Plastic feedstock for recycling in the Netherlands

Market study for the VNCI, VA, Plastics Europe NL, and Versnellingstafel Chemische Recycling – *FINAL VERSION*

—

13-10-2023

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Private and confidential
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Loire 150
2491AK
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22 September 2023,

Dear Sirs and Madams,

Market study

In accordance with our engagement letter dated 6 April 2023 and its attachments (our 'Engagement Letter'), we enclose a copy of our market study into plastic feedstock for recycling in the Netherlands dated 13 October 2023. As stated in our Engagement Letter you have agreed that our final written report shall take precedence over all previous oral, draft or interim advice, reports and presentations, and that no reliance will be placed by you on any draft report other than at your own risk.

The scope of work set out in our Scope is attached as Appendix 1 to the report. This details the agreed scope of our enquiries, directed at those issues which you determined to be critical to your investment. You should note that our findings do not constitute recommendations to you as to whether or not you should proceed with your investment.

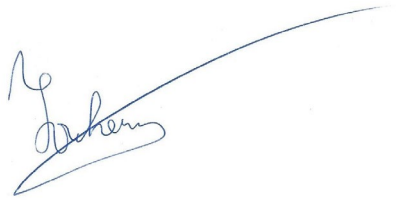
The 'Important notice' on page 3 should be read in conjunction with this letter.

Our report is for the benefit and information of the adressees only and is not to be copied, referred to or disclosed, in whole or in part, without our prior written consent, save as permitted in our Engagement Letter. In accordance with that letter, you may disclose our report to your financial and legal advisors in order to seek advice in relation to our work for you, provided that when doing so you inform them that, to the fullest extent permitted by law, we accept no responsibility or liability to them in connection with our report and our work for you.

Yours faithfully,

KPMG Advisory NV

Tom Hesselink
Partner



Important notice

Our work in respect of the scope of work relating commenced on 21 April 2023 and our fieldwork was finalised on 22 September 2023, with minor changes since. We have not undertaken to update our report for events or circumstances arising after 22 September 2023.

In preparing our report, our primary source has been external information and representations made to us by interview respondents. We do not accept responsibility for such information which remains the responsibility of the original source. Details of our principal information sources are set out in the basis of preparation of our report and we have satisfied ourselves, so far as possible, that the information presented in our report is consistent with other information which was made available to us in the course of our work in accordance with the terms of our Engagement Letter. We have not, however, sought to establish the reliability of the sources by reference to other evidence.

The primary scope of our procedures was to obtain, analyse and comment on the availability of feedstock, demand of feedstock for chemical recycling, and the balance between supply and demand. The procedures we have performed as mentioned in the scope section of the engagement letter only include the procedures which you have indicated as important in respect of the assessment. As a consequence, we may not have discovered matters which may have come to our attention if we had performed an audit or review with respect to the information presented in this report (including Appendices), and which would have been of relevance to your assessment.

We would emphasise that we do not express an opinion or any form of assurance on the information presented in this report (including Appendices). Furthermore we do not make any representations regarding the sufficiency of the procedures we performed for your informational needs.

Our report makes reference to ‘KPMG analysis’; this indicates only that we have (where specified) undertaken certain analytical activities on the underlying data to arrive at the information presented; we do not accept responsibility for the underlying data.

Contents

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Base of prep (1/3)

Primary research – Interviews

Participating companies[a]

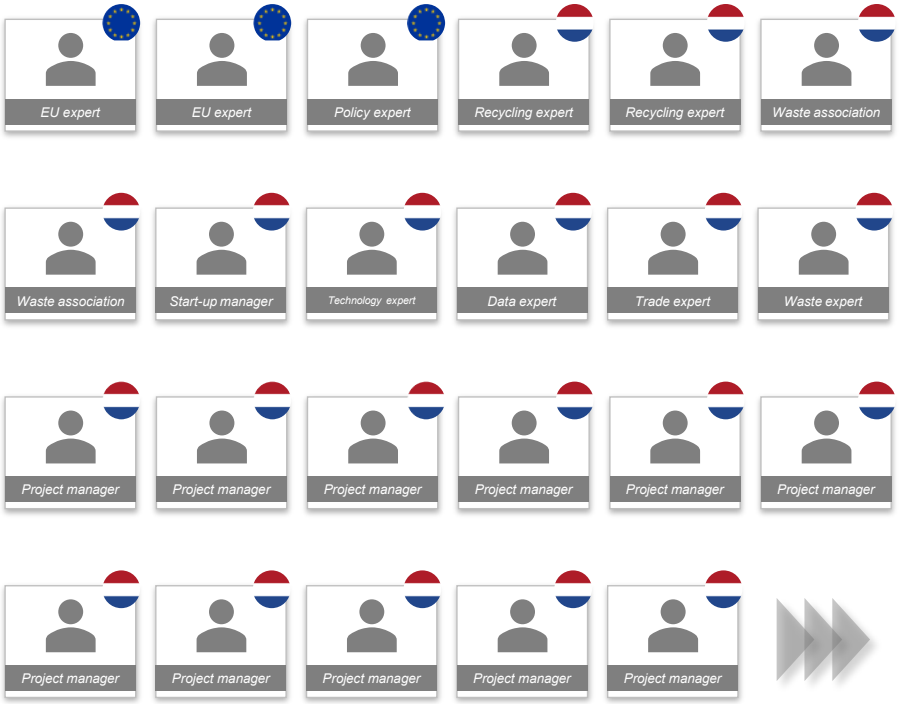
12 member firms from the Vereniging Afvalbedrijven

5 member firms from the Vereniging van de Nederlandse Chemische Industrie

15 other parties

Participating companies

30+ industry insiders from EU expert organisations and otherwise…



Note: (a) The mentioned parties do not endorse all the report's comments and findings.

