Balanced policy support for biobased and recycled plastic

Towards a circular economy in the Netherlands

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Summary

To get on track in realising net zero greenhouse gas (GHG) emissions and a circular economy in the Dutch chemical industry in 2050, significant steps need to be taken towards 2030. The Dutch stakeholder organisation '*Groene Chemie, Nieuwe Economie*' (GCNE) is seeking to create balanced governmental support of both recycled plastic and biobased plastic, in order to shift away from virgin fossil-based plastics and move towards circular chemistry. It also aims for a fair stimulation of biomass in both fuel and material applications in order to reach a level playing field between both applications.

The current situation in the Netherlands is that the use of biomass for fuel applications is supported more than chemical and material applications. The recycled and biobased polymer obligation (Nationale Circulaire Plastic Norm), which is planned to be introduced in 2027, does provide an incentive for the use of biobased plastic. However, there are currently insufficient incentives for an increasing uptake of biobased plastics: various existing policies likely particularly support recycled plastic. Both the use of recycled plastic and biobased plastic will be needed to move to a circular economy.

Alternative EU policy instruments that are in an earlier development stage, such as a European polymer obligation and an Industrial Sustainable Carbon Regulation, are likely to partly level the playing field between biomass use for fuel and material applications (such as plastics) in the longer term. They also have the potential to improve the level playing field between circular plastics and fossil plastics, but have not been worked out in enough detail to assess the likelihood of utilising this potential. The inclusion of incentives for biobased plastics in Extended Producer Responsibility (EPR) systems and the introduction of a minimum subtarget for biobased plastic in the recycled and biobased polymer obligation could contribute to the realisation of a balanced policy support of both recycled and biobased plastics in the Netherlands.

Abbreviations and definitions

Abbreviations

Abbreviation	Full term or phrase
EC	European Commission
EPR	Extended Producer Responsibility
GHG	Greenhouse gas
PE	Polyethylene
PEF	Polyethylene furanoate
PET	Polyethylene terephthalate
PHA	Polyhydroxyalkanoates
PLA	Polylactic acid
PP	Polypropylene
PTT	Polytrimethylene terephthalate
RED	Renewable Energy Directive

Definitions

Term	Definition
Biobased plastics	Plastic materials that are (partly) made from biomass resources (some of which are not biodegradable)
Biodegradable plastics	Plastic materials that can be broken down by microorganisms to naturally occurring gasses and biomass
Circular plastics	Plastics made from plastic waste (recycled plastics) or biomass (biobased plastics) *
Drop-in biobased plastics	Biobased plastics with an identical molecular structure as their fossil counterparts
Novel biobased plastics	Biobased plastics with a molecular structure that is not found in fossil plastics produced in today's industry
Polymer type	Type of plastic material with a specific molecular structure, such as polypropylene (PP)
Recycled plastics	Raw plastic materials that result from the recycling of plastic waste (also called 'plastic recyclates')
Virgin fossil plastics	Plastic materials made from fossil-based polymers that are used for the first time to create plastic products

* The production of plastics from captured CO_2 and renewable hydrogen is not considered in this study.

1 Introduction

In this chapter we first give the background and goal of the study (Section 1.1) as well as the scope (Section 1.2). Next, we explain the concept of biobased plastics (Section 1.3).

1.1 Background and goal

To get on track in realising the long-term goal of the Dutch chemical industry of net zero greenhouse gas (GHG) emissions in 2050, significant steps need to be taken towards 2030.[1] A corresponding goal is to move to a circular economy, in which the industry switches from using virgin fossil carbon for the production of plastics and chemicals to 'circular carbon', which can be obtained from biomass, plastic waste or captured CO_2. To this end the Dutch government aims to lower the use of fossil resources by 50% in 2030 and by 100% in 2050. Whereas CO_2 capture in combination with renewable electricity for the production of synthetic products is still under development and prohibitively expensive in the short term, recycled plastic and biobased plastic are feasible short-term options. In this report, we use the term 'circular plastics' to refer to these two options.

Current and announced Dutch government policy provides stronger support for biofuels than for biobased materials, and also stronger support for recycled plastics than for biobased plastics. The current obligations for the use of biomass for biofuels for the mobility sector and biomethane for the built environment are expected to result in a growing use of biomass for fuels.[2] The recycled and biobased polymer obligation (Nationale Circulaire Plastic Norm), i.e., a mandatory share of recycled plastic and/or biobased plastic in newly produced plastic products, could stimulate the use of biomass for material applications in the chemical industry from 2027 onwards. This instrument is still under development and its impact on biobased plastic is uncertain because the obligation can be fulfilled using both recycled plastic and biobased plastic. However, recycled plastic could be the most attractive option for producers because it already has support from extended producer responsibility (EPR) systems, which reduce the recycling cost and require a certain recycling rate of plastic waste streams.

