National tax on virgin plastics

Possibilities and effects

CE Delft
Committed to the Environment

National tax on virgin plastics

Possibilities and effects

This draft report was written by:
Geert Warringa, Ellen Schep, Geert Bergsma, Amanda Bachaus

Delft, CE Delft, June 2021

Publicatienummer: 21.210190.083

Government policy / Plastics / Taxes / Charges / National / Effects Commissioned by:

Ministry of Finance

All CE Delft's public publications are available via www.ce.nl.

More information on the study can be obtained from the project leader Geert Warringa (CE Delft).

CE Delft
Committed to the Environment

Through independent research and advice, CE Delft contributes to a sustainable society. We are leaders in the fields of energy, transport and raw materials. With our knowledge of technology, policy and economics, we help governments, NGOs and businesses to achieve structural change. For 40 years now, committed and skilled staff have been working at CE Delft to make this happen.

Contents

Brief summary

Currently, 2 billion kilograms of plastic products are bought every year in the Netherlands. In order to make the plastic product chain more sustainable, this study examined a tax on new (virgin) plastic, following the Van Raan (PvdD) motion. The aim of this tax is to reduce the production and use of virgin plastic by making it more expensive.

Plastics are made in a production chain in which crude oil is converted into finished plastic products via various intermediate steps. A tax seems easiest to implement when plastic granules and powder (polymers) are resold to producers of plastic (intermediate) products. The product that is then taxed is homogeneous, easily measurable and the number of taxpayers is relatively limited (15 companies and importers). In addition, recyclate seems relatively easy to exempt from the tax and its application is directly stimulated.

However, a tax on Dutch polymers may cause the plastic products made from them to be replaced by imports from abroad not subject to the tax. As a result, there is a risk that the production of virgin plastics will not decline, but shift. These so-called carbon leakage effects not only limit the effectiveness of the tax, but also have a negative impact on the competitive position of the Netherlands in relation to other countries. The Netherlands may also argue for an EU-wide tax on polymers, so that at least within the EU the same tax is levied.

A tax on plastic end-products does not have these leakage effects, but is more difficult to implement due to the large number of products and taxpayers. Also, the incentive to use recyclate is more indirect than with a tax on polymers. For a more simple design, it might be possible to opt for a more limited application of the tax on new plastics, for example only on the product group packaging.

Various positive environmental impacts are to be expected from a tax on plastics. Less use reduces the chance of litter in nature and plastic soup, and reduces $_{CO2\ emissions}$. Replacing virgin plastics with recyclate also leads to a reduction in emissions. However, when other materials are used, $_{CO2\ emissions}$ may increase on balance. Many alternatives have a greater environmental impact in the chain. Further research is needed to determine the net $_{CO2\ effect}$.

Finally, in addition to introducing a tax, other policy instruments are also worth considering. Examples include increasing plastic recycling targets for various sectors, introducing an obligatory minimum proportion of recyclate in new plastic sold on the Dutch or European market and banning plastic use in litter-sensitive applications such as single-use items.

Long summary

Reason

The Van Raan (PvdD) motion requested the government to investigate the possibilities for a national tax on new plastic (and/or plastics with a too low recycling percentage), and to report to the House on this before the summer of 2021.
CE Delft carried out this study on behalf of the Dutch Ministry of Finance. This report presents the results of the study.

Objective

Conducting a study of the practical possibilities for (variants of) a charge on new plastic and a qualitative assessment of the effectiveness and side-effects on the environment and the economy. The charge applies to new plastics or with a low percentage of recyclate; plastics made from recyclate are excluded.

Results

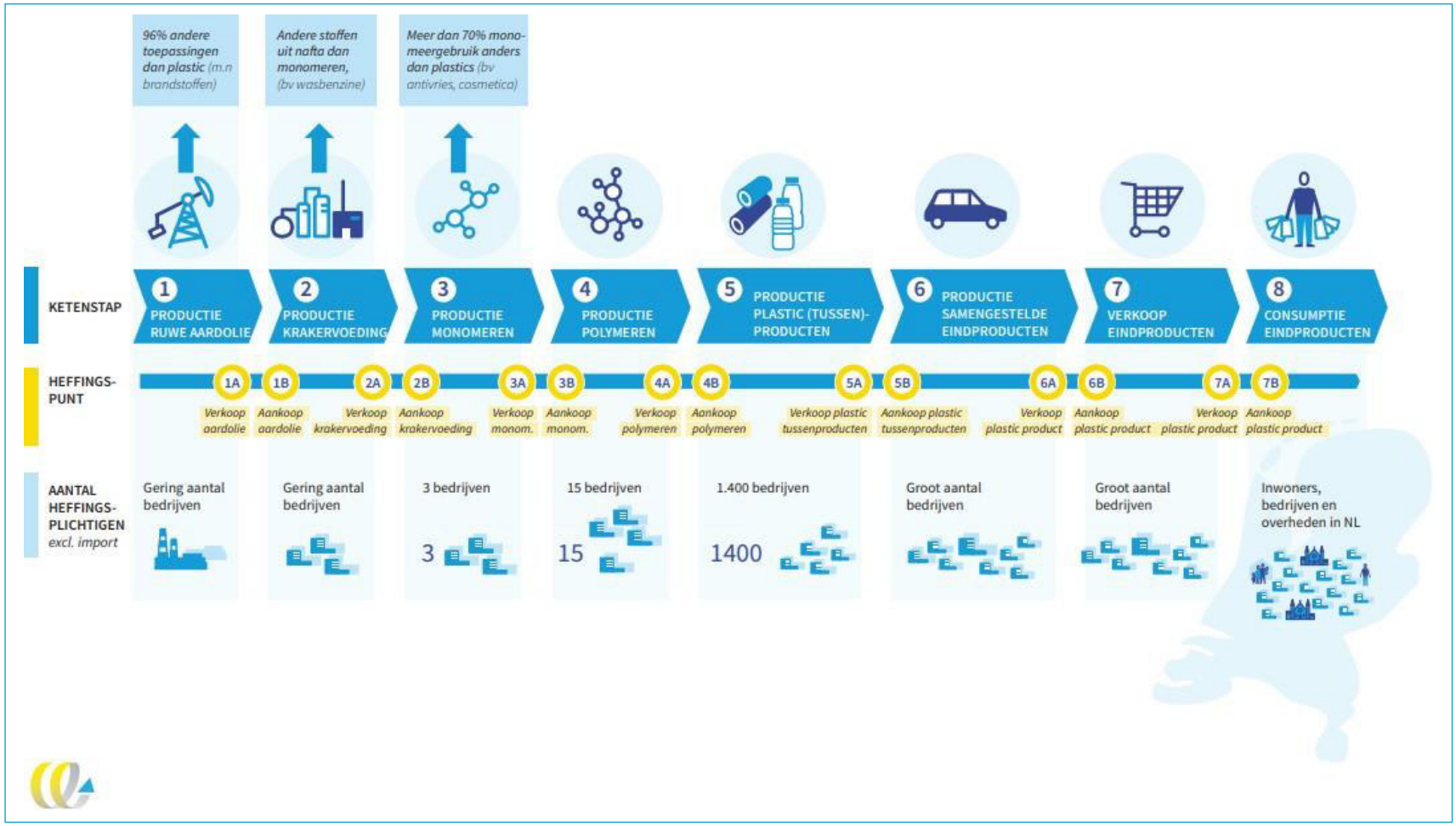
The main results of the study are:

There are 14 different places in the chain where a tax on plastics can take place

Plastics are made in a production chain where crude oil is converted into finished plastic products through various intermediate steps. In this chain, there are several links where a tax can be levied, namely the purchase or sale of:

1. Crude oil.
2. Cracker food.
3. Monomers.
4. Polymers (plastic granules and powder).
5. Plastic (intermediate) products.
6. Composite products with plastics.
7. End products.

Figure 1 - Links in the chain where a tax on new plastics can be levied



The figure shows that the further down the chain the tax is levied, the greater the number of taxpayers. The tax base may be volume (crude oil, cracked food or monomers in gaseous form), weight (crude oil, cracked food, polymers and plastic products), number of items (plastic products) or price. It should be noted that, depending on its design, a tax base based on price may face legal obstacles in the framework of EU legislation.

For each tax point, different sub-variants are possible. For example, the export and import of plastics can be exempted from the tax or taxed. It is also possible to opt for a minimum production volume for a duty payer and, in the case of a product tax, to opt for a minimum share of plastics. These are design aspects that deserve further elaboration.

A tax on polymers is probably the easiest to design

A tax on polymers (Switch 4) is probably the easiest to implement in practice. The product to be taxed is homogeneous and easy to measure (polymers are produced in large quantities in granular or powder form), the number of taxpayers is relatively limited (15 companies and importers) and recyclate is relatively easy to exclude.

A tax earlier in the chain is very complex if the aim is to introduce a tax specifically on new plastics. A tax on crude oil, crackers and monomers (links 1 to 3) would appear to be workable in itself, but a major drawback is that these products may also be used for applications other than plastics, so that further down the chain it is necessary to have an administrative record of whether these products are actually used to make plastics. It is therefore questionable whether these variants are feasible in practice. An advantage is that the number of taxpayers for these products is also limited.

For plastic intermediate and end products (links 5 to 7), a tax is complex to design, as the number of products and taxpayers is large, and it is more difficult to exclude recyclate. The industry is currently working on a monitoring and certification system to determine the proportion of recyclate at product level.
In the case of raw materials from the Netherlands, it is probably possible to determine whether they are virgin or recycled, but it is more difficult to generate and check transparent information on imports (particularly from China). The closer you get to the end product, the more interrelationships there are, and monitoring becomes even more complex.

As plastics often have a limited share in the cost of end products, high taxes are probably necessary for a significant reduction of plastics use.

The purpose of the tax is to reduce the production and use of virgin plastic. The effectiveness of the tax depends on its level and the extent to which consumers react to price changes (also called price elasticity). The plastic tax will increase the average price of plastics and reduce demand.
The absolute reduction of plastics will be greater for low-value plastics (where there is strong price competition) than for high-value applications. It is also true that the higher the tax, the greater the effect. However, we are not aware of any studies that have quantified the price elasticity of plastics and their raw materials.

Because the share of raw material costs in the final product price is limited for many products, we do not expect significant reductions in the production and use of most plastic applications until high taxes (which increase the price of plastics several times over) have been introduced. An earlier evaluation of the packaging tax (€ 0.43 to € 0.48 per kg of plastics), showed that the effects on plastic packaging use remained limited in the period 2008 to 2010.

A tax earlier in the chain entails the risk of leakage effects further down the chain, possibly causing a shift in production and consumption. A tax on end products has the least negative economic impact

A tax earlier in the chain (crude oil, crackers, monomers, polymers and also plastic intermediates) has the risk of leakage effects in the next link of the chain. For example, plastic products from the Netherlands become more expensive when the polymers are taxed, while products imported from abroad are not taxed. If the tax leads to a shift from domestic production to production abroad, there will be no reduction in the production of virgin plastics. A tax further down the chain (Linkages 6 and 7) does make imported products more expensive, however, so there is no shift in production from Dutch to foreign products.

In the Netherlands, this involves the purchase of 2 billion kilograms of plastics (purchases from Dutch companies and imports). The undesirable leakage effects can lead to a loss of turnover, employment and added value for the plastics industry. In the case of a tax further down the chain (links 6 and 7), the adverse effects on the competitive position are less pronounced. However, a tax will lead to an increase in the administrative burden for companies and price increases for consumers.

The incentive to use recyclate in plastic products is most direct with a tax on polymers (Switch 4)

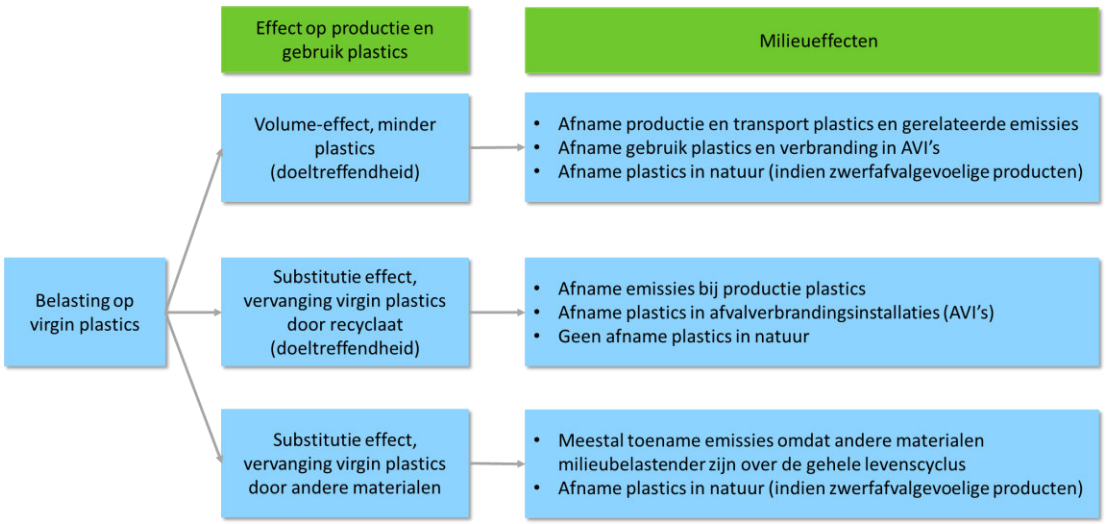
In addition to an absolute reduction in the production and use of plastics, the use of virgin plastics may also decline because producers will use more recyclate instead of virgin plastics. This incentive is expected to be most direct with a tax that targets polymers (Switch 4). If recyclate is exempted from the tax, parties purchasing polymers will enjoy a direct price advantage. In the case of a tax on earlier links in the chain, the price advantage is more indirect; it occurs when the earlier parties pass on the tax, causing the price of virgin polymers to rise. Also with a tax at a later stage in the chain (linkages 5 to 8), the incentive for the application of recycled polymers in products is more indirect.