Base of prep (2/3)

Secondary research
Macro data sources (non-exhaustive)

- Adelphi
- Afval Circulair
- CBS
- CE Delft
- Cefic
- CONAI
- EcoProg
- ECHA
- Eunomia
- Euractiv
- European Commission
- EuRIC
- Eurostat
- Fulcrum Bioenergy
- IMF
- ING
- JRC
- Nedvang
- NPCE
- NTCP
- NVC
- OECD
- PBL
- Plastics Europe
- Plastic Pact NL
- Princeton University
- Rebel
- Refenitiv
- Research papers
- Rijksoverheid
- RIVM
- SkyNRG
- Statiegeld Nederland
- Statista
- Stichting Afvalfondsverpakkingen
- United Nations
- Unilever
- VANG

Base of prep (3/3)

1 Introduction
2 Policies
3 Feedstock
4 Import/export
5 Demand
6 Balance and opportunities

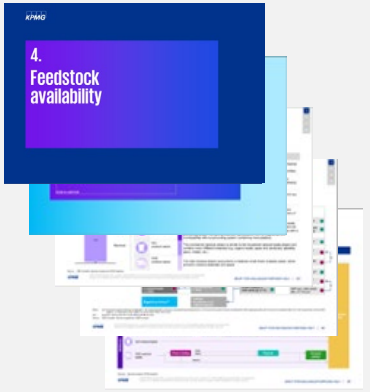
Inputs used

Macro data
Pre-sorted waste data (CBS)
Residual waste data (CBS)

Micro data
Received granular data points from waste managers

Aggregated
Anonymised

Deliverable

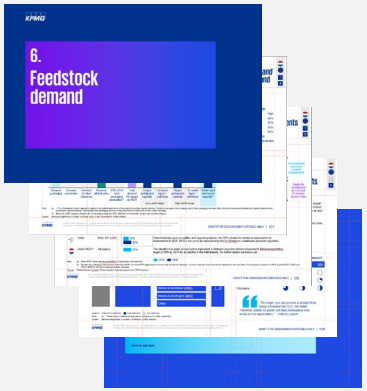


EU/ NL
Minimum recycled content

Recycling yields
Received granular data points from installation managers

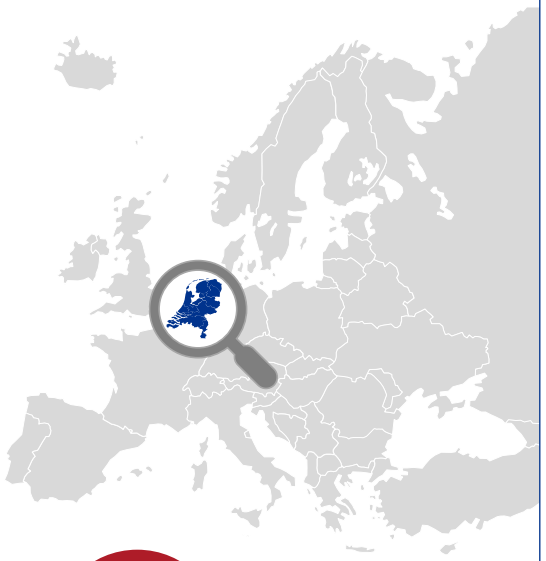
Recycling capacity
Received granular data points from installation managers

Aggregated
Anonymised



Guidance to the reader (1/2)

Scope



The Netherlands

2020-2030

Supply

Macro-data, micro-data, and interview feedback were used to analyse the (Dutch) plastic feedstock supply.

In order to convert collected waste into sorted plastic bales, high level sorting yields (collected through desk research and interview feedback) were applied.

Imbalance

This study shows a supply demand imbalance exists in the form of a shortage of plastic feedstock supply.

The estimated imbalance is an underestimation, as for demand sorted plastic bale specifications on required type of plastics or qualities were not taken into account.

Demand

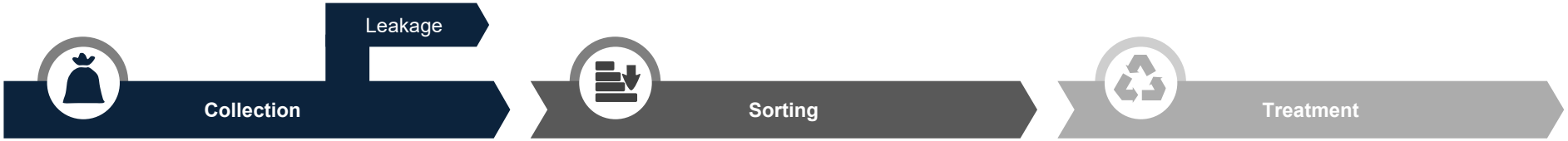
This study examined current and announced recycling capacity (if known) in order to determine the expected feedstock demand.

Recycling projects that are announced without capacity details were ignored.

Additionally a correction is applied to account for announced recycling projects that could be cancelled (refer to methodology slide in Demand section for more details).

Guidance to the reader (2/2)

The following collection streams, types of sorting outputs and treatment types are analysed in this study



Waste stream type

- Household pre-sorted
- Other pre-sorted consumer waste
- Commercial & industrial (C&I) pre-sorted waste
- Construction & demolition (C&D) pre-sorted waste
- Household residual waste
- Commercial & industrial (C&I) residual waste
- Construction & demolition (C&D) residual waste

Other waste streams (such as automotive-, electrical & electronics waste)

Sorting output type

- Monostreams
- Mixed films
- Mixed plastics
- Unsorted waste

Treatment types

- Mechanical recycling[(a)]
- Dissolution
- Depolymerization
- Pyrolysis

Alternative applications

Note: (a) Includes conventional mechanical recycling, advanced mechanical recycling, and downcycling.
Source: KPMG analysis.