The industry argues that the production and consumption of both recycled plastic and biobased plastic need to be scaled up to pursue net zero GHG emissions in 2050.[3] However, the current stimulus for biofuels for transport and biomethane for the built environment may result in a low uptake of biobased resources for material applications in the chemical industry. The Dutch stakeholder organisation '*Groene Chemie, Nieuwe Economie*' (GCNE) is seeking to create balanced governmental support of both recycled plastic and biobased plastic, in order to shift away from virgin fossil-based plastics and move towards circular chemistry. It also aims for an equal stimulation of biomass in both fuels and material applications in order to reach a level playing field between both types of applications. In this report we examine the effects of announced and possible new policy instruments on the uptake of both types of circular plastics.

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1 The Dutch National Climate Agreement follows the European Climate Law which includes goals to reduce greenhouse gas emissions by at least 55% in 2030 and reach climate neutrality in 2050.

2 This does not include direct conversion of biomass into heat or power.

3 Although the Dutch government prefers the use of recycled plastic over biobased plastic, the supply of recycled plastic is expected to be insufficient to move to a circular economy.

1.2 Scope

The scope of the study is delineated as follows:

- We examine European and national policy that influences the uptake of recycled plastic and biobased plastic in the Dutch chemical industry.
- The main time period considered in the study is the period until 2030, but the long-term energy and materials transition towards 2050 is taken into account as the ultimate goal.
- CO_2 capture and its possible use as a third circular carbon source for the chemical industry is outside the scope of this study.

1.3 What are biobased plastics?

The chemical industry currently relies on crude oil and its derived products: about 80% of plastics conversion to plastic products in the Netherlands in 2022 was based on fossil resources (oil and natural gas), approximately 12.8% on recycled plastic and roughly 0.7% on biobased plastic (Conversio, 2024; Plastics Europe, 2024a).[4]
Biobased plastics are made from biomass resources, which include crops grown on agricultural land (e.g. sugarcane, maize, castor bean), non-food crops grown on marginal land, and organic waste streams or byproducts (e.g., residues from agriculture or forestry, used cooking oil, tall oil, sewage sludge). Most currently available biobased plastics use the same biomass feedstocks that are also used to make biofuels, such as sugar and starch extracted from food crops.

Many of the currently produced biobased plastics have the same chemical structure as fossil plastics. For example, bio-PE is identical to fossil PE. Those biobased plastics are called 'drop-ins'. This means they can directly replace fossil plastics in products and fit into the same recycling infrastructure at end of life. Other biobased plastics, such as PLA, PHA, PEF or PTT, have new chemical structures based on molecular structures from plants and can be efficiently produced via fermentation processes. These 'novel biobased plastics' may have other material properties than currently dominant fossil-based plastics, such as biodegradability. However, not all biobased plastics are biodegradable, as explained in Text box 1.

Text box 1 - Biobased or biodegradable?

Biobased and biodegradable refer to different properties of plastics[5] and other materials. The term **biobased** refers to the biological origin of a plastic – the carbon present in the plastic was captured from the atmosphere through photosynthesis in plants. This is different from fossil plastics in which the carbon comes from fossil materials previously stored underground.
Biodegradable plastics are plastic materials that can be broken down by microorganisms to naturally occurring gasses and biomass. Some biobased plastic types are biodegradable, other types are not. There are also some fossil polymer types that are biodegradable.

At end of life, biobased plastics can be recycled with the same technologies as fossil plastics. Drop-in biobased plastics have the same chemical structure as fossil plastics and can therefore be converted with the same (mechanical or chemical) recycling technologies. The existing recycling infrastructure for the most common polymer types in the packaging

[4] The remaining part is pre-consumer plastic waste (production losses), which does not count as recycled plastic.

[5] The term 'bioplastic' is sometimes used to refer to plastics that are biobased, biodegradable or both. As this can be confusing, this term is avoided in this report.

sector (e.g. PP, PE and PET) can also be used for the biobased versions of these polymer types.

Novel biobased plastics have a different chemical structure than fossil plastics, but this does not mean that they cannot be recycled. PLA, for example, can be mechanically recycled or chemically converted back into monomers or basic chemicals (CE Delft, 2019; Pinlova et al., 2024), just like many fossil plastics. The same applies to other novel biobased plastics, in view of the development of chemical recycling processes that can accept a wide range of feedstocks, including biobased plastics. At the moment, however, the recycling infrastructure for novel biobased plastics is still very limited, mainly due to their low market volumes.