In addition, the relative price incentive of a tax at the end of the chain is smaller than when it directly affects polymers. A tax of € 800 per tonne, for example, will result in about a doubling of the polymer price, while the end product will be only a few per cent more expensive. The end-of-chain tax will therefore probably have to be higher to stimulate the use of recyclate than if it were levied on polymers.

A tax on plastics ensures less use and therefore less chance of plastics ending up in nature and the plastic soup. The CO_2 emissions do not necessarily decrease. Further research is needed to determine the net CO_2 effect.

Environmental impacts may occur because fewer plastic products are produced and used, more recyclate is used in plastic products and if plastic products are replaced by other materials (see Figure2).

Figure 2 - Potential environmental impact of a tax on new plastics



A tax on plastics does not necessarily have a positive impact on CO_2 emissions. The tax can result in a shift to other materials that usually have higher CO_2 emissions in the chain. Less plastics through re-use, a longer life span, lighter products and replacement of virgin plastic by recyclate, on the other hand, do lead to CO_2 reduction. The climate effect can therefore be both positive (less plastics, more recyclate) and negative (shift to other materials).
Further research is needed to determine the net CO_2 effect. For litter-sensitive products, there is an environmental benefit in any case. If fewer plastics end up in nature permanently, problems such as the plastic soup and possible harmful effects on ecosystems will also decrease.

In other countries, the taxes are mainly levied on plastic (end) products

An inventory of foreign taxes shows that early in the chain there are hardly any examples of taxes on the sale or purchase of the raw materials for plastics. Most taxes relate to the marketing of (filled) packaging or, more generally, single-use plastics. In Italy and the United Kingdom, taxes on the marketing of packaging have been introduced that exclude recyclate. In addition, there are several other examples of consumer taxes, which are mainly aimed at pricing single-use plastic bags.

Recommendations

To limit the complexity of a tax, threshold quantities could be used and/or the scope of the tax could be limited to a few product groups

A national tax further down the chain has the least risk of carbon leakage but is also relatively difficult to implement in practice. For this reason, the government could also opt to restrict the scope of the tax to new plastic, to packaging, for example. In the Netherlands, there is already a system of producer responsibility that leads to tariffs and cost increases for plastic packaging, but although packaging that can be sorted and recycled well has a lower tariff, the use of recyclate is not yet exempt. A tax on other specific product applications could also be introduced.

A tax at European level can also be recommended

A tax on polymers is the easiest to implement and provides the most direct incentive for the use of recyclate, but leads to undesirable economic effects further down the chain. The Dutch government could argue in favour of an EU-wide tax on polymers. With a tax at the European level, the negative effects are more limited because undesirable economic effects only occur from outside the EU. Competitive disadvantages by importing plastic products could be limited with, for example, tariffs on plastic imports from outside the EU or a carbon adjustment mechanism.

In addition to a levy, consider other policy instruments to make the plastic chain more sustainable

In this study we have focused on making the plastic chain more sustainable through a tax. There are also other policy measures to make plastics more sustainable that can be implemented (whether or not in combination with a tax). These include:

- Raising plastic recycling targets for producer responsibility like the Afvalfonds Verpakkingen, or introducing targets for other sectors like Auto Recycling Nederland or the recycling system for white and brown goods.
- Introducing an obligation to include a minimum proportion of recyclate (possibly also including bioplastic as an option) in new plastic sold on the Dutch or European market (this option is also being studied by CE Delft on behalf of the Ministry of Infrastructure and the Environment).
- Banning the use of plastic in certain litter-sensitive applications as recommended by the EU in its SUP-Single Use Plastics Directive1 policy.

[1] This EU directive aims to reduce single-use plastics and increase the collection and recycling of plastics. The aim is to prevent single-use plastics from ending up in the sea.

1 Introduction

1.1 Reason

Within the framework of the tax plan 2021, the Lower House adopted a motion by member Van Raan (PvdD). The motion requests the government to investigate the possibilities for a national tax on new plastic (and/or plastics with a too low recycling rate), and to report to the Chamber on this before the summer of 2021.
The purpose of this levy is to slow down the production and use of new plastic and thus possibly increase the proportion of plastic recycled.
The Dutch Ministry of Finance asked CE Delft to carry out this study. This report presents the results of the study.

1.2 Objective

Conducting research into the practical possibilities for (variants of) a levy on virgin plastic and a qualitative assessment of the effectiveness and side-effects on the environment and economy. The following research questions are important in this respect:

Identifying the different forms of taxation
- What does the Dutch plastics market look like?
- At what points in the plastic chain can a tax be levied?
- Who could be considered a taxpayer?
- Which raw material, intermediate product and/or final product can serve as a basis?
- Are there examples of a tax on new plastic abroad and, if so, how are they designed?

Effects of different forms of taxation (qualitative, using a scorecard)
- To what extent are the different levy variants practical?
- To what extent is the production and use of new plastic discouraged?
- To what extent is the use of plastic recyclate and production of recycled plastic promoted?
- To what extent do intended and unintended effects on the environment and economy occur for each measure?

1.3 Scope

In accordance with the motion, we are investigating variants of a national tax on virgin plastics. This means that recyclate is exempt from the tax, but bioplastics are not. Because some bioplastics also have environmental advantages over virgin plastics (see Appendix 0), it might also be considered in the future to exclude both bioplastics and recyclate. The present study focuses, however, on an exclusion of recyclate only.

1.4 Approach in a nutshell

In order to answer the research questions, we first surveyed the Dutch plastics market. We mapped out the plastics involved and how many companies are involved in each link in the chain (from the production of plastic granules to end products such as bottles, plastic bags and dashboards). To gain a clear picture of the market, we conducted a literature study and held interviews with contact persons from the sector organisations Plastics Europe and the Federatie Nederlandse Rubber- en Kunststofindustrie (NRK).

We estimated the effects on the use of virgin plastics and plastic recycling on the basis of a literature study. We made use of impact assessments of taxes on plastics in other countries, studies on the reduction of plastic consumption when prices rise, studies on environmental and economic consequences and our own expert judgement.

1.5 Reading guide

The structure of the report is as follows:

- Chapter 2 describes the plastic market and the variants of a levy.
- In Chapter 3, we present the effects of the variants (effects on consumption of virgin plastics, consumption of recyclate, effects on environment and economy).
- In Chapter 4 we present the conclusions and recommendations.

2 Variants for a tax on virgin plastics

2.1 Definition

When we talk about a plastic tax, the first question is what exactly the term plastic means. Plastic is a polymeric material. It involves very large molecules that are formed by linking together a large number of small, usually identical molecules, called monomers. The linking of the smaller molecules to form plastics is also called polymerisation.

It is noticeable that in everyday speech the term plastics is mostly used, while in legal texts (directives, laws, decrees) the term plastic is used.
However, the meaning is the same. For example, in the Parliamentary Letter 'Towards a Circular Packaging Chain (Ministry of I&W, 2018)' of 14 March 2018, the term 'plastic' is used for deposits on plastic bottles, which is substantively the same as the term 'plastic' used in article 6 of the Packagings Management Decree 2014.

A tax on plastics could therefore be based on the definitions of plastics in existing legislation. For example, the EU Single Use Plastics Directive includes the following definition for plastics:

Plastic: A material consisting of a polymer as referred to in Article 3(5) of Regulation (EC) No 1907/2006, to which additives or other substances may be added and which may be used as a structural main component of finished products, other than natural polymers which have not been chemically modified.

NB: Most bioplastics made from biological materials such as sugar cane or maize also fall under this definition (see also Section 1.3). After all, they are also made through a number of chemical steps via polymerisation from monomers.

2.2 Problem analysis

The use of (virgin) plastics can have a negative impact on the environment, particularly due to the emission of $_{CO2}$ during the production of plastic and the waste incineration, pollution of the living environment and the plastic soup. Plastics can break down into so-called microplastics, which can be harmful to human and animal health. Plastics (both small and large pieces) are particularly problematic in nature because they degrade very slowly.

Since the 1960s, the use of fossil plastics worldwide has increased enormously (twenty-fold). The use of virgin plastics is expected to increase further from 370 Mton today to approximately 1.1 Gton in 2050 (CPB, 2017). In addition to the increase in use, the recycling of plastics started later than that of other materials such as metal, paper and glass, so that the net recycling percentage of all plastics in the Netherlands is around 15%. This is much lower than for many other materials and results in more virgin production.

The government's goal is to realise a fully circular economy in 2050, in which no virgin raw materials are used anymore. Achieving this goal will greatly reduce the environmental impact of raw material use and make the Netherlands less dependent on fossil raw materials. One of the instruments to reduce the amount of virgin plastics is a tax. This can happen because the use of plastics absolutely decreases or because virgin plastics are replaced by recyclate. However, a reduction in the use of plastics does not necessarily lead to a positive environmental impact (see box below).

Environmental impact of plastics is not necessarily negative

Not all uses of plastic are by definition net bad for the environment. Examples are:

- Plastic food packaging can reduce food spoilage and waste, and thus also reduce the net environmental impact of a product without plastic packaging.
- Plastic bottles and jars have substantially lower CO_2 emissions (and less breakage of packaging) than single-use glass variants. Therefore, a shift to other materials does not necessarily lead to more environmental benefit. The same applies to plastic bags, which have a lower carbon footprint than paper bags.
- The use of plastic in cars instead of metal can also reduce fuel consumption, as plastic is a light material.

Although a shift to other materials in the above examples will not lead to environmental benefits, the environmental impact will decrease if the virgin plastics are replaced by recyclate.

On the other hand, replacement by recyclate will not solve the plastic soup problem. Recycled plastics also degrade slowly. In addition, the risk of leakage into the environment mainly plays a role in specific applications, such as plastics in fishing nets, packaging for on the road, textiles and cosmetics (micro plastics) and tyre wear. For other plastics, such as those used in cars, electronics and the construction industry, the risk of leakage is greater.
plastic soup problem, because they hardly, if at all, end up in litter.

2.3 The plastic production chain

Figure 3 shows the plastic production chain from raw material extraction to consumption.

Figure 3 - Plastic production chain

The following steps are involved:

1. Most plastics are made from crude oil2. This crude oil is pumped up from the ground.
2. Crude oil is converted in a refinery into a variety of oil products, such as petrol, diesel, paraffin and naphtha. By far the largest proportion of oil (94 to 96%)(BPF, 2019)[3] in Europe is used for applications other than plastics. Various refinery products, in particular naphtha and for example also LPG, form the raw material for plastics as cracking feed.
3. This cracker feed4 is then used in a cracking plant to make *simple* chemical products, the so-called monomers. Examples are ethylene and propylene. These are gaseous substances. Other substances, such as benzene, can also be made from crackers. Most of the monomers are used to make polymers/plastics. In the case of ethylene and propylene, this is more than 70% (Naeff, 2021, The Essential Chemical Industry, 2017). Important other applications of monomers are cleaning agents, pharmaceuticals, antifreeze and cosmetics.
4. Plastic producers make polymers, such as polyethylene and polypropylene, by linking the monomers together (also called polymerisation). Polymers are produced in granular form or as powders.
5. Producers of plastic products purchase the polymers and use various techniques, such as injection moulding, to make plastic products. These can be plastic intermediate products (e.g. dashboard, computer casing, empty packaging) or products entirely made of plastic (e.g. toys).
6. The plastic intermediate products are then processed into an end product, such as cars, computers, washing machines and filled packaging.
7. The plastic products and composite products are delivered to the end user through the final sales channel. This is often the retail sector, but can also be, for example, a company that supplies plastic products through a government tender or sells to another company without the involvement of the retail sector.
8. The consumer buys and uses the end product. This can also be a business consumer or a government. After use, plastic becomes waste and is separated for recycling by consumers or by machines at waste disposal or incinerated in a waste incineration plant with energy production.

Recycling

Plastic can be recycled after use. The most common is mechanical recycling. The plastics are sorted, washed and melted down again into polymers. These recycled polymers can replace virgin polymers in the production of plastic (intermediate) products. An alternative to mechanical recycling that is now being developed in various places is chemical recycling. Here the chemical structure of the discarded plastic is changed and broken down into the original building blocks. These can be polymers, monomers or molecules, depending on the technique. These building blocks can be reused in the chain. Since the polymers obtained by chemical recycling have the same quality (purity), they can be reused in the chain.

---

[2] In addition, plastics can be made from bio-based materials and, for example, natural gas condensate can also be used.
or refinery gas are used for the production of monomers. This natural gas route is not common in Europe, but it is used in the United States.

[3] Incidentally, the United Nations predicts that this share will rise to 20% by 2050 (UN, 2018).