See 'Introduction' section for more details

Glossary of terms

000	Thousands
#	Count/number
~	Approximately
€	Euro
€m	Million euros
BAT	Best available techniques
C&D	Construction and demolition
C&I	Commercial and industrial
CAGR	Compound annual growth rate
CO2	Carbon dioxide
CR	Chemical recycling
CRM	Critical raw materials
DKR	Deutsche Gesellschaft für Kreislaufwirtschaft und Rohstoffe
DRS	deposit return scheme
e.g.	'Exempli gratia' – for example
EBIT(DA)	Earnings before interest and tax (depreciation and amortisation)
EC	European Commission
ECHA	European Chemicals Agency
EfW	Energy from waste
ELV	End-of-life vehicle
EOW	End-of-waste
EPR	Extended producer responsibility
ESPR	Ecodesign for sustainable products regulation
ETS	Emission trading system
EU-27	27 European Union countries
EUR	Euro
FC	Forecast
FCM	Food contact materials
GDP	Gross domestic product
HEFA	Hydroprocessed esters and fatty acids
HDPE	High density polyethylene
HH	Household
IED	Industrial emissions directive
JRC	Joint research centre
kt	Kilotons
LAP	Landelijk afvalbeheer plan
LDPE	Low density polyethylene
LWP	Lightweight packaging
m	millions
MBT	Mechanical biological treatment
MCR	Minimum content requirement
MF	Mixed films
MP	Mixed plastics
MPO	Mixed polyolefins
MR	Mechanical recycling
MS	Monostreams
MSW	Municipal solid waste
Mt	Million tonnes
n.a.	Not available
NL	Netherlands
NPCE	Nationaal programma circulaire economie
OECD	Organisation for Economic Co-operation and Development
P2P	Plastic-to-plastic
p.a.	per annum
PFAS	Per and polyfluoroalkyl substances
PE	Polyethylene
PET	Polyethylene terephthalate
PMD	Plastic, metal, drinking cartons
PO	Polyolefins
PP	Polypropylene
PPWR	Packaging and packaging waste regulation
PS	Polystyrene
PS/EPS	Polystyrene/ Expanded polystyrene
PVC	Polyvinyl chloride
RDF	Refuse derived fuel
SAF	Sustainable aviation fuel
SRF	Solid recovered fuel
SRM	Strategic raw materials
SVHC	Substances of very high concern
SUPD	Single-use plastics directive
UK	United Kingdom
WFD	Waste framework directive
WtE	Waste to energy
WtH	Waste to hydrogen
WtM	Waste to methanol

1. Executive summary

Key headlines (1/4)

INTRODUCTION AND CURRENT STATUS

- The goal of this study is to determine supply and demand for plastic waste in the Netherlands and determine the imbalance in 2030, taking into account (suggested) policies impacting waste supply and demand, and import & export dynamics, in order to assess what needs to happen to move the Dutch plastics economy in an even more circular direction.
- A circular plastics economy is of great importance and benefit to the Netherlands given the importance of the petrochemical and plastics industry in the Netherlands as well as the maturity of the Dutch plastic recycling industry.
- There is still a huge untapped potential of unsorted plastics waste in the Netherlands. Currently, the majority of plastic waste is sent to energy-from-waste (EfW) and high caloric incineration (RDF / SRF) facilities while only ~30% is recycled. Less than 50% of plastics waste (0.8 Mt) goes through a (post-)sorting facility, meaning the majority is unsorted – e.g. the largest plastic containing stream, C&I residual, goes to incineration without sorting.

THE IMBALANCE

- When continuing on the current trajectory there will be a shortage of plastic waste feedstock of 1.2 Mt (55% of total feedstock demand) in 2030 to be able serve the Dutch recycling industry which is expected to have a feedstock demand of 2.2 Mt. Shortages are expected in mechanical recycling, where monostreams are demanded, and in pyrolysis, where mixed films and mixed plastics are the desired feedstock.
- There are additional opportunities to increase the supply in the Netherlands, primarily through the expansion of post-sorting of residual waste. However even after these optimisations, local supply will be insufficient to meet the future feedstock demand for plastic recycling. Increasing imports of plastic feedstock through stimulus and policy is essential to meet the demand for feedstock in the Netherlands

FEEDSTOCK SUPPLY

- Total plastic feedstock in the Netherlands is expected to slightly increase, with an increasing share of C&I pre-sorted and plastics from household residual waste. The plastics available for recycling are expected to significantly increase – where monostreams and mixed films will account for the largest growth as these are the most valuable.
- Sorting after collection of plastics often yield three output streams: monostreams, mixed plastics and mixed films – however, most plastics are unsorted with a huge untapped potential in residual waste which could either be unlocked by better pre-sorting or post-sorting residual waste. By 2030 it is expected that post-sorting of C&I residual waste will have taken it’s big first step.

Key headlines (2/4)

FEEDSTOCK DEMAND

- Total announced feedstock input capacity for recycling in the Netherlands for plastic recycling technologies is expected to equal 2.2 Mt in 2030, after which no projects have been announced yet. This is a doubling of 2022 capacity of which the majority of the increase will come from pyrolysis (+0.9 Mt). Many recyclers indicated that they aim to significantly increase capacity, however unclarity on (local) availability of feedstock and policies are delaying their investment decisions.
- The anticipated recycling capacity in NL in 2030 (2.2 Mt) should be sufficient to meet local demand in the Netherlands and support the position of the Dutch plastics industry within Europa to fulfil the demand resulting from mandatory content requirements (announced and illustrated) in 2030. As the Netherlands has one of the most mature recycling industries of the EU there is an opportunity to position the Dutch recycling industry as key engine of the EU's circularity agenda.
- Alternative applications, such as Waste-to-Fuel (WtF), Waste-to-Methanol (WtM), Waste-to-Hydrogen (WtH) and Waste-to-Energy (WtE), have a very low chance of competing with mechanical or chemical recycling for the same feedstock given the waste hierarchy priority and pressure to reach recycling targets. However, they do play an important role in recycling difficult-to-recycle fractions such as residues and residual waste which cannot be treated (or at very high cost) by other technologies.

IMPORT AND EXPORT

- As a net-importer of plastic waste the Netherlands plays a significant role in the European recycling landscape. The both significant imports and exports (~60% and ~40% of domestic supply) indicate a mature industry where specialisation of treatment ensures that plastic waste flows to where most value can be created. A significant share of current plastic waste exports could be retained in the Netherlands as future feedstock for recycling plants.