Sustainability of biobased plastics

A key reason to develop biobased plastics is their potential to reduce GHG emissions. When using biomass resources instead of fossil resources as a feedstock for plastic production, no fossil carbon enters the economy. The carbon present in biobased plastic was first removed from the atmosphere through photosynthesis in plants. Because of this benefit, biobased plastics can offer lower GHG emissions than their fossil counterparts. However, the EC has concerns regarding the environmental impact of biobased plastics, related to GHG emissions associated with biomass cultivation, transport and conversion, and to indirect land use change. To ensure that biobased plastics stimulated by government policies do not lead to adverse environmental effects, a minimum GHG emission reduction and the use of sustainably produced biomass could be mandated (CE Delft, 2023). This approach could be aligned with the sustainability criteria for biofuels as used in the Renewable Energy Directive (RED).

2 Governmental policy

We start this chapter with explanations of why a balanced support of recycled plastic and biobased plastic is needed (Section 2.1), and why a level playing field of using biomass for material vs. fuel applications is important (Section 2.2). Next, we present a qualitative analysis of the effects of current and announced policy instruments (Section 2.3) and alternative policy instruments (Section 2.4) on the uptake of recycled plastic and biobased plastic for the production of plastic products in the Netherlands.

2.1 Balanced support of recycled plastic and biobased plastic

Due to the rapidly growing use of plastic in products with a long lifetime, the annual amount of plastic waste is less than 60% of the annual plastics use.[6] This highlights that it is not possible to establish a circular economy for plastics based on recycling alone. To reach a higher share of circular plastic, the use of biobased plastic needs to be scaled up. In previous work, we concluded that a target of 55% circular plastics use in 2030 would be achievable, but only if the use of both recycled plastic and biobased plastic are scaled up (CE Delft, 2022). This finding is in line with the Dutch biomass sustainability framework, which states that the use of biomass resources as a replacement of fossil resources is crucial in order to realise CO_2 neutrality and a circular economy and to retain the Dutch industries' competitive position (SER, 2020). However, the potential of biobased plastic is limited by the availability of sustainable biomass.

Therefore, we conclude that both the use of recycled plastic and the use of biobased plastic as a feedstock for the production of plastics are important for the transition to a circular economy and need to be scaled up. This requires a balanced policy support for recycled plastic and biobased plastic.

2.2 Material vs. fuel applications

Plastic waste applications

An important matter is the allocation of circular feedstocks for material vs. fuel applications. The energy transition and the materials transition are tightly linked, both in the chemical industry and in the economy as a whole. Plastic waste could technically be used to produce recycled carbon fuels (RCFs), but in the Dutch implementation of the Renewable Energy Directive this cannot be used to meet the CO_2 reduction obligations in the transport sector. This limits their potential use, even though RCFs may still count towards meeting the objectives from ReFuelEU Aviation and FuelEU Maritime on decarbonisation of the aviation and maritime sector (Guidehouse Netherlands B.V., 2023). Moreover, waste streams should be recycled if possible, according to the Dutch National Waste Management Plan (Landelijk Afvalbeheerplan) and its future follow-up, the Circular Materials Plan (Circulair Materialenplan). Other policy instruments call for increased recycling of fossil waste as well, because this will contribute to the circular economy and

[6] This was calculated using data from Plastics Europe Plastics Europe. (2024b). *De circulaire economie voor plastics: Data 2022 - Nederland.* .

because there are more readily available sustainable alternatives for conventional fuels than there are for fossil-based materials and products.

Biomass applications

The material vs. fuel debate is more relevant for biomass. Biomass can be used for material applications in the chemical industry, but it can also be used as a fuel in the mobility sector, for thermal energy for industrial processes, in horticulture, the built environment and electricity generation. According to the Dutch biomass sustainability framework 'Biomass in balance' developed by the Social and Economic Council (SER), the use of biomass as a fuel has a lower societal value than its use as a feedstock for chemicals and materials (SER, 2020). Biomass combustion for electricity and heat production is even regarded as undesirable. However, the current policy regime in the Netherlands and Europe promotes the use of biomass as an energy carrier rather than as a material feedstock: Two main policy instruments driving an increasing demand for biomass in the Netherlands are the Annual Obligation Energy Transport (Jaarverplichting Energie Vervoer)[7] and the biomethane blending obligation (bijmengverplichting groen gas) for ETS2 sectors.

In the short to medium term, biomass resources are the only feasible circular carbon alternative to recycled carbon for use as a chemical feedstock. This is because synthetic chemicals and materials based on renewable electricity and CO_2 from air or water are in an early stage of development and still very expensive. Therefore, biomass has a high societal value as material feedstock for the Dutch chemical industry. Furthermore, there are various sustainable alternatives to biomass for energy applications, such as electrification and green hydrogen. This lowers the societal value of biomass for energy purposes, although it may help to realise GHG emission reduction targets in energy applications in the short term.