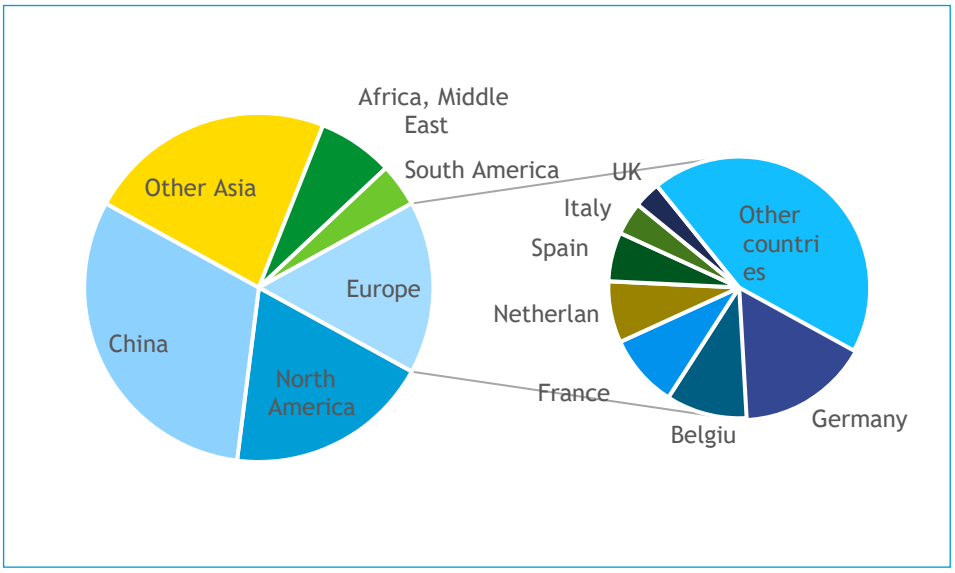
[4] In Europe, an average of 63% of the cracking raw material consists of naphtha, and the rest of LPG and other natural gas liquids (PBL, 2021b).

have the same characteristics as those of virgin plastics, they can be used to make higher quality plastics with more applications than mechanically recycled plastics. However, the environmental benefit of chemical recycling is generally less than that of mechanical recycling, because more energy is needed to recycle the plastics. With solvolysis (PS) and depolymerisation (PET), this difference is very small. With pyrolysis and gasification, the environmental benefit of chemical recycling is roughly half that of mechanical recycling.

2.4 Production plastics international

Many different types of polymers are produced (Step 4 in the chain). Polymers are produced all over the world. Half of the worldwide production of 370 million tons comes from Asia; in North America the share is 19%; Europe accounts for 16% of production (58 million tons). Production in South America (4%) and Africa/Middle East (7%) is relatively more limited. The main production countries in Europe are Germany, Belgium, France, the Netherlands and Spain (EUROMAP, 2016). In Europe, 53 companies are members of the industry association Plastics Europe, which represents more than 90% of the total plastic production in Europe.

Figure 4 - Polymer production by region



Source: EUROMAP, (2016) Plastics Europe, (2020).

The EU's main trading partner is the United States. Roughly a quarter of Europe's polymer imports come from the US, followed by China (15%), Switzerland (12%), Turkey (11%), and Japan (6%). The US was also the most exported in 2019 (17%), followed by Switzerland (10%), China (9%), Russia (8%), and Turkey (6%). These figures refer to the import and export of plastics as raw materials (polymers, Step 4 in the chain), not yet applied in products and packaging (Steps 5 and 6 in the chain). In addition, there is also a large volume of imports and exports of plastics in products and packaging.

2.5 Production and consumption of plastics in the Netherlands

The raw materials for the plastics (Step 3 in the chain), the so-called monomers, are produced in crackers. There are three producers of monomers in the Netherlands, who own a total of six naphtha crackers (three at Dow in Terneuzen; two at Sabic in Geleen; one at Shell Moerdijk).

Producers of polymers (Step 4 in the chain) are mostly multinationals that produce large quantities. In the Netherlands, some 15 companies produce the polymers. [5] Examples of companies are Dow, Sabic, Lyondell, DSM, Shin-Etsu and Trinseo. The Netherlands is a relatively large producer of polymers. In 2018, over 5.3 Mton of plastics were produced in the Netherlands (this is just under 10% of European production (Plastics Europe, 2019). Of the 5.3 Mton production, more than half was exported from the Netherlands.

According to Plastics Europe, approximately 2.4 Mton of polymers were used in the Netherlands for the production of plastic (intermediate) products (Step 5 in the chain). The transition agenda
circular economy about plastics reports 2.0 Mton. A large part (40%) of this was for packaging. Other categories are plastics in buildings, electronics, the automotive industry, agriculture, households and other (including furniture). It is mainly SMEs that produce plastic products. In the Netherlands, there are more than 1,400 companies, of which only 10% have more than 50 employees. [6] These companies thus occupy a position between the multinationals in the chemical industry (which produce the polymers, Step 4 in the chain) and the customers for plastic products, such as the packaging industry, construction, agricultural construction, automotive and electrical engineering industries (Steps 6 and 7 in the chain).

Sectors in the Netherlands that consume plastics

Important sectors with consumption of plastics are:

- **Agriculture** in the Netherlands consumed about 155 kt in 2018. Examples of applications are agricultural films, which are used to protect crops from the elements and pests.
- **Construction**. In the Netherlands, some 300 ktonnes of plastics for construction are put on the market annually, mainly present in pipes, insulation and window profiles. In construction, PBV, HDPE, PUR and EPS are mainly used (CE Delft, 2019). In the Netherlands, a number of companies are active in the production of plastic products for construction.
- **Packaging**. A number of companies, both large and small, are active in the packaging industry in the Netherlands. Most packaging is seen as semi-finished products. They are delivered empty to the packaging industry. Only when they are filled, they are delivered to the consumer.
- **Electronics**. The market for electronic devices is an international market. In the Netherlands, some large, but mostly many small companies are active in this market. A large production location of Philips is located in Drachten. Some 2,000 people work here, on the production of shavers and coffee machines, among other things.
- **Automotive**. In the Netherlands, various companies are active in the production of plastic parts for the automotive industry. Some companies are also involved in assembly. Many companies focus on focuses on more sectors than just automotive. Most of the semi-finished products for the automotive industry

[5] According to CBS, there are 140 companies in the plastics industry, including a number of small ones. These will probably be companies that make special polymers from polymers. These are the so-called compounders,
based on granules, these companies make all kinds of products with which special types of plastics can be made. become.

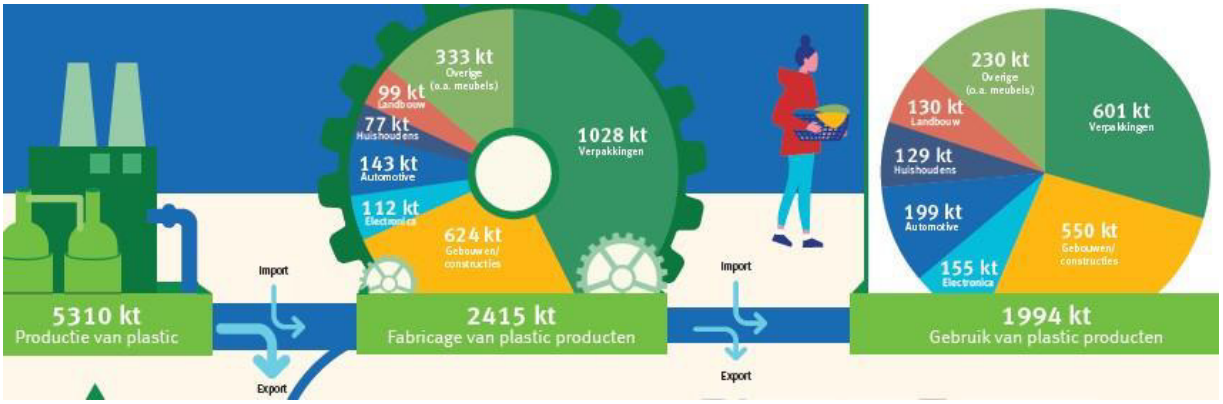
[6] Source: CBSStatlineCompanies;industry sector

exported, especially to Germany. The car industry in the Netherlands is very limited. The only manufacturer of series models is the Limburg-based factory VDL Nedcar in Born.

-Plastics are also widely used in **textiles**, but production in the Netherlands is limited. In the 1950s, the Netherlands was a major producer (regions such as Tilburg and Twente), but the industry has since been decimated. [7] Nowadays, the Dutch ateliers are mainly located in Amsterdam, Brabant and the east of the country. However, for larger fashion companies, the production capacity of Dutch ateliers is still too small. [8]

Domestic consumption of plastic products amounted to just under 2 Mton in 2018 (Government Gazette, 2018). This means that there are both more polymers and more plastic
products are produced in the Netherlands than consumed. Part of the production is intended for export; plastic products and packaging are also imported from abroad. Precise import and export quantities are not known.

Figure 5 - Production and consumption of plastics and plastic products in the Netherlands



Source: PlasticsEurope(2018)

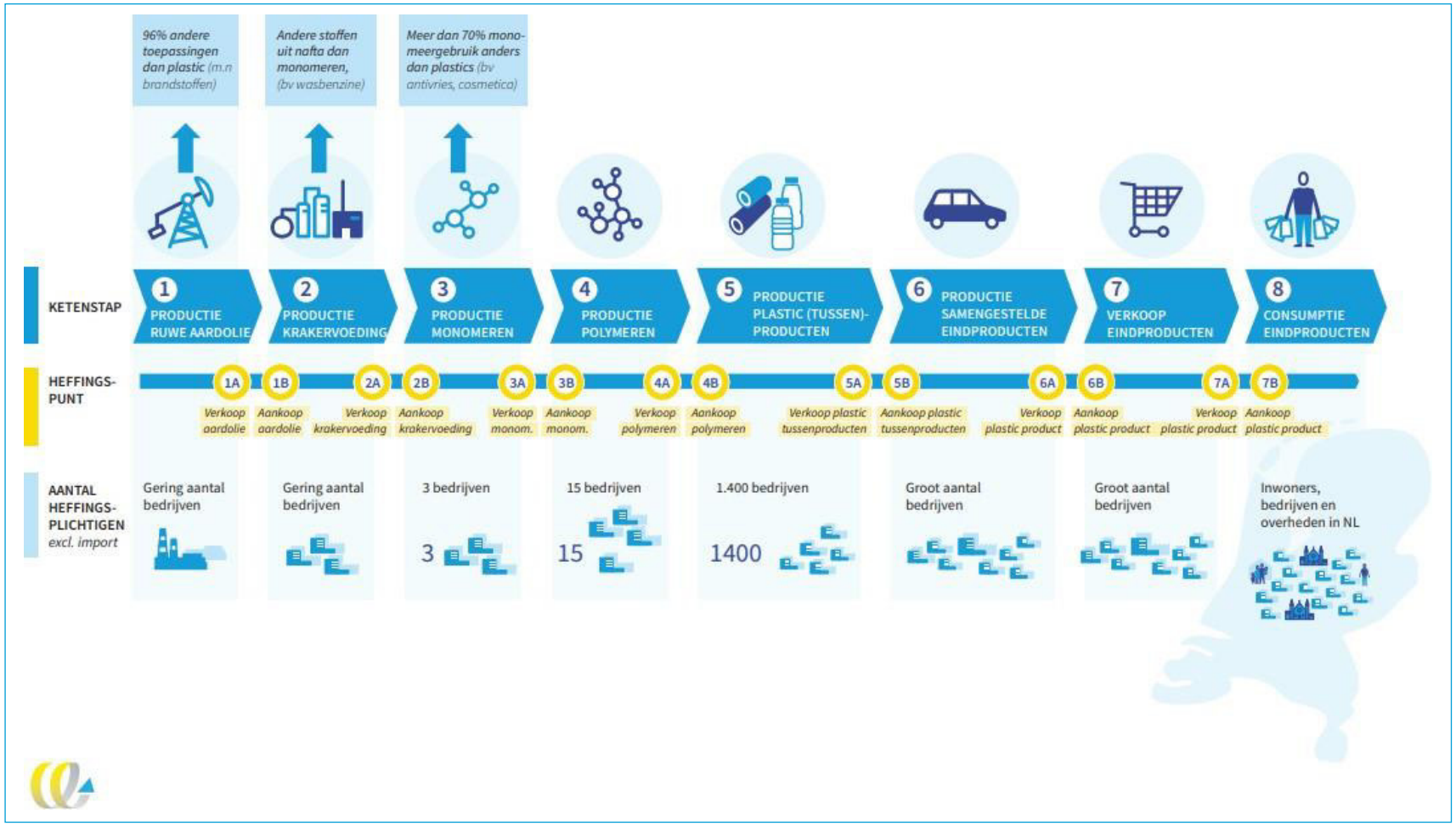
2.6 Where do we stop in the chain?

If the entire plastic chain is considered and a distinction is made between sales and purchases of raw materials (especially oil) to the end product (plastic product), a tax can be levied at 14 points. Figure6 shows the potential tax points along the chain.

[7] CBS : The decline of the textile industry

[8] Dutchtextile industrymaking a comeback

Figure 6 - Plastic chain, duty point and number of duty subjects



At the various links in the chain, taxes can be levied on both the sale and purchase of an (intermediate) product. For each tax point, different sub-variants are possible. For example, the export and import of plastics can be exempted from the tax or, on the contrary, taxed.

In this study, we elaborate on variants in which imports are taxed and exports are exempt from tax. If this does not happen, it could lead to adverse effects on the competitive position of Dutch companies and to leakage effects. After all, Dutch companies would then be confronted with cost increases, while foreign competitors would not be. In the foreign examples of plastic taxes, we see that export is exempted and import is not.

To limit the scope of the tax, one could also choose to work with threshold quantities or only tax a certain category of plastic products (Switch 5 to 7). An example of this is the packaging tax introduced in the Netherlands in 2008. This tax was subsequently repealed on 1 January 2013 and replaced by a system of producer responsibility through the Packaging Waste Fund (see also Variation 6a). Here, only companies that are at least 50,000 kilograms of packaging material on the Dutch market are subject to contribution.