CURRENT REGULATORY FRAMEWORK

- A combination of European and Dutch policies which are targeted at all areas of the value chain will spur the availability of Dutch plastic feedstock in the years to come. While a number of these policies are already active, others are yet to be finalised and legislated, will be revised to include more ambitious targets, or will only come in force within a decade time. New policies (such as for Ecodesign) can result in significantly higher amounts of available plastic waste.
- While European and Dutch policies are the single most important driver for feedstock demand, most policies are still under debate making it hard to determine the exact impact these will have on demand. The minimum recycled content requirements for products is expected to have the largest impact on the entire plastic waste value chain.

Key headlines (3/4)

POLICY SUGGESTIONS AND AREAS FOR FURTHER INVESTIGATIONS (1/2) – which should be considered *in conjunction* and should *not* be cherry picked

Current regulatory framework

- As the regulatory framework is *the* key driver for both demand for recycled plastics *and* the supply of feedstock, it is imperative that the uncertainties in the current regulatory framework are resolved as soon as possible. Ongoing legislation that is expected to impact plastic recycling needs to be clarified in both the Netherlands (e.g. 'Circulaire plastic norm', 'Jetten climate plan') and the European Union (e.g. minimum recycled content, acceptance of chemical recycling as recycling method, Ecodesign directive) to create a reliable and attractive investment climate for circular investments. More than the specific timing, scope and requirements of the regulations, clarity on regulations is the key driver of investments in the plastic recycling value chain.
- Increasing the availability of feedstock requires safeguarding the European level playing field. The Dutch government should therefore identify and solve possible fiscal and regulatory trade barriers to the import of plastic-rich waste streams in the short term. This concerns in particular national barriers on European policy that can hinder the import of plastic-rich waste streams to the Netherlands and thereby also investments in sorting and post sorting

Expansion of (local) availability of feedstock in the Netherlands

- Increasing collaboration between the waste management industry, mechanical and chemical recycling industry is the first key step to better match supply and demand volumes and specifications.
- Expansion of availability of feedstock from plastic waste in the Netherlands is primarily driven by more collection and better (post-)sorting as well as reducing low quality exports outside of the EU. To reduce the exports outside of the EU a full plastic waste extra-EU export ban should be implemented.
- Stimulating further sorting requires a multitude of actions and policies; further raising the bar for non-recycling solutions and simultaneously increasing EPR funding to fund this further sorting seems a prerequisite. As well as the general requirement for businesses in the Netherlands to source-separate and/or post sort plastics. Furthermore, reducing costs (e.g. through lower waste taxes) of incineration for (well-sorted) sorting residue could further stimulate proper pre-sorting and subsequent sorting of plastics (and other recyclables). Lastly, permitting for sorting and recycling facilities should be prioritised and made easier as significant new capacity is required.
- Increasing further post-sorting specifically could be stimulated by a integrated combination of (1) prohibition of incineration of plastic waste that has not been separated or sorted, (2) The swift short term evaluation by the government of national fiscal and regulatory barriers that hamper the import of plastic-rich waste streams to the Netherlands and as such adapt this to safeguard an European fiscal playing field, thereby making more plastics waste available for mechanical and chemical recycling.(3) carbon emission calculations for Dutch CO2 levy and later EU ETS need to take into account actual emissions at the chimney / end of the process of incinerated waste (so *after* post-sorting), thus reducing Dutch CO2 levy and later EU ETS costs if post-sorting takes place.

Key headlines (4/4)

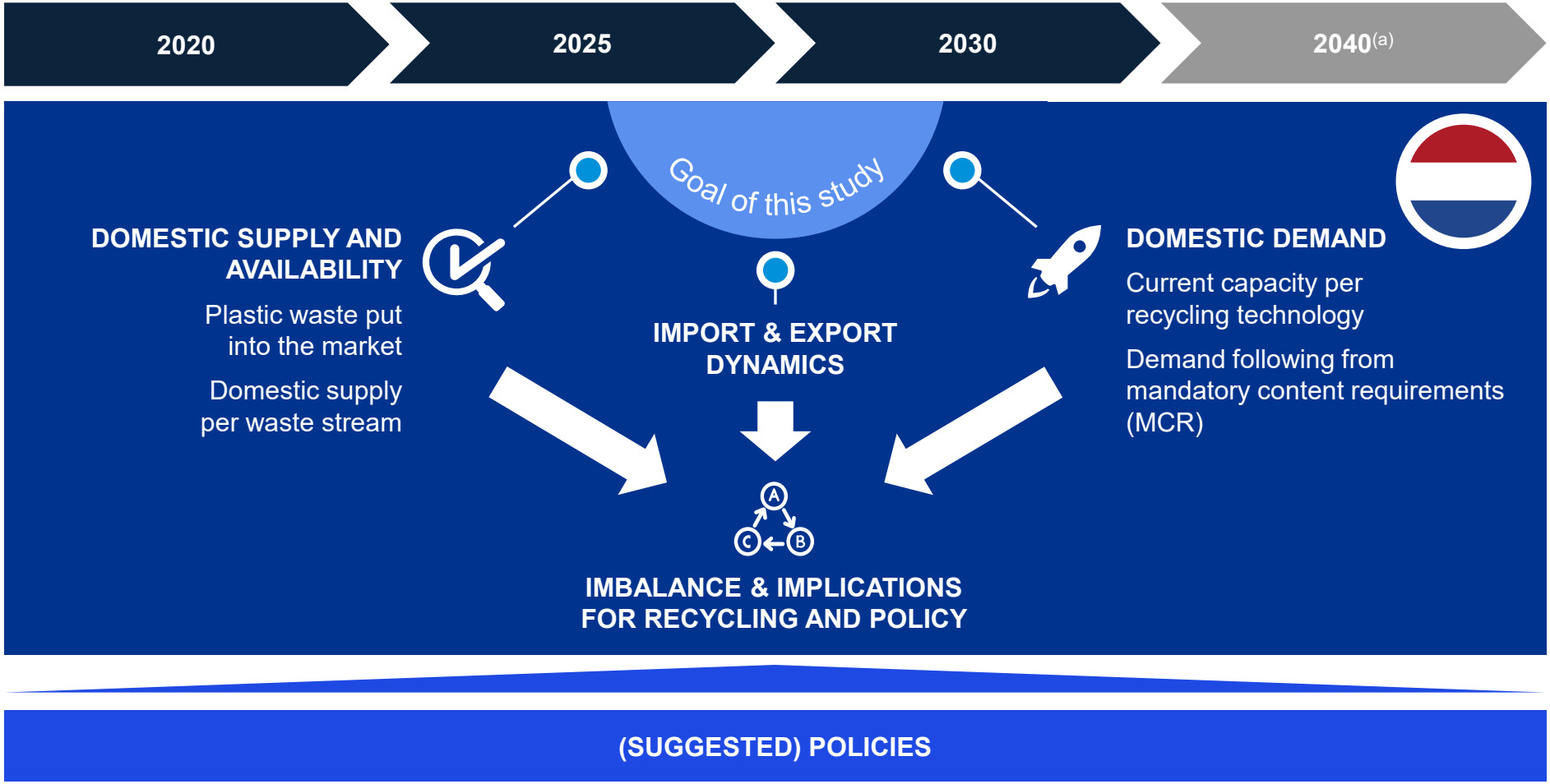
POLICY SUGGESTIONS AND AREAS FOR FURTHER INVESTIGATIONS (2/2) – which should be considered *in conjunction* and should *not* be cherry picked