There is currently no policy that incentivises the use of both recycled plastic and biobased materials in the chemical industry. Although there are initiatives such as the announced Dutch recycled and biobased polymer obligation (Nationale Circulaire Plastic Norm) which requires a minimum share of circular plastics in new plastic products, the expected resulting use of biomass for biobased plastics is much smaller than the expected biomass use for fuel applications (CE Delft, 2024b).

2.3 Current and announced policy instruments

The analysis of the effects of current and announced policy instruments on recycled plastic and biobased plastic use in the Dutch chemical industry is presented in Table 1. This table includes the most important relevant current and announced instruments but is not exhaustive. For example, existing and foreseen subsidy schemes that can (directly or indirectly) lead to the increase of plastics recycling and the use of recycled and biobased plastic are not included in the overview.[8]

[7] This obligation constitutes the implementation of the renewable energy obligation for mobility from the EU Renewable Energy Directive (RED).

[8] For example, the Subsidy Circular Plastics NL is a subsidy for companies that produce, convert or use plastics, as well as for organisations that do research on the utilisation of plastic waste. In the subsidy round that ended in January 2024, a total budget of € 47.2 million was available. This subsidy can be used for a research project or show case.

Table 1 - Effects of current and announced policy instruments on recycled plastic and biobased plastic use in the chemical industry in the Netherlands towards 2030

Policy	NL/EU	Active?	Description	Effects on use of recycled plastic and biobased plastics
Recycled and biobased polymer obligation (Nationale Circulaire Plastic Norm)	NL	Probably as of 2027	This instrument will require a certain share of circular plastic (recycled and/or biobased plastic) to be used in new plastics that are produced for the Dutch market. Companies that convert polymers in the Netherlands can comply to the obligation by physically using the required share of circular polymers, or administratively by buying Circular Polymer Units (Circulaire Polymeer Eenheden; CPEs). In the initial year of 2027, the required circular plastic share will probably be 15%. For 2030, a circular plastic share of 25% will probably be set. No subtarget for biobased plastic is foreseen. Both the year of entry and the level of the obligation are still under discussion.	This instrument will still have little effect in 2027. In 2030, the obligation will at first incentivise mostly the use of recycled plastic, because this is usually cheaper and is prioritised over bioplastics in policy. (Food packaging foil, where bio-PE is perhaps cheaper than recycled PE, may be an exception.) If the obligation is higher than 30%, biobased plastic is needed, because there is insufficient Dutch recycled plastic. Because biobased plastic is more expensive, probably a considerable part of the obligation will be met by import of recycled plastic from Germany (depending on the development of policy in Germany and the EU). This will change if more countries in the EU will introduce a national polymer obligation. These effects depend on the way the obligation will be implemented by the Dutch government. Notably, the CPE trading system is still under development and could also help to support biobased plastic.
Circular economy action plan (CEAP)	EU	Yes	This action plan announced initiative across the life cycle of products to move to a circular economy in the European Union. Packaging and plastics are two main key product value chains covered by the action plan. The action plan introduces legislative and non-legislative measures, which are to be implemented by means of legislation such as the Packaging and Packaging Waste Regulation.	This instrument promotes the increased recycling of fossil waste and may also improve the recyclability of fossil waste streams. It does so indirectly, as included measures are implemented in other EU regulations. Biobased plastic is not targeted by this action plan.
Bioeconomy Strategy and Action Plan	EU	Yes	The EU Bioeconomy Strategy covers all sectors and systems that rely on biological resources, including biomass producing sectors (e.g., agriculture and forestry) and biomass-processing sector, including the production of biobased chemicals and plastics. The Strategy aims to accelerate the deployment of a sustainable EU bioeconomy. Sustainability and circularity are two core principles. The related Action Plan formulates concrete measures, among others for the scale-up of biobased sectors.	This instrument covers the bioeconomy in general and may thereby contribute to the uptake of the production of biobased chemicals and biobased plastics. The Action Plan has no legislative status, so the measures included should be implemented through other policy instruments. As there is no specific EU bioeconomy legislation, this will probably be done via sectorial legislation.