The tax base can be the volume (crude oil, cracking food or for monomers that are gaseous), the weight (crude oil, cracking food, polymers and plastic products), the number of pieces (for plastic products) or the price.
It should be noted that, depending on its design, a price-based levy may face legal obstacles in the framework of EU legislation. The disadvantage of price as a tax measure is that it need not be fixed but can vary and is dependent on the market situation. This makes the price as a yardstick more susceptible to fraud.
Volume, weight and number of units are not volatile and therefore more predictable (more legal certainty).

The following variants were included in the analysis9:

- **1a: Tax on the placing of crude oil for plastics production on the Dutch market.** In this variant, right at the beginning of the chain, crude oil used to produce plastics is taxed. As 94 to 96% of crude oil is used for applications other than plastics, only a small proportion of the crude oil brought onto the Dutch market is taxed in this variant. A condition is therefore that it can be made administratively clear that the oil brought onto the market is used in the further stages of the chain for the production of plastics. The tax base could be the volume (litres), weight or price of the crude oil.
- **1b: Tax on the purchase of crude oil for plastics production.** In this variant too there is a tax on the 4-6% of crude oil used for plastics production, but in this case it is the party purchasing the crude oil who pays the tax. Here too, it must be possible to demonstrate administratively that the crude oil is used for the production of plastics further down the chain. The tax base may be the volume (litres), weight or price of the crude oil.

[9] A tax at the very end of the chain (7b) is not considered. Such a tax means that all consumers are taxable and transactions by consumers have to be administered.

[10] Impuls Zeeland: Dow is going to invest in Terneuzen

[11] C2W : Electric cracker saves environment

[12] In this report, the term 'importers' refers to all parties who bring products from abroad (EU and non-EU) to the Netherlands.

- **2a: Taxation of the placing on the Dutch market of crackers' feed for plastics production.** One step further down the chain, the sale of crackers' feed used for plastics production can be taxed. A condition for this tax is that it must be clear what happens to the cracker feed further down the chain. During the cracking of various raw materials, mainly monomers10 such as ethylene and propylene are formed, but also residual products such as petrol. [11] In this respect, naphtha is not only used for the production of monomers in a cracker, but is also used to make diesel and paraffin, for example. The tax base can be the volume (litres), weight or price of the cracker feed, related to the carbon content of the product concerned.
  2b: Tax on the purchase of crackers' food for plastic production. In this variant, too, there is a tax on pretzels, but the purchase is taxed instead of the sale. In this variant too, it must be administratively clear that the cracker feed is intended for the production of plastics. The three Dutch companies with naphtha crackers are taxable. The tax base can be the volume (litres), weight or price of the cracker feed, related to the carbon content of the product concerned.
- **3a: Tax on the placing on the Dutch market of monomers for plastic production.** The taxpayers are the companies with crackers in the Netherlands (3 companies with 6 crackers) and companies that bring monomers onto the Dutch market from abroad. Although a large proportion of monomers are used for plastics (for ethylene and propylene more than 70%), monomers also have other applications such as cosmetics, antifreeze and medicines. The tax base can be the volume of the monomers (gaseous) or the price (euros).
- **3b: Tax on the purchase of monomers** for **plastic production**. The tax payers are about 15 parties who buy monomers in the Netherlands to make polymers from them. The tax base can be the volume of the monomers (gaseous) or the price (euros).
- **4a: Tax on the placing of polymers on the Dutch market by polymer producers.** The taxpayers are the 15 parties in the Netherlands (who produce at least 100 kton of polymers per year). There are also traders who (usually) produce large quantities of parties buy polymers from abroad and sell them to Dutch producers of plastic products. In addition, foreign producers can supply large Dutch customers without the intervention of intermediaries. It is not known how many traders and foreign companies are involved. The tax base may be the weight of the polymers or the price (euros).
- **4b: Tax on polymer procurement by producers of plastic products.**
  These are companies that buy the polymers and make products from them (both for the Dutch market and for export). This concerns approximately 1,400 Dutch companies. The tax base may be the weight of the polymers or the price (Euros).
- The taxpayers are the same 1,400 companies as in the variant above, plus the intermediaries (importers)[12] and companies that sell to Dutch parties from abroad without the involvement of intermediaries. It is not known how many traders and foreign companies are involved. The tax base can be the weight of the products, the price (euros) or the number of products.

---

2 Impuls Zeeland: Dow is going to invest in Terneuzen

3 C2W : Electric cracker saves environment

4 In this report, the term 'importers' refers to all parties who bring products from abroad (EU and non-EU) to the Netherlands.

- **5b: Tax on purchases of plastic intermediates.** Taxpayers are industries that purchase plastic intermediate products. These include, for example, the packaging industry, but also companies that produce electronics and purchase plastic parts for this purpose. The tax base can be the weight of the products, the price (euros) or the number of products.
- **6a: Taxation of the placing on the Dutch market of composite end products.** It concerns companies that place composite end products on the Dutch market. An example is the packaging industry such as Unilever, which fills a plastic bottle with shampoo. This option is similar to the earlier packaging tax and to the
  The place in the chain where the Afvalfonds Verpakkingen13 collects the contribution for producer responsibility for packaging. The levy basis can be the weight of the plastic in the products, the price of the product (in euros) or the number of products.
- **6b: Tax on the purchase of finished and composite plastic products.** The taxable persons are those who purchase finished plastic products in order to sell them to the final consumer, such as the retail sector (supermarkets, garages, department stores, building centres, etc.) or possibly public authorities. The taxable base can be the weight of the plastic in the products, the price of the product (euros) or the number of products.
- **7a: Tax on sales in the Netherlands of plastic end products and assemblies to final consumers.** The taxpayers here are also the retail sector (supermarkets, garages, department stores, DIY stores, etc.), other companies supplying the final consumer (e.g. governments) and importers. The tax base can be the weight of the plastic in the products, the price of the product (euros) or the number of pieces of product. This variant differs from 6b because it is not levied at the moment of purchase, but at the moment of sale.

Experiences from abroad

Appendix 0 contains an overview of different taxes corresponding to the charging points described above. As can be seen, the taxes are generally levied on the marketing of products (i.e. the a-variants) rather than on procurement (the b-variants). Upstream, there are hardly any examples of taxes on the sale or purchase of the raw materials for plastics. Most taxes relate solely to the marketing of (filled) packaging or, more generally, single-use plastics. In Italy and the UK, packaging marketing taxes have been introduced that exclude recyclate.
In addition, there are several examples of consumer taxes, which are mainly aimed at pricing single-use plastic bags.

The vast majority of countries have introduced (or plan to introduce) a packaging tax. The Netherlands has also previously had a packaging tax levied on producers of products and importers who put the packaging on their product (packaging industry).

[5] The Dutch Packaging Fund (Afvalfonds Verpakkingen) collects the waste management levy from companies that put packaged products on the Dutch market, provides fees (to municipalities) for the (separate) collection of household packaging waste and reports to the government on all packaging and the recycling percentages.

However, an example in Denmark shows that for other homogeneous product groups (PVC products) it has also been practically feasible to introduce a charge.
However, further research is needed to work out specifically for which product groups a charge can be levied and how to determine the proportion of recyclate in these products.

Although plastics are used throughout almost the entire economy, the sectors that consume the most are construction, agriculture, packaging and electronics (see also Section 2.5 and Figure 5). Below is a brief review of the most relevant sectors in which plastics are used in the Netherlands.

The **packaging industry** has experience with a packaging tax and the taxpayers are well understood. The total amount of plastic packaging put on the market in 2017 was approximately 530 kilotonnes, this consists of approximately than 95% of all plastic packaging and 5% of composite plastic packaging such as drinks cartons (paper and plastic) and laminates (e.g. chip bags). The proportion of plastic is easy to determine for the majority of packaging.

In the Netherlands, some 417 kilotonnes of **electrical appliances are** put on the market each year. The precise plastic content of these appliances has never been determined and will vary from product to product (CE Delft, 2019). A tax on the share of plastic in a final product (lifecycle step 7) is therefore difficult to implement in practice. Estimates also show that the share of plastic is often less than 50%. So if there is a threshold (as proposed in the UK), few products will fall under the tax. Plastic semi-finished products such as the casing of a laptop or the spray arms of a dishwasher could, however, be taxed separately on the basis of their weight (Chain Step 5). This is an international market. It is unclear what the Netherlands' position is there. There is also chain integration, whereby production and assembly take place at the same location and the product no longer consists entirely of plastic.

As mentioned earlier in Section 2.5, **parts for cars** are made in the Netherlands, but assembly mainly takes place abroad. On average, a car consists of 115 kg of plastic. About 13 types of plastic are used for this purpose, notably PP (32%), PUR (17%) and PVC (16%). With an average car weight of around 1,200 kg, this amounts to just under 10% plastic (CE Delft, 2019).

In the Netherlands, some 300 ktonnes of **plastics for construction are** put on the market annually, mainly present in pipes, insulation and window profiles. In construction, PBV, HDPE, PUR and EPS are mainly used (CE Delft, 2019). The products are relatively homogeneous.

Producers and importers of clothing and other **textile products** are obliged to add a label when placing textiles on the market. This applies to all products that consist of more than 80% textile materials. The label shows the materials of which the product consists. In this way, it is relatively easy to find out whether or not plastics have been used in the product (Ondernemersplein).

The most important use of plastic in **agriculture** is the use of agricultural plastics for, for example, covering crops or preserving animal feed. For these products, the share of plastic is relatively easy to determine. In agricultural plastics, use is already made of recyclate.

1.1 Conclusion

There are several possibilities for a tax on virgin plastics. The tax can be introduced on the sale or purchase of crude oil, crackers, monomers, polymers (plastic granules and powders), plastic (intermediate) products, composite products containing plastic or in the last link at the end-user (usually retail). The further down the chain the tax is levied, the greater the number of taxpayers. If the tax is levied at the beginning of the chain (crude oil, crackers, monomers), it must be made administratively clear that the raw materials will be used to produce plastics further down the chain. In the case of end-of-life taxes, it must be possible to clearly demonstrate how much plastic and/or recyclate the product contains. The levy measure could be volume, weight, price (euros) or number of units. In the next chapter we discuss the effects and feasibility of the various variants.

3 Effects per variant

3.1 Effects per variant

The effects per variant are shown in Table 1. The effects give an absolute assessment compared to a situation without a load. Sections 3.2 to 3.5 discuss the effects per variant in more detail.

Table 1 - Impacts per variant

	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	6a	6b	7a
	Sale of crude oil	**Purchase of crude oil**	**Sales of cracker food**	**Purchase of crackers**	**Sales of monomers**	**Purchase of monomers**	**Polymers sales**	**Purchase of polymers**	**Sale of partial products**	**Purchase of partial products**	**Sale of finished products**	**Purchase of finished product**	**Sales of finished products to consumers**
Practical feasibility													
Clearly demarcated levy roundabout	Very complicated				Complicated		Relatively simple		Relatively Complicated		Complicated		
Number of taxpayers	Some	6	6 + import	3	3 + import	+- 15	+-15 + import	+- 1400	+- 1400 + import	Thousands			
Identify levy payers	Relatively simple							Complicated		Very complicated			
Easy to exclude recyclate	Chemical and mechanical recycling further down the chain automatically excluded				Mechanical automatic excepted, chemical more complicated				Requires information earlier from chain				
Effectiveness													
Incentive to reduce use of plastics	Dependent on levy level												
Incentive to use recyclate in products	Indirect		Direct chemical recycling only				Directly for chemical and mechanical recycling		Indirect		Very indirect		
Chance of shift effects towards import of virgin plastic products further in the chain	Very large								Large		Limited		
Environmental impact													
Less virgin plastic and more recyclate	Possible, positive environmental impact												
Substitution to	Possible, environmental impact depends on alternative												

	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	6a	6b	7a
	Sale of crude oil	**Purchase of crude oil**	**Sales of cracker food**	**Purchase of crackers**	**Sales of monomers**	**Purchase of monomers**	**Polymers sales**	**Purchase of polymers**	**Sale of partial products**	**Purchase of partial products**	**Sale of finished products**	**Purchase of finished product**	**Sales of finished products to consumers**
Economic effects													
Effects on competitiveness, leakage	Very high risk								High risk		Limited risk		

3.2 Practical feasibility

We have based the practical feasibility of the tax on:

- The possibilities per variant to delimit the tax base, this can be divided into two aspects:
  - To what extent the raw material is used for plastic production (Links 1 to 3) or the proportion of plastic in a product (Links 5 to 7);
  - the extent to which the proportion of recyclate is easy to determine.
- The number of taxpayers and whether the taxpayers are in the public eye (as part of a licensing scheme or similar).

Possibilities to delimit plastics in the tax base

The tax base for a virgin plastics tax is virgin plastic. The share of raw materials used for plastic production is very complicated to delineate in the case of a tax on crude oil and crackers (links 1 and 2). For this, the seller or buyer of the products must know what happens to the product further down the chain. It should also be noted that excise duties are currently levied on oil products made from crude oil, while crude oil itself is not yet taxed. [14] If it is not possible to determine what happens further down the chain, there is a risk of double taxation. After all, both the crude oil and the petrol or diesel produced from the crude oil would be taxed. We consider the difficulty of delineating the plastic component to be a major practical drawback of a crude oil tax. For raw materials used in a cracker (Switch 2), they are exempt from excise duty if they are used for the production of non excisable goods. Goods intended for chemical processing do not fall under an excise category. Therefore, when these refinery products are put on the market, it is possible to define what is used in a naphtha cracker. Naphtha crackers keep accurate records of their feed under ETS regulations. However, it is then complicated to determine what part of this is used for plastic production.

