chemically.

The starting point is chemical processing via pyrolysis to cracker feed (naphtha). All plastics containing chlorine or oxygen, such as PET and PVC, are therefore excluded.

Potential sources of material for pyrolysis:
1. Not profitable financial flows in mechanical recycling.
2. Loss through mechanical recycling from financially profitable flows (the not mechanically recyclable fraction).
3. Plastic potential from residual waste.

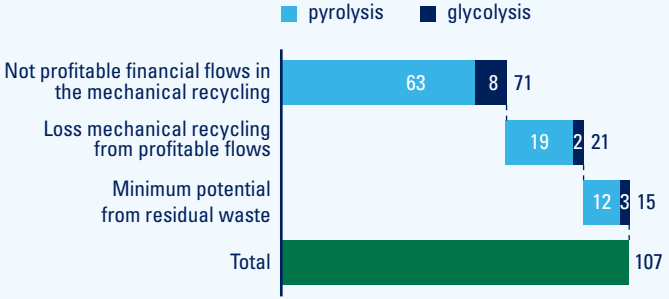
On the following pages, an assessment is made of the volume of each of the three sources.

In summary, this concerns 71 kT plastics per year (net) which are now mechanically recycled and for which mechanical recycling is not financially profitable. 63 kT of this is suitable for pyrolysis, 8 kT for glycolysis.

From the loss of mechanical recycling of the other (unprofitable) flows, in theory 21 kT is available for chemical recycling every year: 19 kT for pyrolysis and 2 kT for glycolysis.

For residual waste, the potential is at least 12 kT for pyrolysis and 3 kT for glycolysis.

Potential for pyrolysis and glycolysis in the Netherlands is 107 kT, based on 2015



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63 kT from unprofitable flows can be made available for pyrolysis. For glycolysis, this is at least 8 kT

1. Not profitable financial flows in the mechanical recycling

From the merit order for 2015, it appears that not all waste flows can be mechanically recycled in a profitable manner. For all the flows that come from households, the business case is negative in net value. It is our expectation that as a result of further optimization, a number of flows can still be positive.

In 2015, the following flows were delivered by households for recycling:

Foil (DKR 310)	26.5 kT
PE (DKR 329)	9.5 kT
PET (DKR328)	9.0 kT
PP (DKR324)	15.2 kT
Mix (DKR350)	59.4 kT

The PET flow is for technical reasons not suitable for pyrolysis, but it is for glycolysis. We assume that, as a result of further optimization, the PE and PP flows can be recycled with a positive business case. For foil fraction, we assume that half of it can be recycled with a positive business case.

The flows that then remain for pyrolysis are a domestic mix flow and half of the domestic foil flow. For glycolysis, the PET flow (DKR 328) and a small part of the mix flow qualifies.

Based on the different DKR sorting quality descriptions, we assume that 10% of these flows are made up of impurities. Furthermore, we assume that these impurities are not plastic. We additionally apply a correction of 4% for the PET share that may be left in the mix fraction.

From the foil fraction (DKR310), 12 kT could be available for pyrolysis. From the mix fraction (DKR350), this is 51 kT. From the PET fraction, 8 kT is available for glycolysis.

This assessment depends largely on the business case that is yet to be developed for chemical recycling. On the basis of the merit order research for 2015, we estimate that fractions DKR310 and DKR350 now have a net negative business case in mechanical recycling of €-50 €-110/ton, respectively.

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Nedvang2015 waste tool/personal communication Packaging Waste Fund Foundation/Berenschot merit order research

From the loss of mechanical recycling from profitable flows, 19 kT may be made available for pyrolysis and 2 kT for glycolysis

2. Estimation of mechanical recycling volume loss

Used packing material from companies and households is offered, after collection and sorting, to recycling companies. The recycling process also encounters losses; a kilo of collected and sorted material provides less than a kilo of recycled material. The reason for this is, among other things, adherent dirt, labels and/or remnants of the packaged product. A certain part of the loss therefore consists of plastic and another part of non-plastic.

Assumptions

We assume that the scrap percentage of the domestic flow is 39%. For the power from waste plants, we assume 23%. Both numbers are calculated (using the formula: 1 – yield) on the basis of the weighted average of the yields of the different flows from the merit order.