Policy	NL/EU	Active?	Description	Effects on use of recycled plastic and biobased plastics
Packaging and Packaging Waste Regulation (PPWR)	EU	As of 2030	This will probably only set a norm for a couple of types of plastic packaging material (40% of the market). The values may vary between subcategories of packaging material. Minimum targets of recycled content for 2030 are 30% for contact sensitive packaging made from PET and for single-use beverage bottles, 10% for contact-sensitive packaging made from other plastic materials, and 35% for other plastic packaging. Furthermore, EU member states must decrease packaging waste per capita by 5%.	This instrument will direct the plastic waste required for meeting the Dutch recycled and biobased polymer obligation to a couple of types of packaging material. The main effect will be that recycled plastic will be used more for packaging and less for other demand sectors of the plastics industry, like automotive and agriculture.
Single-Use Plastics (SUP) Directive	EU	Yes	Contains a range of detailed measures, including a 77% collection target of plastic bottles as of 2021 and a ban on certain disposable plastic products. From 2025, 25% of the material of a PET bottle must consist of recycled material. From 2030, 30% of the material of all bottles must be recycled.	The effect on the amount of available recycled plastic will be limited, as the measures aim to prevent plastic waste ending up in the environment. The measure on recycled content of bottles will contribute to an increased use of recycled plastic, although targeted at plastic bottles. This does not promote the use of biobased plastic.
Circular plastic levy	NL	As of 2028	This levy will be put on virgin plastic to increase the competitiveness of circular plastic. It is not yet known what the detailed policy design will be (among others, which types of plastic products are targeted), but the goal is to collect a total sum of € 547 million from this levy as of 2028, as included in the financial annex of the 'hoofdlijnenakkoord', the high-level agreement of the Dutch cabinet (Bureau woordvoering kabinetsformatie, 2024).	A levy could make recycled plastic more competitive with virgin plastic and make biobased plastic more financially attractive compared with virgin plastic. The exact effect is strongly dependent of the height of the levy and the plastic products falling under the levy. It could facilitate the Dutch recycled and biobased polymer obligation. If the levy would target only packaging material, the feedstock cost of (virgin) packaging material could become twice as high as it is now.
Policy framework on the sourcing, labelling and use of biobased plastics, and the use of biodegradable and compostable plastics	EU	Yes	This policy framework from the European Commission focusses on sustainability challenges, the prevention of greenwashing and the compostability of plastics. It is not legally binding. It concerns sustainability risks of biobased plastic, but also biodegradable and compostable plastics made from fossil resources. A main sustainability challenge of biobased plastics is the risk that they can cause deforestation and other environmental problems.	This framework focusses on the risk that companies may mislead consumers with biobased plastic products. It does not contribute to the promotion of the uptake of biobased plastics. Instead, it might create an administrative barrier for companies, if for example they must prove adherence to newly installed sustainability requirements for biobased plastics, or if their biobased plastic products need to be approved with regard to transparency towards consumers.

Policy	NL/EU	Active?	Description	Effects on use of recycled plastic and biobased plastics
Extended Producer Responsibility (EPR) systems for plastic recycling	NL/EU	As of 2025	EPR is a policy tool that extends the producer's responsibility for a product to its end-of-life stage, in order to help meet national and EU recycling and recovery targets. EPR systems organise the recycling of plastics and also make companies pay for collection, sorting and recycling (Afvalbeheerbijdrage Verpakkingen). For packaging, textile, cars and electronics a share of plastic waste has to be recycled. For plastic packaging, a 50% target is applied for 2025, and a 55% target for 2030.	An EPR system often makes recycled plastic cheaper for the users than fossil plastic (the costs are paid by the 'packer', i.e. the market party that uses the packaging material), although the price differences are often small. For biobased plastic such a cost support system is not in place, so the buyer has to pay all additional costs. This means that, with the current design, EPR strongly incentivises the increased use of recycled plastic, but does not equally promote biobased plastic.
European levy on non-recycled plastic packaging material, without redistribution to the industry	EU	Yes	This levy, of € 800 per tonne of non-recycled plastic packaging material, is a EU member state obligation that is currently not charged (redistributed to the industry) in most member states, but is paid by the national governments instead. For the Netherlands the sum is € 220 million, which is currently paid from general taxes.	The current Dutch implementation of the European levy has no effect on the uptake of recycled plastic or biobased plastic, as the levy is paid from general taxes.
Annual Obligation Energy Transport (Jaarverplichting Energie Vervoer)	NL (EU)	Yes	This instrument involves the implementation of the Renewable Energy Directive (RED) in Dutch legislation regarding the energy transition in the transport sector. As of 2026, the Annual Obligation will require Dutch fuel suppliers to meet a certain GHG emissions reduction target (following the RED III). Fuels made from biomass (biofuels) can be used towards the target, but the use of biofuels made from food and feed crops and from oil and fats is capped. In the Netherlands, fuels made from plastic waste (recycled carbon fuels) cannot be used towards the target.	This instrument is expected to lead to a growing demand for biomass in the mobility sector, as biofuels are often drop-in fuels and generally a cheap sustainable alternative. In aviation it is the main option in the short term. The growing biomass demand will likely drive up the biomass price and decrease biomass availability for the chemical industry. The biomass demand in the mobility sector in 2030 is estimated to be about 7 to 12 times larger than the biomass demand for chemical products (CE Delft, 2024b).
Biomethane blending obligation	NL	As of 2026	This instrument requires natural gas suppliers to the ETS2 sectors (including the built environment, agriculture and small industrial companies) to realise a certain GHG emission reduction percentage through the administrative or physical delivery of biomethane.	This instrument will lead to a growing demand for biomass in ETS2 sectors, which will drive up the biomass price and decrease the availability for the chemical industry. The biomass demand in the ETS2 sectors is expected to be about 3 to 4 times larger than that of the chemical industry (CE Delft, 2024b).
Blending obligation of sustainable aviation fuel (SAF)	EU	As of 2025	The ReFuelEU Aviation regulation sets annual targets for the use of SAF. From 2025 onward, aviation fuel suppliers are required that delivered fuel contains a certain percentage of SAF. As of 2030, a minimum share of synthetic fuel (e-fuel) is required as well.	This instrument will lead to a growing demand for biomass in aviation, as biobased SAF is the main option for fuel suppliers to meet the blending obligation in the short term. This will drive up the biomass price and decrease biomass availability for the chemical industry.