The share of monomers (Switch 3) used for plastic production is easier to delineate than for crude oil and crackers, but still complicated because monomers are also used for applications other than plastics. With polymers, the tax base is the easiest to determine. Polymers are the raw materials for plastic products and are produced in large quantities in granular or powdered form, making quantities (weight or value) easy to measure.

Also for (sub) products (Switch 5) that consist entirely of plastics, the share of plastic is relatively easy to determine. In this case, too, the weight or value of the products could be measured, for example (although in practice this would probably require more effort from the taxpayers, because it would mean that products would have to be weighed or the value would have to be determined).

[14] The mineral oils subject to excise duty are light oil (petrol), medium oil (petroleum), gas oil (diesel), heavy fuel oil, liquefied petroleum gas (LPG) and methane. Other products may also be designated as mineral oils. An example is vegetable oil used as motor fuel or as heating fuel. Source: Customs:Exciseandconsumption tax,detailsperexcise product

For composite products (Switch 6 and 7), it is more complicated to determine the tax base, as the weight or value in euro of the plastic components in the products must be known. This would mean, for example, that the weight or value of the plastic components in cars or computers would have to be known.

Recycling as a tax base can easily be excluded

In the case of a tax on crude oil and crackers, no recyclate is used (Links 1 and 2), so that in these links only fossil raw materials for virgin plastic are automatically taxed.
With a tax on monomers, it is more complicated to exclude recyclate from chemical recycling (Switch 3). This is because, chemically, the monomers from fossil raw materials or recycled plastics are identical. Moreover, the inputs are often mixed. For example, virgin cracker feedstock and pyrolysis oil (made from plastics) may enter a steam cracker together, producing partly recycled and partly virgin monomers that are indistinguishable. This requires a chain of custody system to monitor what is recycled and what is not. One possibility is the 'Mass balance' method that relates the ratio of recycled output to input. However, mechanically recycled plastics are excluded from a monomer tax.

For the polymers (Switch 4), it is also necessary to determine to what extent chemically recycled monomers have been used as input. In addition, mechanically recycled polymers must also be excluded. Mechanically recycled polymers are a different product than virgin polymers. They come from a different market and have a different market price. It must therefore be possible to make a distinction. This must, however, be demonstrable.

Further down the chain it becomes more challenging (Links 5 to 7) to determine the amount of recyclate in the product. The industry is working on a monitoring system to determine the share of recyclate at product level. This will probably work in the short term for production in the Netherlands and the EU, but will be difficult for imports (particularly from China) because it requires monitoring across the various stages of the chain. [15]

Number of taxpayers and in the public eye

The more downstream the chain, the greater the number of taxpayers and the less clear-cut the picture becomes about who the taxpayers are. At the front of the chain, a limited number of companies in the petrochemical industry are subject to licensing. Oil and cracker feed are well defined and the movement must be registered by AGP holders16. AGP holders need a licence, so they are in the picture.

The number of producers of monomers in link 3 of the chain (three companies excluding importers) and polymers in link 4 of the chain (15 companies excluding importers) is also still limited. The number of companies producing plastic products is already much higher.

[15] It should be noted that import and export are terms that, in the context of taxation, are always to/from. outside the EU. Within the EU, this is a 'transfer' from/to another Member State.

[16] Storage and production of excise goods is only allowed in an approved area for which the customs authorities have issued a permit, the so-called Excise Goods Location (AGP). This authorisation holder is the AGP holder.

(in Schakel 5 about 1,400 companies) which use the granules and powder to make a wide variety of plastic (intermediate) products, such as casings for electronics, toys, packaging, dashboards, films for agriculture, etc. In the case of a levy on composite products (Switch 6) or at the retail level (Switch 7), the number of taxpayers increases even further. It is not known how many taxpayers are involved, but in any case several thousand.

3.3 Effects on consumption of virgin plastics and recyclate

The Van Raan motion requests the government to investigate the possibilities for a national tax on new plastic (and/or plastics with a small percentage of recyclate) noting that the production of new plastic continues to grow and contributes to climate change and environmental pollution.

The purpose of the tax is to reduce the production of new plastic. We have assessed the effectiveness of the tax in terms of:

- Reduction of the production of plastics in general (both virgin and recycled). For example, because it becomes financially more attractive to design lighter products, to reuse plastic products more often, to design products with a longer life span.
- Reduction of virgin plastics by substituting recyclate, as it becomes more financially attractive to sell recyclate and design products that can be better recycled.

Reduction of plastics

The effectiveness of the tax depends on its level and the extent to which consumers react to price changes (also called price elasticity). The plastic tax will increase the average price of plastics and reduce demand.
The effect will be greater for low-value plastics (where there is strong price competition) than for high-value applications. It is also true that the higher the tax, the greater the effect. However, we are not aware of any studies that have quantified the price elasticity of plastics and their raw materials.

The evaluation of the packaging tax for the period 2008-2010 shows that this tax has hardly led to a reduction in the use of plastics (CE Delft, 2010). The reasons for this are as follows:

- The financial incentive provided by the packaging tax (€0.43 to €0.48 per kg) has been too low to prompt large-scale changes to the packaging strategy. The costs that can be saved by adapting the packaging strategy often do not outweigh the (financial) costs associated with implementing the strategy (development costs, costs of modifying the packaging line, risk that the new packaging does not 'catch on' with consumers, etc.).
- Cost price increases can often be passed on to the consumer quite easily. Passing on the packaging tax has led to a limited increase (1 to 3%) in consumer prices.
- With consumer goods, the marketing function and functionality of the packaging often play a more important role than the cost of the packaging.
- The packaging market is generally strongly internationally oriented. In many cases, internationally operating companies use uniform packaging strategies in the various national markets.

Although the above arguments apply to a tax specifically for the packaging market (approximately 40% of all plastics used in the Netherlands), we believe that at least the first two arguments also apply to many other plastic applications, as the share of raw material costs in the final product price is relatively limited for many products. For example, a charge of €0.80 per kg, as Europe applies, will result in a price increase of €0.32 for a 400g plastic waste bin costing consumers €5-€30. Many end-consumers will therefore only notice a price increase, even if it is substantial at the plastic raw material level.

These conclusions apply to rates such as the packaging tax (€ 0.43 to € 0.48 per kg in 2008-2010), the European tax (€ 0.80 per kg) or the tax as introduced in the UK (converted to approximately € 0.23 per kg). However, significant volume effects may occur if much higher taxes are introduced. For example, taxes in Norway and Finland on non-refillable bottles have led to an increase in the proportion of refillable packaging. However, these were rates of, respectively
0.10 (Norway) and € 0.71 per bottle (Finland), while the Dutch packaging tax has led to a price increase of € 0.02 per bottle. In (CE Delft, 2010) it is suggested that the tax would need to be 4-5 times higher than the rate at the time to have any substantial impact on the beverage packaging market.

It is important to note that a tax at an earlier stage in the chain may have displacement effects later in the chain, leading to a shift to imports rather than reduction effects. A tax on crude oil, cracker food, monomers, polymers and plastic intermediates (Switch 1 to 5), for example, has the disadvantage that imports of finished plastic products are not subject to the duty, so that products manufactured in the Netherlands may be displaced by untaxed plastic products from abroad. Although the share of imports and exports is not precisely known and will differ for each product, we consider it likely that displacement will occur because raw materials and plastic (intermediate) products are traded internationally. If the tax leads to Dutch products being displaced by foreign products made from virgin plastics, there will be no reduction in the production of virgin plastics at global level.

Reduction of virgin plastics by replacing them with recyclates

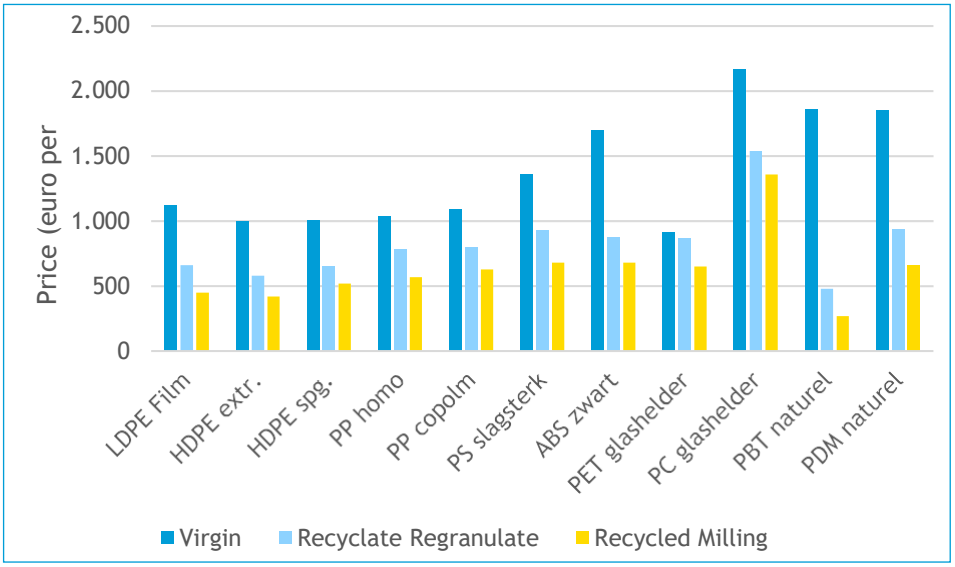
The production and use of virgin plastics may also decline as virgin plastics are replaced by recyclate. This incentive is expected to be most direct in a tax that targets polymers (Switch 4). If recyclate is exempted from the tax, parties using polymers will gain a direct price advantage when they purchase. If they purchase recyclate instead of virgin polymers, the demand for virgin polymers in the Netherlands will decrease. In case of a tax at the front end of the chain, the price advantage is more indirect; it occurs when the earlier parties pass on the tax, causing the price of virgin polymers to rise. If parties partially absorb the tax (e.g. by accepting lower margins), the effect of the tax will be less pronounced.

Also with a tax later in the chain (Switch 6-8), the incentive for the application of recycled polymers in products is more indirect. A tax on an end product containing virgin plastics provides no direct incentive for producers of plastic products, but rather a price advantage that is passed on indirectly in the lifecycle. In addition, the relative price incentive of a tax at the end of the chain is smaller than when it is imposed directly on polymers. A tax of € 800 per tonne, for example, will result in a doubling of the relative price incentive.

of the polymer price, while the end product only becomes a few percent more expensive. Therefore, the tax at the end of the chain should probably be higher to stimulate the application of recyclate than when it is applied to recyclate.
If more recyclate is used, the production of virgin plastic will decrease.

It should be noted here that price is not the only consideration in the choice between virgin plastics and (mechanical) recyclate. Factors other than price, such as quality and availability of (mechanical) recyclate, also play an important role in the choice between virgin or (mechanical) recyclate. [17] A tax on virgin plastics will have an incentive effect, because in many cases the prices of regranulates and granulates will follow (with a time lag) the prices of the virgin materials, and because the higher prices will make it more profitable for recycling companies to develop activities and sell recyclates on the market. This effect is likely to occur mainly in the longer term when more investments are made in recycling plants, which may also improve the quality of recyclate. It is therefore important for an effective tax that it provides long-term investment security and is not abolished after a few years.

Figure 7 - Prices of virgin plastics and recyclate (€ per tonne) in week 1 2021



Source: (Plastics and Rubber, 2021).

Note: Milling material is cleaned and ground plastic material. Homogeneous fractions can be remelted and processed into granules, or regranulates. Heterogeneous flows of regrind are also used directly in the production of finished plastic products.

The British government expects that the share of recyclate in packaging will increase by 40% in one year's time as a result of the tax of 200 pounds per tonne of plastics. The British tax includes a threshold value of 30%, and it is expected that especially companies just below this threshold value will use more recyclate. There is also an incentive to

[17] The NRK therefore indicates in its fire letter to the government that, despite the continuous improvement in the sorting and recycling processes, the quality of the waste collected remains a point of concern. This contamination is caused by other flows in the collected plastics (paper, metal drinks cartons), contamination in post separation and insufficient monitoring by municipalities.

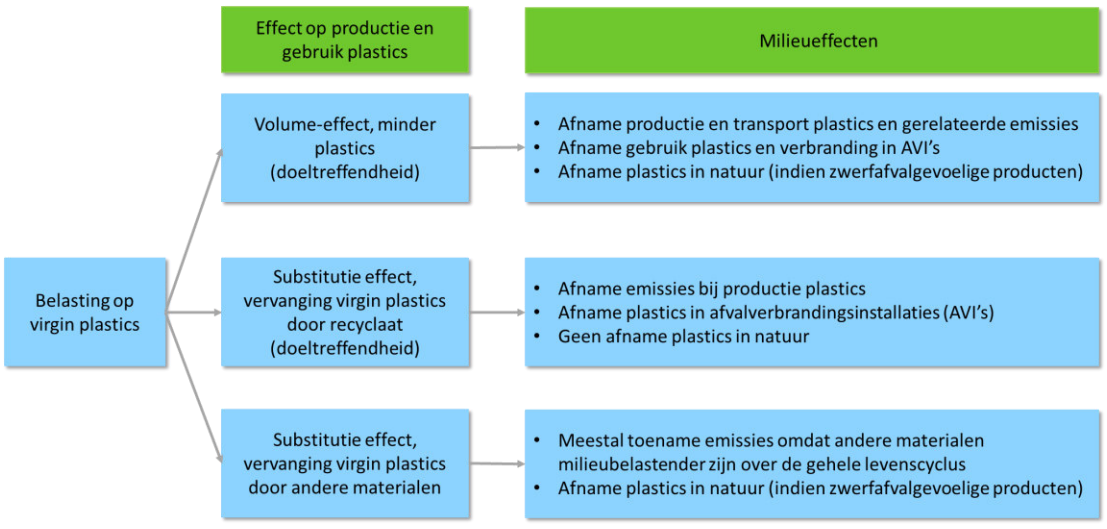
design products that are easier to recycle. For example, IHS Markit estimates that there will be a shift from multi-layer packaging that is difficult to recycle to single-material packaging that is more recyclable (especially the plastic PE). This could lead to a 2% growth in demand for PE packaging. How this will play out in the Netherlands will depend on the scope and design of the tax.