Stimulation of import of plastic waste to the Netherlands

- Increasing the availability of plastic waste for recycling in Europe in general could be stimulated by expanding (waste streams beyond MSW, e.g. C&I) and pulling forward and enforcing the landfill directive (maximum percentage of landfilling – now 10% for MSW waste by 2035).
- Increase the functioning of a secondary raw material market across Europe: in line with the EU Green Deal circular economy action plan ambitions, standardisation of plastic waste fractions across Europe need to take shape urgently in order to create a commodity market with more transparency and volumes. Ease of transportation of secondary raw materials (across borders) is an important prerequisite here.
- Reducing hurdles and increasing attractiveness of imports of plastic waste into the Netherlands can drive the significant plastic waste volumes that may further increase due to possible policy interventions above towards the Netherlands.

1.1

The goal of this study is to determine supply and demand for plastic waste in the Netherlands and determine the imbalance in 2030, taking into account (suggested) policies impacting waste supply and demand, and import & export dynamics. Opportunities/possibilities have been identified to close the imbalance.

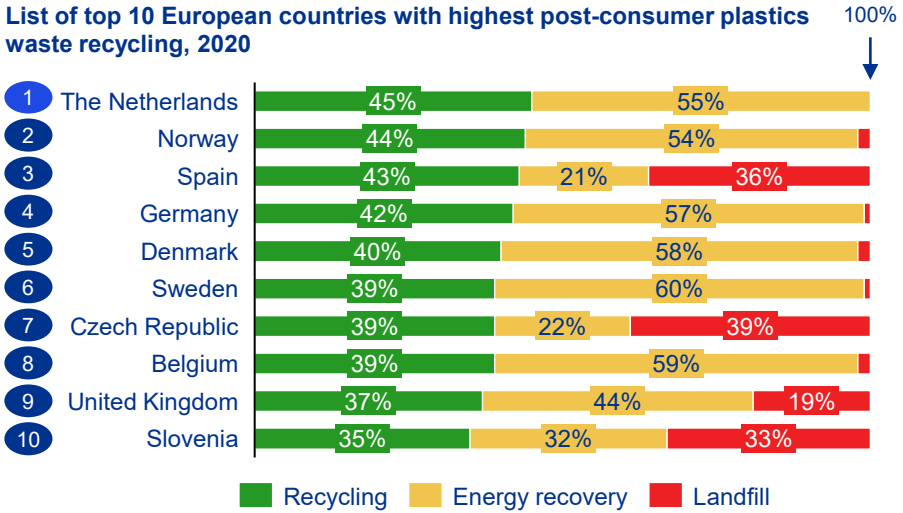


Note: (a) Only 2040 forecast is made for the demand based on mandatory content requirements.
Source: KPMG analysis.

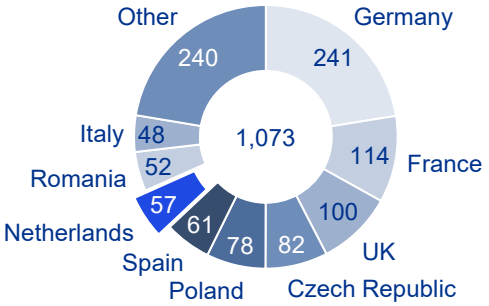
1.2

The Netherlands is a powerhouse in (plastic) recycling and has a leading chemicals industry which can play a major role in Europe's circular ambitions. The Dutch (plastic) recycling industry is one of the most mature in Europe with both developed pre-sorting and post-sorting systems resulting in high recyclability. The Dutch chemicals industry is rapidly developing and deploying new recycling technologies to secure future continuity and success.

List of top 10 European countries with highest post-consumer plastics waste recycling, 2020