Based on the policies presented in Table 1, a number of overarching conclusions can be drawn:

- The current and announced policy regime in the Netherlands towards 2030 will lead to more recycled plastic use (mainly in packaging, but also in other plastic product types). It may also bring about a small amount of biobased plastics, but this is very uncertain. Thus, under this policy regime there is probably no balanced support of both recycled plastic and biobased plastic.
- Most policies target a specific economic sector and one circular plastic option. There are no economy-wide policies or policies supporting both biobased plastic and recycled plastic as of yet. The Dutch recycled and biobased polymer obligation, which will probably entry into force in 2027, will influence the uptake of both circular plastic options. However, recycled plastic will probably be used more than biobased plastic towards the obligation of (probably) 25% circular plastic in 2030, due to lower purchase costs and more policy support. The EPR system for plastic waste redistributes the additional cost of recycled plastic to the 'packers' (the first users of plastic), but for biobased plastics such a system is not in place.
- Most plastics policies use obligations/norms that should be met by producers. The only exceptions are the European levy on non-recycled plastic packaging and the proposed circular plastic levy in the Netherlands. Such a levy creates a strong incentive for growing the use of recycled plastic (also in the frame of the Dutch recycled and biobased polymer obligation), if properly designed.
- There is currently no government policy specifically supporting the use of biobased plastics in products. The Dutch recycled and biobased polymer obligation includes the option to use biobased plastic, but no subtarget has been announced so far.
- Regarding the use of biomass, European policies focus on biomass use for fuel applications. Regarding recycled plastic, the focus lies on packaging. EU policymakers consider biobased plastic to be problematic for the environment.
- Overall, there is more support for the use of biobased carbon in fuels than for its use in products such as plastics. Because, under the current and announced policy regime, the expected biomass demand in Dutch mobility is much larger (roughly seven to twelve times in 2030), the availability of biomass for material applications is limited. Under this policy regime there is no level playing field between biomass use in material applications and biomass use in fuel applications. However, the Dutch recycled and biobased polymer obligation could become a very important instrument to realise such a level playing field.

2.4 Alternative policy instruments

The analysis of the effects of possible alternative policy instruments on recycled plastic and biobased plastic use in the Dutch chemical industry is presented in Table 2. In this analysis we analyse each policy instrument separately, compared to the current and announced policy framework discussed in the previous subsection.

Table 2 - Possible alternative policy instruments and effects on recycled plastic and biobased plastic use in the chemical industry in the Netherlands towards 2030