3.4 Effects on the environment

The environmental impact of plastics is mainly caused by emissions during the production of raw materials for plastics (refining and steam cracking), combustion at the end of the life cycle and when plastics end up in nature (plastic soup). A tax on virgin plastics can ensure that less virgin plastics are produced, for example, because products have a longer life or because of more recycling. If fewer virgin plastics are used, there will also be less production of virgin plastics (and the associated emissions) and fewer plastics will end up in the incinerator (so fewer combustion emissions). This mainly concerns $_{CO2\ emissions}$. The emissions of nitrogen oxides (NOx), sulphur oxides (SO2) and particulate matter (PM10) related to plastics are relatively limited in Europe due to existing standards (CPB, 2017).

A reduction in the use of litter-sensitive plastics (such as plastic candy wrappers) will also reduce the size of the plastic soup. The environmental effects of a tax are therefore strongly linked to its effectiveness. Reducing the use of plastics has positive environmental effects. Replacing virgin plastics with recyclate also has positive environmental effects. When plastics are replaced by recyclate, less plastics end up in the incinerator (so fewer emissions) and less energy is needed to produce plastics. However, a tax on plastics can also lead to plastics being replaced by other materials. If the alternative materials have a greater environmental impact than plastics, there is no positive environmental effect on balance.

Figure 8 - Potential environmental impact of virgin plastic load



We therefore assess the effects on the environment in terms of:

- Environmental impacts through reduction of plastics in general (without substitution to other materials, e.g. through increased recycling). These environmental impacts are usually related to the effectiveness of the tax (see Section 3.3). In general, the lower the production and use of plastics, the greater the positive environmental impact, unless less use has adverse consequences such as food spoilage.
- Environmental impact of replacing virgin plastics with recyclate. These environmental impacts are also related to the effectiveness of the tax (see Section 3.3). The greater the use of recyclate, the greater the positive environmental impact.
- Environmental impacts through substitution of plastics to other materials.

Environmental impact of plastics reduction (volume effect)

The environmental effects of a plastic tax are strongly linked to its effectiveness (reduction of virgin plastics and replacement by recyclate). In theory, a price increase of products containing plastic could also stimulate reuse, a longer life span and the design of lighter products. Although we are not aware of specific studies, we expect this effect to be limited because the share of material costs in product prices is generally small. Only in the case of high taxes that increase plastic prices by a number of factors (see Section 3.3) can there be significant positive environmental impacts through volume effects.

Environmental impact of substitution by recyclate

The potential environmental impacts of replacing virgin plastic with recyclate can be substantial. An earlier study by CE Delft showed that lifecycle $_{CO2\ gains}$ amount to about 2.5 kg per kg plastic. Assuming 15% recyclate use at the moment, the total potential for 2 Mtonnes of plastic consumption in the Netherlands thus amounts to over 4 Mtonnes $_{CO2\ reduction}$. [18] Half of this environmental gain consists of not burning plastic in an incinerator and the other half of having to produce less new plastic from oil.

However, this is the theoretical potential if all plastics were replaced by recyclate. In practice, only a part will be replaced by recyclate due to a plastic tax. According to the UK government, environmental gains associated with the packaging tax are 200 kt $_{CO2\ in\ the}$ short term (UK Government, 2021). In the UK, approximately 1.5 Mtonnes of packaging are consumed annually. This is 2.5 times more than in the Netherlands.
(600 ktonnes). Assuming a similar effect in the Netherlands, a packaging tax excluding packaging with a share higher than 30% recycled would lead to 80 kt reduction in the Netherlands in the short term19 . In the longer term, the effect may be greater if more investment is made in recycling plants.

[18] 2 Mton (plastic consumption) * 2.5 kg CO (environmental benefit of recycling per kg plastic) * 85% = 4.25 Mton.

[19] (600 kt packaging in the Netherlands / 1,500 kt packaging in the UK)* 200 kt $_{CO2\ reduction}$ in the UK = 80 kt $_{CO2\ reduction}$ in the Netherlands.

Environmental impact through substitution to other materials

As mentioned in Section 3.3, a tax on plastics may also result in a shift to other materials. This effect may occur at all links in the chain, but particularly if a tax is levied on links 6 and 7. In the case of non-litter-sensitive packaging and bags this is likely to lead to an increase in environmental impact, as packaging made of other materials often has a higher net environmental impact.

For litter-sensitive products, however, there is an environmental advantage. If fewer plastics end up in nature permanently, problems such as the plastic soup and possible harmful effects on ecosystems will also decrease. However, a lot of packaging is used and discarded almost exclusively indoors, such as plastic packaging for pasta (kitchen) or toothpaste (bathroom). For this reason, these types of packaging also feature very little in the litter and in plastic soup. At present, 52% of this packaging is returned for recycling (source: Afvalfonds) and 35-39% is used net in new plastic products (source: WUR). The amount of recyclate used to make new packaging is much lower. This is mainly because the quality of the plastics collected is not sufficient to comply with food legislation.

Market bureau IHS Markit estimates that if the European plastic packaging tax were to be passed on from 800 per tonne, the cost of products including packaging will increase by between 3 and 8%. This, they say, will lead to a 2 to 3% shift in demand to other materials such as wood, cotton, paper or metal packaging.

In the budget estimate of the plastic tax on packaging in the UK, the shift effects to other plastics with sufficient recycled content and packaging made of other materials (glass, cardboard) are estimated at 3% (Office for Budget Responsibility, 2020). This estimate seems realistic to us. Although anecdotal, we see no major shifts in the volume of packaging on the market in the Netherlands as a result of producer responsibility (Afvalfonds), despite the fact that for plastics a
higher fee than other packaging materials.

The environmental effects will be different for each market and application. Sorting this out precisely takes much more time than was available for this study. Anecdotally, the following can be reported:

- Plastic jars (powdered milk, sweetener, etc.) score better in environmental terms than single-use glass jars, particularly due to their much lower weight.
- Thin films around food generally score better environmentally than other materials such as aluminium.
- Large and soon also small PET bottles are subject to the deposit system. These consist of approximately 50% recycled material. Here, it is conceivable to shift to tinplate (also with a deposit), which does not make much difference from an environmental point of view, or to multi-use glass (also comparable) or to single-use glass, which is unfavourable from an environmental point of view.

In the home **packaging market**, it is not possible to say with certainty what shifts to other materials will achieve environmentally, but most indications are that the effect will often be negative (greater environmental impact). In particular, shifts to single-use glass can lead to higher environmental impacts.

In the **automotive sector**, the use of plastics generally leads to lighter vehicles and thus to significant fuel savings. A tax on virgin plastics provides an incentive to use other materials, but the standards for energy efficiency and the emphasis on range in electric cars is so high that plastic is unlikely to be replaced as a material.

In other markets, such as **electronics,** plastic for housings is so well established and so practical in production and design that it is unlikely that a refrigerator or hoover will be made of aluminium. In general, the small shifts that are occurring are likely to lead to increases in environmental pressure. After all, plastic is often the most environmentally suitable material due to its light weight and strength.

In the **construction industry**, plastic is increasingly used in, for example, window frames, wall cladding or insulation material. The low costs and ease of maintenance, in particular, make plastic interesting compared to wood. It is not known to what extent this tax will cause shifts here. It also depends on each case what the environmental impact will be.

A large part of the plastic **packaging waste** collected is recycled into other sectors such as the construction industry, the textile industry and the automotive market. In these sectors, the application of recyclate will become more interesting. It is likely that collection for recycling will also increase within these sectors. However, whether parties will want to set up such a system depends on the stability of the virgin plastic tax. The earlier packaging tax was also abolished after a number of years, and other environmental taxes in the Netherlands (cf. flight tax) were also uncertain in terms of continuity.

If, in parallel with the virgin plastic tax, producer responsibility is also imposed on sectors such as construction, electronics and textiles, with a recycling percentage to be achieved, it is more certain that recyclate from their own sector will be recycled in these sectors. If this does not happen, recycling of plastic from the packaging sector will be stimulated in the short term and the setting up of own collection will depend strongly on the level and expected stability and continuity of the tax.

Existing policies to reduce virgin plastics

Implementing producer responsibility (Afvalfonds Verpakkingen)
In the packaging market, there is an extensive system of producer responsibility which, in the Netherlands, is organised by the Afvalfonds Verpakkingen. The system of executive producer responsibility (UPV) makes producers legally obliged to collect and recycle the (plastic) packaging they use, while meeting legally set targets. Producers implement these obligations together privately. They pay a private waste management contribution for this. The government and the business community agree on recycling targets for all packaging materials.

For plastic packaging, the measuring point for recycling has recently changed. There is now a stricter assessment of whether plastic packaging that is collected is actually used again in new products. This means that within 5 years, manufacturers must increase the recycling percentage from 35-39% net today to 50% in 2025. This means that half of the packaging waste must be turned into new plastic products. It is not about the application of recyclate in packaging.

The packaging market is primarily a waste recycling sector, but little recyclate goes back into it. The use of recyclate is relatively limited because in many cases the quality of the collected material is insufficient to comply with food regulations. Only in the case of PET bottles is the use of recyclate

However, this is due to deposit systems that produce relatively clean material and because of the fact that, of all plastics, the material PET is the easiest to clean into material that is again suitable for food packaging. This is much more difficult for the PE and PP materials that are used for, among other things, bottles and foils.

If there is a tax on the application of virgin plastic, it is expected that packaging companies will apply more recyclate where possible, especially for non-food applications. The price difference between recyclate and virgin plastic will then increase, however. For food packaging, the use of mechanically recycled material is largely not permitted. More can be done in this respect with extra processing steps, but the big step towards more application of recyclate in packaging will probably have to come from the chemical recycling techniques currently being developed.

In the longer term (2 to 10 years), larger-scale forms of chemical recycling will probably become available (CE Delft, 2018), which can supply recycled plastic to the packaging market on a large scale. A tax on the use of virgin plastic in packaging could promote this development. In environmental terms, there is a benefit, although for some of the chemical recycling techniques (pyrolysis and gasification) this benefit is lower than for mechanical recycling (about half (CE Delft, 2018)).

Ban on distribution of free plastic bags
Another measure is the ban on free plastic bags. The aim of this is to prevent litter on the streets and in the sea. And to prevent the waste of raw materials. Retailers are allowed to set the price themselves. The guideline price for a plastic bag is € 0.25. In exceptional cases (protection of food, prevention of food wastage, plastic bags are allowed up to a maximum of 0.015 millimetres). A sealed plastic bag at a duty-free shop at an airport or in an aeroplane is also exempted.

EU fee for non-recycled plastic packaging waste
From 1 January 2021, Member States will have to pay a levy to the EU for plastic packaging waste that is not recycled. This agreement was made by the European government leaders as part of the negotiations on the recovery fund. Each member state must pay €0.80 per kilogram of packaging waste that has not been recycled. [20]

Conclusion on environmental impact

Environmental effects may occur because fewer plastic products are produced and used, more recyclate is used in plastic products, and if plastic products are replaced by other materials. A tax on plastics does not necessarily have a positive impact on $_{CO2\ emissions}$. The tax can actually result in a shift to other materials that usually have higher $_{CO2\ emissions}$ in the chain. Less plastics through re-use, a longer life span, lighter products and replacing virgin plastic with recyclate, on the other hand, do lead to $_{CO2\ reduction}$.
Further research is needed to determine the net $_{CO2\ effect}$. For litter-sensitive products, however, there is an environmental benefit in any case.

3.5 Effects on the economy

We expect adverse effects on the Dutch economy to be greatest for a levy imposed early in the chain (link 1 to 5). A disadvantage of imposing a tax early in the chain is that it will put Dutch producers at a competitive disadvantage. It may be possible to pass on the tax further down the chain, but this may be a competitive disadvantage, particularly for homogeneous products that compete strongly on price.
The variants do assume a levy on imports and an exemption of exports

[20] European Commission : **Plastic own resource**

of the product subject to the duty, but without corrections further down the chain, this still makes plastic products made from Dutch polymers less attractive than foreign ones. This can lead to a loss of turnover, employment and added value for the plastics and plastic products industry.

With a tax further down the chain (links 6 and 7), the adverse effects on the competitive position are less pronounced. However, a tax will lead to an increase in the administrative burden for companies and price increases for consumers. The effects on businesses and consumers have been studied for the packaging tax in the UK. Because companies can pass on the tax one-to-one to their consumers and are exempt when recyclate is used, the macro-economic effects are expected to be limited. For households, too, no major disruptive effects are expected in the UK, as plastic packaging is only a small part of their spending pattern (HM Revenue & Customs, 2020b).