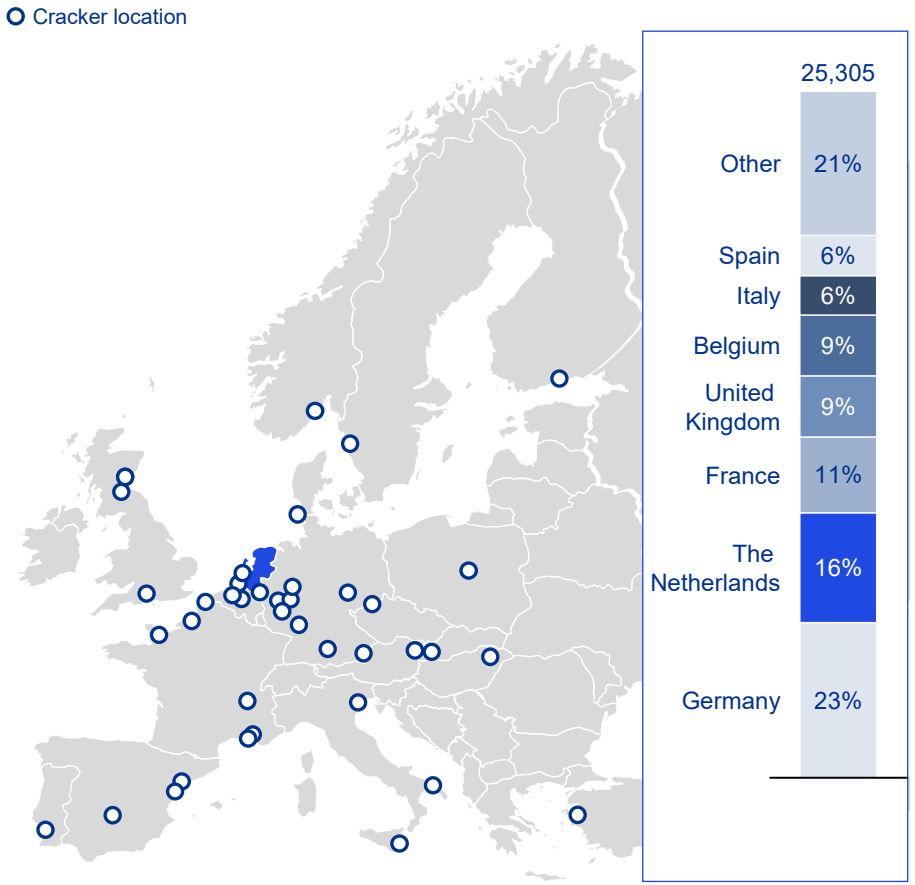


Number of plastic recycling facilities per European country, 2020



At least two of the largest independent recyclers being Morssinkhof and Repeats are based in the Netherlands

Share of European cracking capacity, Kt ethylene per year, 2021

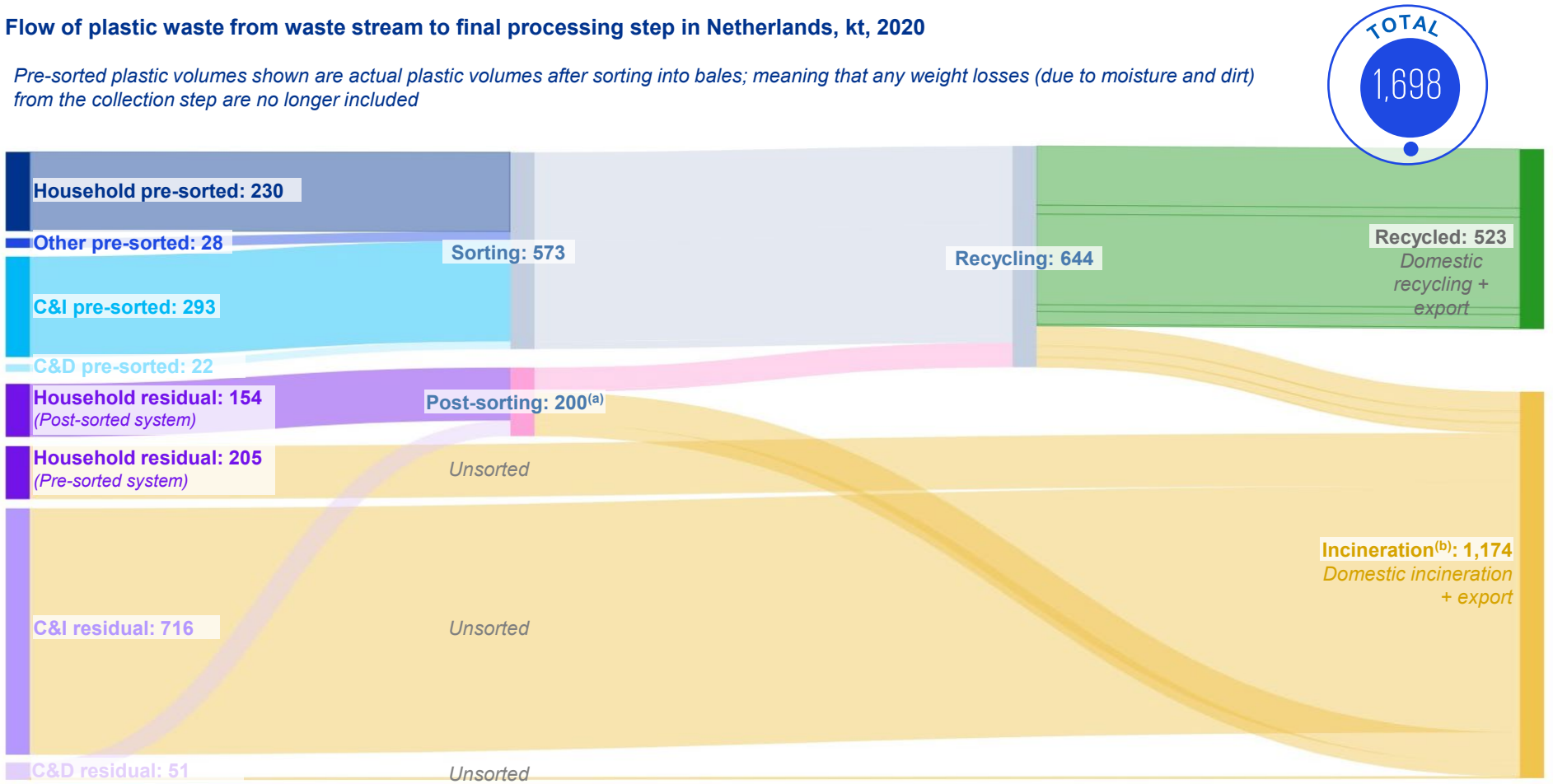


Source: EcoProg, Petrochemistry, KPMG analysis.