Further, we assume that the loss consists for 50% of plastic that is suitable for pyrolysis.

Potential of packaging material from companies

In 2015, 123 kT of plastic packaging material from companies was mechanically processed, the loss of which would be suitable for pyrolysis. Assuming a loss of 23% and a 50% share of plastic (see heading 'assumptions' opposite), 11 kT of this flow could be delivered to a pyrolysis plant.

Potential of packaging material from households

In 2015, 38 kT of plastic packaging material from households was processed in a financially profitable manner via mechanical recycling, the waste of which would be suitable for pyrolysis. Assuming a loss of 39%* and a 50% share of plastic (see heading 'assumptions' opposite), 8 kT of this flow could be delivered to a pyrolysis plant.

It is estimated that of the PET that originates from companies (including returnable bottles), 2 kT per year may become available for glycolysis. The assumption based on the merit order is that the loss incurred in mechanical recycling is 20%* and that PET constitutes 50% of that loss.

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* Berenschot merit order research among 14 Dutch plastic recyclers/ Nedvang 2015 Wastetool

From residual waste, 12 kT can be made available for pyrolysis and 3 kT for glycolysis. Further research is needed to assess the potential of the not collected part

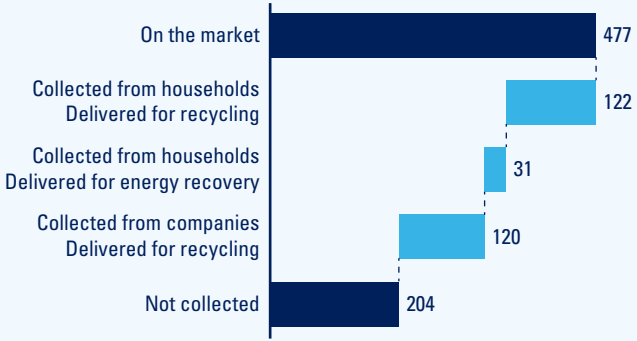
3. Potential from residual waste

Each year, more plastic packaging is put on the market in the Netherlands than is being collected and recycled. Of the 477 kT that was put on the market in the Netherlands in 2015, a total of 273 kT has been collected. 120 kT of which was collected from companies and delivered for recycling. 153 kT is collected from households, 122 kT of which is delivered for recycling and 31 kT for energy recovery. This concerns packaging retrieved through pre-separation, of which it became clear that it could not be sorted for one of the five flows; for example, because of their color or the degree of contamination. In theory, 31 kT could be used for pyrolysis or glycolysis.

Furthermore, 204 kT was not collected. This packaging has possibly ended up in the residual waste. The recovery of plastic packaging waste from residual waste will not be easy. This depends partly on the choices that municipalities take in relation to pre-sorting or post-sorting. Because it is very likely that this packaging is now present in the residual waste, it is only possible to sort it for recycling through post-separation.

On the basis of sorting tests used for household packaging, we can assume that plastic packaging in the residual waste consists for 25% out of PET (22%) and PVC (3%). A quarter of the flow is therefore lost in any case for pyrolysis. It is also likely that this flow is very contaminated. Due to the large uncertainties, this flow has not been taken into account in the assessment.

Processing of collected packaging material in 2015 [kT]



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The plan was developed in cooperation with the plastic chain and research institutes

This plan for the improvement of sustainability has been compiled by Berenschot en Partners for Innovation, commissioned by and in close cooperation with NRK Verpakkingen, PlasticsEurope Nederland and the Packaging Waste Fund Foundation.

After analyzing all stakeholders and the program of requirements, a first concept has been drafted on the basis of a desk research. To validate and complement, this concept has been submitted to a large number of stakeholders from the sector and through knowledge and interest groups. This has led to a selection of topics on which the plan further elaborates. During the validation workshop, it also became clear that this is more like a roadmap than a concrete plan. This is due to the degree of complexity.

After the implementation of the elaborated plan and after detailed discussions with and refinement by the NRK Verpakkingen and PlasticsEurope Nederland Boards, the plan was presented to the KIDV. More specifically, the plan has been offered to an advisory committee.