We are not aware of any studies that have quantified the impact on the competitive position. The negative effects on the competitive position will be smaller if the tax is designed on a European scale, particularly if the tax is levied earlier in the chain (Switch 1 to 5). Even with a European tax, however, there will still be leakage effects due to imports from outside the EU. A European tax will also have less of a negative impact on competitiveness if imposed further down the chain.

3.6 Conclusion

A tax on polymers (Switch 4) is the easiest to implement in practice. The product is homogeneous and easy to measure, the number of taxpayers is relatively limited and the recyclate is relatively easy to exclude.

A major disadvantage of a tax on crude oil, crackers and monomers (Switch 1 to 3) is that these products can also be used for applications other than plastics, which means that further down the chain it must be administratively known whether these products are actually used to make plastics. It is therefore questionable whether these variants are feasible in practice.

For plastic intermediate and end products (5a to 7a), a tax is again more complex to design, as the number of products and taxpayers is much larger, and it is more difficult to exclude recyclate. The industry is currently working on a monitoring and certification system to determine the share of recyclate at product level.
In the case of raw materials from the Netherlands, it is probably possible to determine whether they are virgin or recycled, but it is more difficult to generate and verify transparent information on imports (particularly from China). The closer you get to the end product, the more cross-links there are, and monitoring becomes even more complex.

A tax further down the chain (links 6 and 7) has great advantages in terms of preventing undesirable economic effects. A tax further down the chain also makes it possible to tax the import of finished plastic products. This will prevent a shift from Dutch production to foreign production.
If a shift mainly occurs, the environmental gain is limited and Dutch companies suffer economic disadvantages.

On the other hand, the relative incentive of a tax is greater earlier in the chain. A producer of dashboards, for example, will experience a relatively larger price increase if the polymer price doubles than a garage that buys a car with artificial materials in it. In relative terms (in terms of the total price of a car), the price increase resulting from the levy is less. Charging at an earlier stage in the chain has the advantage that the relative price incentive is greater, but the disadvantage that leakage effects occur. Which effect is dominant is uncertain and will also depend on the precise design of the tax.

4 Conclusions and recommendations

4.1 Conclusions

The aim of this study was to identify the practical possibilities for (variants of) a charge on virgin plastic and to make a qualitative assessment of the purpose and effects on the environment and economy. Our conclusions are:

- There are 14 different places in the chain where a tax on plastics can take place.
- A tax on polymers is probably the easiest to design.
- Since plastics often make up a limited proportion of the cost of end products, high taxes are probably necessary for a significant reduction in plastics use.
- A tax earlier in the chain creates the risk of leakage effects further down the chain, possibly causing a shift in production and consumption.
  A tax on finished products has the least negative economic impact.
- The incentive to use recyclate in plastic products is most direct with a tax on polymers (Switch 4).
- A tax on plastics ensures less use and therefore less chance of plastics ending up in nature and the plastic soup. The $_{CO2\ emissions}$ do not necessarily decrease.
  Further research is needed to determine the net $_{CO2\ effect}$.
- In other countries, taxes are mainly levied on plastic (end) products.

4.2 Recommendations

- To limit the complexity of a tax, threshold quantities could be used and/or the scope of the tax could be limited to a few product groups.
- A tax at European level may also be recommended.
- In addition to a tax, consider other policy instruments to make the plastic chain more sustainable.

5 Bibliography

Afvalfonds Verpakkingen. 2020. *List of participants* [Online]. Available: https://afvalfondsverpakkingen.nl/producenten/deelnemerslijst/index.html [Accessed 7 May 2021].

Berenschot, 2012. Route map NRK 2012-2030. Utrecht, Berenschot Groep B .V

BPF. 2019. *Oil Consumption* [Online]. British Plastics Federation. Available: https://www.bpf.co.uk/press/Oil_Consumption [Accessed 2021].

CE Delft, 2018. Exploration chemical recycling: What are - and will be - the opportunities for climate policy? Delft, CE Delft.

CE Delft, 2019. Plastic use and processing of plastic waste in the Netherlands. Delft, CE Delft.

CE Delft, 2020. What policy on biobased plastics? Delft, CE Delft.

CE Delft, 2021. Growth projections for energy-intensive industry. Reference scenarios for climate policy impact analysis. Delft CE.

CPB, 2017. The circular economy of plastics: raw materials to waste The Hague, Netherlands Bureau for Economic Policy Analysis.

Chemical Watch. 2017. *Denmark to scrap tax on PVC and phthalates* [Online]. Available: https://chemicalwatch.com/61121/denmark-to-scrap-tax-on-pvc-and-phthalates [Accessed 6 May 2921].

Deloitte. 2015. *Belgium Budget 2015 The tax measures* [Online]. Available: https://www2.deloitte.com/be/en/pages/tax/articles/Belgium-Tax-Reforms-Deloitte-Belgium-Tax/Budget-2015-Tax-Measures-Deloitte-Belgium-Tax.html [Accessed 5 May 2021].

Deloitte. 2020. *Plastic Tax How to compete in a "Plastic-Free" World* [Online]. Available: https://www2.deloitte.com/it/it/pages/strategy/solutions/plastic-tax-ENG---deloitte-italy--strategy.html [Accessed 21 April 2021].

E.H. Pechan & Associates, 1995. Economic Impact Analysis for the polymers and resin group : NESHAP. United States Environmental Protection Agency (EPA).

EUROMAP, 2016. Plastics Resin Production and Consumption in 63 countries worldwide. Frankfurt am Main, EUROMAP.

HM Revenue & Customs, 2020a. Plastic Packaging Tax: Summary of Responses to the Policy Design Consultation. HM Revenue & Customs.

HM Revenue & Customs. 2020b. *Policy paper Plastic packaging tax* [Online]. Available: https://www.gov.uk/government/publications/introduction-of-plastic-packaging-tax/plastic-packaging-tax [Accessed 25 May 2021].

Plastic and Rubber. 2021. *Guide prices plastics week 1* [Online]. Available: https://www.kunststofenrubber.nl/nieuws/id6250-richtprijzen-kunststoffen-week-1.html [Accessed 7 May 2021].

Martinho, Balaia & Pires, 2017. The Portuguese plastic carrier bag tax: The effects on consumers' behaviour. *Waste Management*, 3-12.

Ministry of I&W, 2018. Letter from the State Secretary for Infrastructure and Water Management dated 10 March 2018 regarding Packaging Policy and National Waste Management Plan , kamerst. 28694/30872, no. 135. The Hague, House of Representatives of the States General

Naeff. 2021. *Plastics Encyclopedia : Propylene* [Online]. Naeff nv. Available: https://www.naeff.nl/nl/kunststof-encyclopedie/propyleen [Accessed May 2021].

Office for Budget Responsibility, 2020. Economic and fiscal outlook. London, Office for Budget Responsibility.

Entrepreneurs' square. *Rules for labelling of clothing and textiles* [Online]. Available:

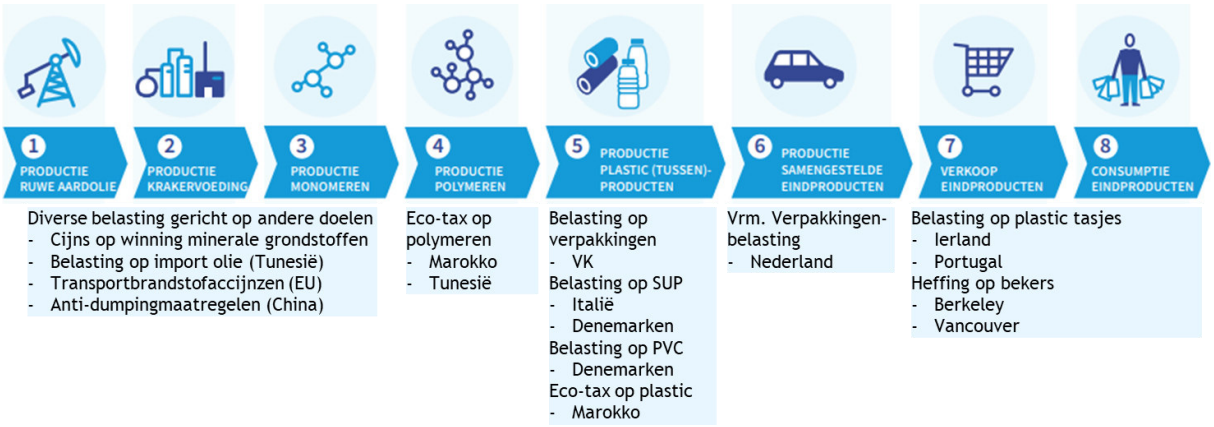
https://ondernemersplein.kvk.nl/regels-voor-etiketten-van-clothing/#:~:text=Does%20you%20wear%20or%20other%2C%20must%20have%20a%20label. Accessed 7 May 2021].

PBL, 2021a. Decarbonisation options for Large Volume Organic Chemicals production, SABIC Geleen. The Hague, Netherlands Environmental Assessment Agency (PBL).
PBL, 2021b. Decarbonisation options for the Dutch polyolefins industry. The Hague, Netherlands Environmental Assessment Agency (PBL).
PBL & ECN-TNO, 2020. Decarbonisation options for the Dutch potato processing industry. The Hague, Netherlands Environmental Assessment
Agency (PBL). **Plastics Europe,** 2019. Plastics- the facts 2019.
Plastics Europe. **Plastics Europe,** 2020. Plastics- the facts 2020.
Plastics Europe, 2020.
Pre-Waste, 2011. Eco-taxation on disposable plastic bags, kitchen utensils, food wrap & aluminium foil (pic-nic tax), Belgium. European Union.
REB Market Intelligence. 2021. *Project working on standard for recycled plastic content* [Online]. Available: https://www.rebnews.com/project-working-on-standard-for-recycled-plastic-content/ [Accessed 10 May 2021].
Retsinformation. 2020. *Lov om afift af polyvinylklorid og ftalater (PVC afgiftsloven)* [Online]. Available: https://www.retsinformation.dk/eli/lta/2020/2061 [Accessed 6 May 2021].
Rijksoverheid, 2018. Transition agenda plastics : Plastics of value. The Hague, Ministry of Infrastructure and Water Management.
Royaume du Maroc. *L'écotaxe au service du développement de la filière de recycling du plastique* [Online]. Available: http://www.environnement.gov.ma/fr/component/content/article?id=633:l-ecotaxe-au-service-du-developpement-de-la-filiere-de-recyclage-du-plastique [Accessed 5 May 2021].
Seedhouse, 2021. Excise & Environmental Taxes Policy Design, 10 May 2021.
Sengupta & Pike, 2012. Chemicals from Biomass: Integrating Bioprocesses into Chemical Production Complexes for Sustainable Development. Boca Raton, CRC Press.
The Climate Chance Observatory team. 2020. *Morocco WASTE Morroccan society's uneven response to the proliferation of waste* [Online]. Available: https://www.climate-chance.org/wp-content/uploads/2020/03/cp-waste_morocco_english.pdf [Accessed 5 May 2021].
The Essential Chemical Industry. 2017. *Ethene (Ethylene)* [Online]. Available: https://www.essentialchemicalindustry.org/chemicals/ethene.html [Accessed May 2021].
Total Corbion PLA bv, NRK & Natuur&Milieu, 2020. Biobased Plastics Action Plan. The Hague, Sustainable Packaging Knowledge Institute (KiDV).
UK Government. 2021. *Introduction of Plastic Packaging Tax from April 2022; Policy paper* Online]. London: HM Revenue & Customs. Accessed May 2021].
UN, 2018. The state of plastics : World Environmental Day Outlook 2018. Bangkok, United Nations (UN), UNEP.
VNCI. *Heating without oxygen: the advance of pyrolysis* [Online]. Leidschendam: VNCI. Available: https://www.vnci.nl/chemie-magazine/actueel/artikel?newsitemid=5619384321&title=heating-without-oxygen:the-opmarch-of-pyrolysis [Accessed 7 May 2021].
World Trade Organization. 2016. *Trade Policy Review Tunisia* [Online]. Available: https://www.wto.org/english/tratop_e/tpr_e/s341_e.pdf [Accessed 5 May 2021].
WWF, 2019. Stop the flood of plastic : How Mediterranean countries can save their sea. World Wide Fund for Nature (WWF).
Zero Waste Europe, 2018. Research paper on a European tax on plastics. Brussels, Zero Waste Europe.

A Examples from abroad

Figure 6 provides an overview of foreign taxes on plastics, per chain step.

Figure 9 - Overview of foreign taxes per chain step



Switch 1 and 2 - Crude oil production and refining
Various countries have taxes on the extraction of mineral raw materials and the marketing of refined oils such as transport fuels. These taxes and duties are not aimed at reducing the production of virgin plastics. An example of a tax is the tax on the import of oil into Tunisia (see explanatory note to Switch 4).

Switch 3 - Production of monomers
It can be seen that there is no experience with taxes on the production import of monomers. China, for example, does have an import tax on certain types of monomers (such as styrene), but this is aimed at preventing the dumping of foreign styrene on the Chinese market and has no environmental purpose.

Switch 4 - Polymer production
Since 2003, Tunisia has had an environmental tax on the sale, including import, of a number of products which the country imports almost exclusively. These include oil, batteries, chemicals and polymers. The levy is 5% of the sales value and the proceeds are used to fill two funds that promote recycling and nature conservation (World Trade Organization, 2016). Morocco has a tax on the production, sale and import of all plastics covered by HS Code 39. This includes polymers. The levy is 1% of the sales value. Here, too, the proceeds are deposited in a fund to promote recycling. The annual revenue is approximately €15 million (The Climate Chance Observatory team, 2020); (Royaume du Maroc). Both Tunisia and Morocco produce hardly any plastics themselves (EUROMAP, 2016).