1.3 There is still a huge untapped potential of unsorted plastics waste in the Netherlands. Currently, the majority of plastic waste is sent to a energy-from-waste (EfW) facility while only ~30% is recycled. Less than 50% of plastics waste (773kt) goes through a (post-)sorting facility, meaning the majority is unsorted – e.g. the largest plastic containing stream, C&I residual, goes to a EfW facility without sorting.

Flow of plastic waste from waste stream to final processing step in Netherlands, kt, 2020

Pre-sorted plastic volumes shown are actual plastic volumes after sorting into bales; meaning that any weight losses (due to moisture and dirt) from the collection step are no longer included



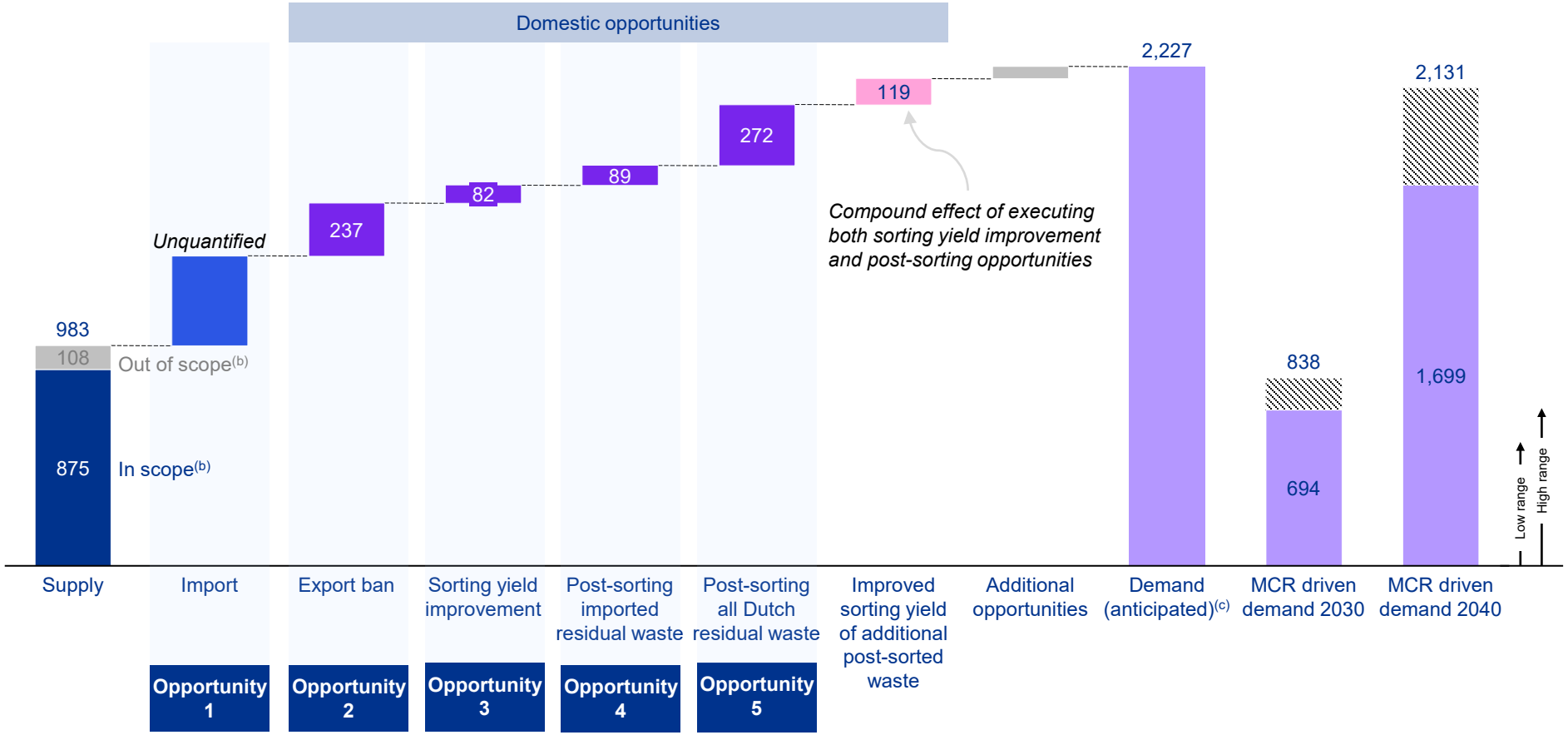
Note: (a) A large share of available plastics in residual waste streams that are sent to recycling, are ultimately not sorted out (due to sorting inefficiencies). The fraction residual waste fraction that is not sorted out is sent directly to mostly incineration
(b) Incineration is Energy-from-Waste and SRF/RDF

Sources: CBS; Eurostat; Interview programme; KPMG analysis

2.1

There are several opportunities that could boost domestic feedstock availability, however a significant share still needs to be sourced from abroad. This means that the Dutch government and recycling industry need to seriously invest in new policies and strategy to divert foreign plastic waste towards the Netherlands to be able to satisfy demand.

Total overview of opportunities to increase supply (mass balance)[(a)], 2030, kt



Note: (a) Shortage is an underestimated as recyclers specialise in certain types of plastics and qualities and the 'fulfilled' demand likely does not fully match with supply.
(b) Total is shown to give a more accurate view of mass balance. Supply in scope refers to volumes forecasted in this study, out of scope volumes represent Automotive or Electrical & Electronics volumes which have not been forecasted in this study and therefore 2020 volumes (p. 48) have been added including a 1% CAGR (in line with total plastic waste volume) to get a 2030 estimate.
(c) Based on existing and announced capacity.

Source: Interview programme; KPMG analyses

2.2

Making it easier to import feedstock should be the one of the core focus of the Dutch recycling value chain. This can be realised at European level by ensuring that there is a level playing field for internal traffic of plastic feedstock and that plastic waste can be easily transported across borders as feedstock (i.e. not as waste). At Dutch level import restrictions and duties should be suspended.

OPPORTUNITY 1: Importing feedstock

Ensure a level playing field within the European Union for the internal traffic of plastic feedstock – i.e. avoid in-country treatment requirements by EPRs and governments, as these undermine the common market.