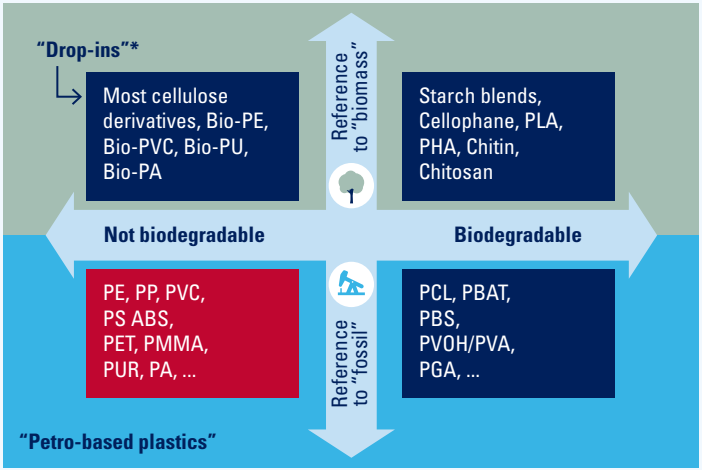
VALIDATION WORKSHOP PARTICIPANTS

Name	Organization
Mr Bellert	Attero
Mr Bolck	WUR
Mr Brons	Cumapol
Mr De Boer	Sabic
Mr De Ruijter	NRK
Mr Heideveld	Het Groene Brein
Mr Liebers	Hordijk
Mr Lievestro	NRK / Recticel
Mr Schutjes	NRK recycling
Mr Tanger	Weener Plastics Group
Ms Topp	Windesheim
Mr Van der Grift	Nedvang
Mr Van Dord	NRK / DPI
Mr Van Enckevort	QCP
Ms Vrind	KIDV
Mr Wessemius	Oerlemans Plastics
Mr Wevers	DOW
Mr Zandbergen	NRK / Veolia

Background information: definitions of the terms biobased, biodegradable and oxodegradable

Bioplastics is a collective name for biobased plastics and biodegradable plastics.

Certain biobased plastics are also biodegradable, such as PLA and PHA. However, not every plastic from a renewable source can degrade, and not every degradable plastic is made from a renewable resource. The following matrix provides a schematic overview.



* Drop-ins: the materials are processed via the same production and processing techniques as standard plastic.

Biobased plastics

Because the application of biobased plastics is still in its development stage, the actual contribution to the implementation of a circular, sustainable economy will only be visible at the time the industry has reached maturity. The use of biomass is linked to the condition that its application does not have adverse effects on food production.

Biobased products with Green certificate

To be able to prove that chemical products and plastics are made from renewable raw materials, a green certificate has been developed. A method and criteria have therefore been recorded in the 'Green Deal' green certificates.

For more details, see: http://greendeal-groencertificaten.nl

read more

Background information: definitions of the terms biobased, biodegradable and oxodegradable

Biodegradable plastics

Biodegradable plastics can be broken down by micro-organisms into water, CO_2 and biomass. This degradation strongly depends on, among other things, the temperature, and the presence of micro-organisms, oxygen and water.

"Compostable" and "organically" degradable, however, are not protected terms and are sometimes used to describe materials that cannot be composted in an industrial composting plant or in a natural environment.

Plastics that comply with the European standard EN-13432 can be composted in an industrial composting plant, but not necessarily in a natural environment. These products may carry a 'Kiemlogo' (seed logo) or the 'OK logo'.

Kiemplantlogo

OK Compost logo

The application of biodegradable plastics is only useful for specific applications. First of all, the material properties must meet the product requirements and the biodegradability must be useful for the intended application. Secondly, it must also be possible to break down the product in the composting process.

Because biodegradable plastics do not necessarily degrade in an outdoor environment, they should not be seen as a solution to the problem of littering.

Mixing of biodegradable plastics with the regular plastic waste recycling leads to loss of quality of the recycled material.

Oxodegradable plastics

Oxodegradable plastics disintegrate into tiny, non-biodegradable plastic fragments during oxidation processes. The term 'oxodegradable' gives the false impression that the material will biodegrade. NRK and PlasticsEurope deem the production and the use of oxo-degradable plastics as very undesirable, because they have no added value; not for the environment, not for recycling and not for the properties of the product.

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