Switch 5 - Production and import of plastic (sub)products
Most existing taxes focus on the production and import of plastic products. The producer or importer is the taxpayer in this case. The most common is a tax on packaging and a more specific tax on the production or import of plastics. Several dozen countries in the world have some form of tax or levy on the production or import of packaging. In Denmark, for example, disposable cutlery is also covered by this tax. These taxes do not exempt packaging made from recycled material. Such a tax is introduced in Italy and the UK (see below in more detail).

The most common is therefore a tax on packaging. A notable other plastic tax is the PVC tax in Denmark (see below in more detail). This tax clearly had a different purpose and a different product group, but shows that it was possible to tax a specific product group. The aforementioned ecotax in Morocco applies to both plastic and plastic products.

Switch 6 - Production and import of finished plastic products
Taxation of the production and import of plastic end-products is not very common abroad. However, the Dutch contribution within the framework of the Waste Fund can be placed under this link. Under this scheme, the packaging industry is obliged to contribute.

Switch 7 and 8 - Sales and consumption of finished plastic products
Around 30 countries have a consumer tax on the use of plastic bags (and as many countries have a production/import tax). [21] This is the most common consumer tax. Experiences show that the pricing of plastic bags is very effective as a habit-disrupter for the consumer. In Portugal, for example, the tax led to a 75% reduction in the use of single-use plastic bags (Martinho et al., 2017).

From 2007, Belgium had a tax on plastic bags, foils and disposable cutlery in order to reduce their use. This tax was levied on wholesalers and is therefore one step ahead of the end consumer. The tax resulted in a strong reduction in the use of disposable bags, but the impact on the use of disposable cutlery and films was unclear (Pre-Waste, 2011). In 2015, the tax was dropped due to low revenues due to changing consumer behaviour (Deloitte, 2015).

In addition, more and more regions are introducing bans on the free distribution of disposable cups and the number of countries with deposits on plastic bottles is increasing. The aim of these measures is to curb the one-off use of plastic products.

Packaging tax in the United Kingdom (UK)

In the UK, a tax on virgin plastic packaging components will be introduced in April 2022. The tax will be levied on packaging components with less than 30% recyclate content (measured by weight). Plastic packaging materials have been chosen because packaging is a major source of waste. In the UK, 45% of plastic production is used for packaging, but it accounts for 67% of plastic waste. The aim of the tax is to promote the use of recycled plastic in the production of packaging (Seedhouse, 2021).

[21] In the Netherlands, there is a ban on the free distribution of plastic bags.

Product definition: A packaging component is plastic if plastic is the predominant material by weight. There is a reversed burden of proof: producers must pay tax unless they can demonstrate that less than half of their packaging consists of plastic; or more than 30% of the plastic content is recycled plastic. It has not yet been worked out how they can demonstrate this, but contracts, product specifications and invoices, among other things, can be used. A consortium of companies has been commissioned to develop a standard by which companies can demonstrate that their product contains recycled material (REB Market Intelligence, 2021).
Also plastic products that are intended to serve only as packaging for consumers fall within the scope, such as household foil.

Form of the tax: The taxable event is the placing of (empty) plastic packaging on the market. Taxable persons are producers and importers of packaging.
It is estimated that there are around 20,000 such batches. On import, both empty and filled packaging are taxed, and on export, both empty and filled packaging are exempt. The tax amounts to 200 pounds (€ 230) per tonne of plastic packaging material. Small producers/importers (<10 tonnes of plastic packaging material per year) are exempt (HM Revenue & Customs, 2020a).

Single-use tax in Italy

A tax on virgin single-use plastics has been announced in Italy. The aim of the tax is to reduce the production and consumption of single-use plastic products. The tax was initially due to be introduced on 1 July 2020, but has been postponed due to COVID-19 until at least 1 July 2021.

Product definition: The tax targets all single-use plastic items made wholly or partly of plastic and falling under customs code 3901-3911.
Plastic produced from recycled plastic and compostable bio-plastics are exempt from the tax. To qualify for the exemption, the burden of proof lies with the producer. The producer is obliged to document to the tax authorities which types of plastics he produces, his production capacity, how he stores raw materials
He must also organise separate storage of new and recycled plastic in his factory. In his tax return, he must indicate how much plastic he has supplied, its nature and quality and the weight of virgin plastic.

Taxation: The taxable event is the marketing of single-use plastic products. If products on which tax has been paid are exported, the tax can be reclaimed (Deloitte, 2020).
The taxpayer differs from one situation to another:
- In the case of products manufactured in Italy, the producer or the party ordering the production is liable to pay tax.
- For products from other EU countries:
  - Business-to-business: the buyer;
  - Business-to-consumer: the seller.
- For products from non-EU countries, the importer is liable to pay

tax. The tax amounts to € 450 per tonne of plastic in the item.

PVC tax in Denmark

In Denmark, a tax on PVC containing plasticisers (phthalates) was in force from 2000 to 2019. The purpose of the tax was to discourage the use of plasticisers in PVC. In 2019, the tax was abolished because 'the tax no longer had a behavioural effect on the environment and health'. This was because the use of plasticisers had decreased significantly, partly because a number of plasticisers are now banned or other restrictions apply. The removal of the tax would also have a positive effect on the Danish business climate (Chemical Watch, 2017). The tax was reintroduced in 2021 (Retsinformation, 2020).

Product definition: Products for which PVC constitutes more than 10% of the weight are covered. These include: flooring materials, cables, pipes, curtains, rain suits, aprons, gloves, ring binders and adhesive tape.

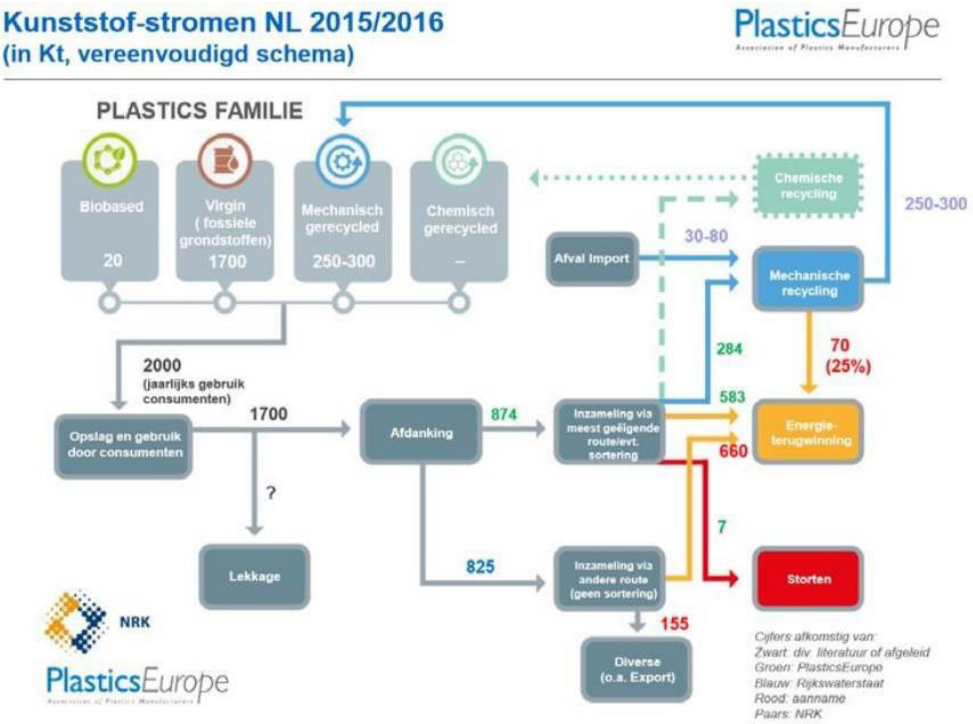
Taxation: The taxable event is the placing on the market of PVC containing plasticisers by producers or importers. In case of export, the tax can be reclaimed.
The taxable amount is the weight of the PVC and plasticisers in the product. If the weight cannot be proved, the tax has to be paid on the whole product. Producers must keep records of taxable goods produced and supplied. They must keep taxable goods physically separate from non-taxable goods. The rate is differentiated by product type. Most products are taxed per kg, some are taxed per piece (plastic bags) or per m^2 (tarpaulins). Companies selling less than DKK 10,000 (€1,350) of taxable goods annually are exempt.

B Biobased

Alignment with plastics transition agenda

At the moment, plastics are already a spearhead for the government-wide programme within the circular economy. Figure 10 shows how the 2,000 ktons of plastics used are now roughly met. In net terms, approximately 15% is used for recycling and 1% for bioplastics.

Figure 10 - Plastics flows in the Netherlands in 2015

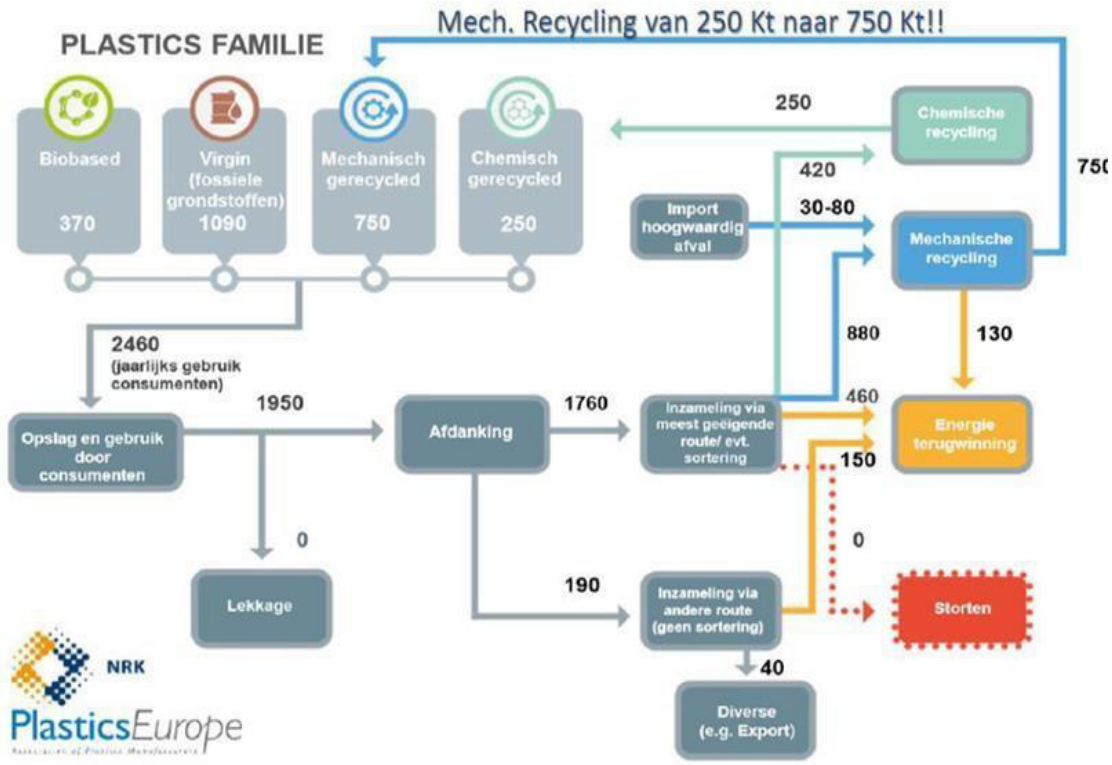


Source: Plastics Transition Agenda.

Targets have been formulated for 2030 that relate to an increase in mechanical recycling from 250 to 750 ktons per year, chemical recycling from 0 to 250 ktons and biobased plastics from 20 to 370 ktons. As a result of these ambitions, 55% of the application of plastics in the Netherlands would be renewable. This would amount to 40% recycling (1,000/2,460) and 15% bio-based input (370/2,460).

These objectives have not yet been provided with policy instruments. A tax on virgin plastic could help (if bio-based is excluded). Interestingly, this transition agenda does present internalising the external costs for plastics as an option. If we assume an average $_{CO2\ emission}$ of about 4 kg $_{CO2}$ per kg plastic from cradle to grave without recycling, then at a $_{CO2\ price}$ of XX the tariff could be about 4 x XX.

Figure 11 - Target picture for plastic flows 2030



Source: Plastics Transition Agenda.

Bio-based plastics often, but not always, have a lower environmental impact (particularly CO_2 emissions) than fossil-based plastics. Excluding bio-based plastics from the tax could be logical from this point of view. The additional costs (CE Delft, 2020) of bio-based plastics vary from several hundred to several thousand euros per tonne of material. A tax of e.g. € 800/tonne, as requested by Europe from member states in the context of the EU levy on non-recycled plastic packaging waste, would make a number of types of bio-based plastics interesting.

Biobased plastics are generally no better when discarded in nature as litter. Only the bioplastic PHA has been shown to break down easily in nature. PLA degrades slowly, and bio-PE and bio-PET are molecularly identical to fossil plastics and therefore only break down very slowly or not at all. Bioplastics are therefore not seen as a solution to the plastic soup problem.

To guarantee that bio-based plastics that are exempt from the tax are beneficial to the environment, sustainability criteria should be set for the bio-plastics that are exempt (as proposed in the bio-based plastics action plan drawn up for companies, the government and an NGO (Total Corbion PLA bv et al., 2020). Only bioplastics that reduce $CO_{2\ emissions}$ by at least 30% and apply sustainable agro- standards should be included.