Policy	NL/EU	Status	Description	Effects on recycled plastic and biobased plastic use
European levy on non-recycled plastic packaging material, *with redistribution to the industry*	EU	EU option that is not applied in NL at the moment	This levy, of € 800 per tonne of non-recycled plastic packaging material, is a EU member state obligation that is currently not charged (redistributed to the industry) in most member states, but is paid by the national governments instead. For the Netherlands the sum is € 220 million, which is currently paid from general taxes.	Redistribution of the European levy to the industry has led in Spain to a levy of € 0.45 per kilogram of non-recycled plastic (ecosistant, 2023). With such a redistribution to the industry, there will be increasing support for and effort put into recycling of plastic packaging material.
European polymer obligation	EU	In development	This instrument could introduce a minimum target for recycled and/or biobased plastic use in the EU. Whether biobased plastic is allowed under this target is still under discussion. This could be a separate instrument, or it could be an extension of the PPWR; this is still unclear.	If the Dutch recycled and biobased polymer obligation is a success, Dutch policy makers hope that the EU will follow in 2032 or 2035 with a European polymer obligation. This would also make the Dutch obligation much more effective (if biobased plastic is also eligible under the European polymer obligation).
Industrial Sustainable Carbon Regulation	EU	In development	This regulation is in an early stage of development; it might be introduced in 2035. It is a variation on the polymer obligation, but applied to the entire chemical sector. Possibly, the European polymer obligation will be implemented in the form of the Industrial Sustainable Carbon Regulation.	A regulation on sustainable carbon use in industry has the potential to cover both recycled plastic and biobased plastic. However, the current proposal is not advanced enough to assess whether this potential is likely to be utilised.
Regulation on circularity requirements for vehicle design and management of end-of-life vehicles	EU	In development	Two main objectives of the EC's proposal for this regulation, which was presented in July 2023, are to increase the recycling rate of waste from vehicles at end of life, and to increase the use of recycled content in the production of vehicles (EP, 2023). A mandatory minimum target of 25% use of recycled plastics is being considered in the proposal (EC, 2023).	Since there are suitable biobased plastic options available to substitute the fossil plastics currently used in vehicles and substantial substitution rates (e.g. 5% to 10%) are possible, a biobased content target for vehicles could be included in the eventual regulation. This could come in the form of a combined target for recycled and/or biobased plastic, a combined target with a cap on biobased, or separate targets (CE Delft, 2024a). If included and designed carefully, this could create a more balanced support of both types of

Policy	NL/EU	Status	Description	Effects on recycled plastic and biobased plastic use
				circular plastic in the automotive sector. (In the Netherlands, 8% of the plastics consumption occurs in this sector.)
Support for biobased plastic in EPR systems	NL/EU	Suggestion (this study)	Inclusion of incentives for biobased plastics in Extended Producer Responsibility (EPR) systems for packaging, textile, automotive and electronics and all new EPR systems. Options for this are: targets, subsidies paid from general taxes, and subsidies paid through an extra levy on the use of fossil plastic (which means different tariffs in the EPR system for fossil and circular plastic).	Targets for the use of biobased plastic in EPR systems could create a more balanced support of the application of biobased plastic and recycled plastic. Subsidies could achieve the same, by improving the cost competitiveness between both.
Minimum biobased plastic target in the Dutch recycled and biobased polymer obligation	NL	Suggestion (this study)	The introduction of a minimum (sub)target for biobased plastic in the Dutch recycled and biobased polymer obligation.	This policy amendment could correct for the fact that recycled plastic is already supported by EPR systems, and ensure a balanced uptake of both recycled plastic and biobased plastic.
Tax reform for waste incineration	NL	Suggestion (this study)	Reform of the tax for incineration of waste into a tax targeted to non-recycled fossil plastic.	A tax reform would provide an additional incentive to recycle plastic waste. This could increase the amount of plastic waste going to recycling and the use of recycled plastic.
A lower value-added tax (VAT) on circular plastic	NL/EU	Suggestion (this study)	The EU views the use of VAT as a possible tool to promote environmental sustainability, by installing a lower tariff for circular products, for example a 7% VAT tariff (instead of 21%), or a higher VAT tariff on fossil products. The 2022 reform of the EU VAT Directive already permits a reduced VAT on ecofriendly services, and enables member states to tailor their tax policies. However, it is not always clear which products qualify for reduced VAT tariffs. In a future EU VAT reform, specific circular products could be made eligible for VAT rate reduction (Asquith, 2024).	A lower VAT on circular products could help to make these products more cost-competitive to fossil products, which could spur more sustainable consumer choices and increase sales of circular products. A lower VAT tariff for biobased products could help to create a balanced support of recycled plastic and biobased plastic.

Considering the alternative EU policy instruments presented in Table 2 (upper part), we conclude that these instruments are likely to partly correct the level playing field problems between biomass use for fuel applications vs. material applications. In addition, they have the potential to create a balanced support of recycled plastic and biobased plastic. However, the alternative policy instruments have not been worked out in enough detail to assess the likelihood of utilising this potential. The EC's concerns regarding the environmental impact of biobased plastics may prohibit the development of detailed policy designs that would create a balanced support of recycled and biobased plastic.

In Table 2 (lower part) we also included some policy suggestions for the Netherlands. The inclusion of incentives for biobased plastics in Extended Producer Responsibility (EPR) systems and the introduction of a minimum (sub)target for biobased plastic in the Dutch recycled and biobased polymer obligation could contribute to an increased and balanced use of both recycled plastic and biobased plastic to replace virgin fossil plastics in the Netherlands.

3 Conclusions and recommendations

3.1 Conclusions

Due to the rapidly growing use of plastics in products with a long lifetime, the annual amount of plastic waste generated in the Netherlands is less than 60% of the annual plastics use. This highlights that it is not possible to establish a circular economy for plastics based on recycling alone. To reach a higher share of circular plastic, the use of biobased plastic needs to be scaled up.

Currently, the use of biomass for fuel applications is supported more than material applications. Furthermore, although the Dutch recycled and biobased polymer obligation does provide an incentive for the use of biobased plastic, existing policy instruments such as Extended Producer Responsibility (EPR) systems likely support the uptake of recycled plastic more than biobased plastic. There are currently insufficient incentives for the uptake of biobased plastics.

Alternative EU policy instruments that are in an earlier development stage, such as a European polymer obligation and an Industrial Sustainable Carbon Regulation, have the potential to partly correct the level playing field problem between biomass use for fuel applications vs. material applications. They also have the potential to create a balanced support of recycled plastic and biobased plastic, but have not been worked out in enough detail to assess the likelihood of utilising this potential. The inclusion of incentives for biobased plastics in EPR systems and the introduction of a minimum subtarget for biobased plastic in the Dutch recycled and biobased polymer obligation could both contribute to more balanced support for, and increased use of, recycled plastic and biobased plastic to replace virgin fossil plastics in the Netherlands.

3.2 Recommendations

We have the following recommendations for GCNE with regard to a balanced uptake of both recycled plastic and biobased plastic in the Netherlands:

- Develop a transition agenda with other stakeholders such as Circular Plastics NL and BioBased Circular that includes a technical, organisational and policy roadmap to reach a sustainable plastics future in 2040, with attention for both recycled and biobased plastics. This agenda could also describe which policy instruments are key to establishing a level playing field between virgin plastic and circular plastic and between material applications and fuel applications of biomass, and to creating a balanced support of recycled plastic and biobased plastic. The agenda may also list technical and organisational measures to move towards a circular economy and reach intermediate policy goals.
- Support the establishment of a harmonised GHG emission calculation method at EU level for both biobased and recycled plastics, which enables the comparison of both options regarding achievable GHG emissions reduction. This would contribute to a balanced support of both options. Furthermore, the GHG emission reduction calculation method from the EU's RED III for biofuels could be required for material applications such as

biobased plastics as well. This would improve the level playing field of biomass use for both material and fuel applications.
- Support the introduction of a minimum GHG emission reduction requirement for biobased plastics. A suitable value could be 1 kg CO_2-eq. per kg biobased plastic (CE Delft, 2023). This would ensure that biobased plastics contribute to GHG emissions reduction while still allowing different production pathways and biomass feedstocks for the production of biobased plastics. Furthermore, the same biomass sustainability criteria that are used for biofuels under the RED III could be applied to biobased plastics, as is advocated in the Dutch biomass sustainability framework (SER, 2020).
- Start a discussion with the European Commission and the Joint Research Centre (JRC) on the sustainability of biobased plastics and the value that biobased plastic has next to recycled plastic to make plastics 100% circular and sustainable in the long term. Important propositions to discuss are that there is a need for a level playing field between virgin plastic and circular plastic and between biomass for material and fuel applications, that biobased plastic will be needed to realise a circular economy, and that its production and use should therefore be scaled up. The anticipated European polymer obligation and Industrial Sustainable Carbon Regulation are two important European policy instruments to include in the discussion, as these could be designed in such a way that recycled plastic and biobased plastic are equally promoted.

Recommendations for further research

On the highest economic level, an answer is needed to the question of how to realise and maintain a level playing field between circular plastic and virgin plastic. In 2024, several recycling companies in the Netherlands went bankrupt because they could not compete with the import of cheap virgin plastics. Finding policy solutions to making circular plastics cost-competitive is essential in order to create a stable investment climate for the circular plastics industry.

The findings on relevant policy options for the creation of a balanced support of recycled plastic and biobased plastic in this study are the result of a high-level qualitative analysis. In further research, the effects of detailed designs of policy instruments such as the Dutch recycled and biobased polymer obligation could be analysed in more detail. This could also include business case analyses in which the effect on product costs and prices are studied.

Finally, more research is needed to uncover the potential technical and environmental performance of recycling technologies and different types of bioplastics, and the suitability of different biomass feedstock types for the production and use of biobased chemical products and plastics. Because available volumes of plastic waste and sustainable biomass are limited, finding resource-efficient ways to use these resources is an important step in the pursuit of a sustainable, climate-neutral and circular economy. For the same reason, reduction of resource consumption and improvement of the quality and recyclability of waste streams is another important area of research.

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