Ensure easy cross border transport of plastic waste feedstock (and derivatives such as pyrolysis oil).

Standardisation of waste could help to better match supply and demand by making the market more liquid and import & export more easy.

Suspension of import tax for combustible waste which contains significant amounts of plastics in case this waste is post-sorted.

2.3

Besides importing feedstock there is no easy way satisfy the Dutch recycling demand as all opportunities require cooperation of multiple parties, investments and tailored policies to substantially increase the supply of plastic waste. Most opportunities will yield relatively lower quality of plastics feedstock which will not be able to satisfy the demand for high quality feedstock in mechanical recycling.

Potential opportunities to close the supply/demand gap

	Opportunity	Additional plastic feedstock[(a)], kt	Quality of additional plastics	Return on investment	Ease of implementation	Opportunity description
2	**Implementation of extra EU-27 export ban[(b)]**	237	◔	●	◕	European Environmental committee is considering a proposal to ban all exports of plastic waste to non-OECD countries followed by an export ban towards non-EU OECD countries within 4 years.
3	**Sorting yield improvement**	82	◑	◑	◔	Stimulating or obligating design for recycling and investments in improved separation technologies.
4	**Post-sorting of imported residual waste**	89 – 119	◔	◕	◕	Post-sorting of imported residual waste from other countries.
5	**Post-sorting all collected Dutch residual waste**	272 – 361	◔	◕	◕	Post-sorting of residual waste from households, C&I and C&D, generated in the Netherlands which is currently not sorted.
	Additional opportunities (unquantified)					
	Mining landfills	◕	◔	◔	◔	Landfills could contain between 4-8% plastics which could be utilised together with other resources.
	Importing waste from (extra) EU-27 countries	◕	TBD	◕	◕	Enabling import of plastic waste from countries with a less sophisticated waste infrastructure might be an opportunity to fulfil demand.
	Leakage in other waste streams	◔	◔	◕	◑	Better educating the population on disposal of material in the correct waste bin could prevent leakage of plastics into other waste streams.
	Expired products in retail	◔	◔	◕	◕	Expired products (~6kt of plastics per year) go to incineration now and could be sorted and directed towards recycling instead.

Legend: ● High ○ Low

Note: (a) When range is give the higher volume indicates the compound effect of executing multiple initiatives.

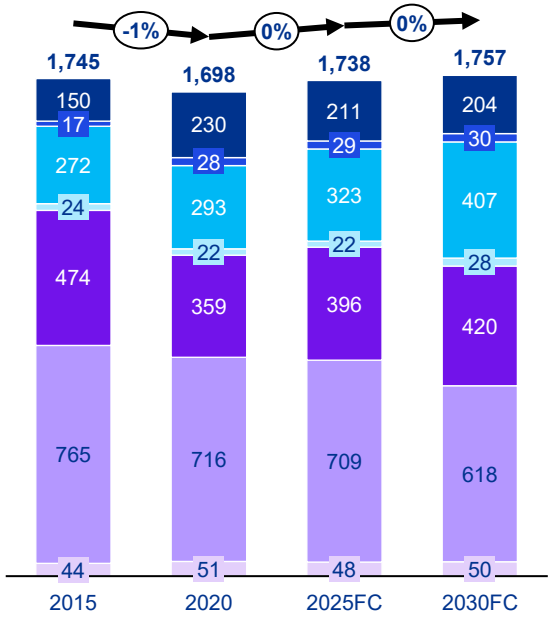
(b) The implementation of extra EU-27 export ban may lead to undesirable consequences when plastics that is exported for mechanical recycling is used for chemical recycling in the Netherlands after implementation of the ban.

Source: Interview programme; KPMG analyses

3.1

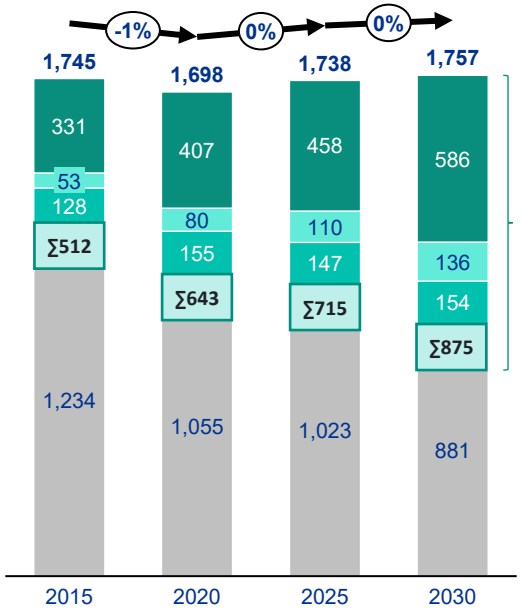
FEEDSTOCK SUPPLY: Total plastic feedstock in the Netherlands is expected to slightly increase, with increasing share of C&I pre-sorted and plastics from household residual waste. The plastics available for recycling are expected to significantly increase – where monostreams and mixed films will account for the largest growth as these are the most valuable.

Overview of total plastics per waste stream, kt, 2015-2030FC



CAGR (%)	'15-'20	'20-'30FC
HH pre-sorted	8.9	(1.2)
Other pre-sorted	10.3	0.6
C&I pre-sorted	1.5	3.4
C&D pre-sorted	(2.3)	2.6
HH residual	(5.4)	1.6
C&I residual	(1.3)	(1.5)
C&D residual	2.6	(0.1)

Overview of sorting output available for recycling, kt, 2015-2030FC



Plastics available for recycling

CAGR (%)	'15-'20	'20-'30FC
Monostream	4.3	3.7
Mixed films	8.6	5.4
Mixed plastics	3.9	(0.1)
∑ Available	4.7	3.1
Unsorted	(3.1)	(1.8)

Shift from pre-sorting to post-sorting residual (households)

Shift from residual to pre-sorting (C&I)

Improving sorting efficiency (for pre-sorting), design for recycling, increasing value of plastic waste

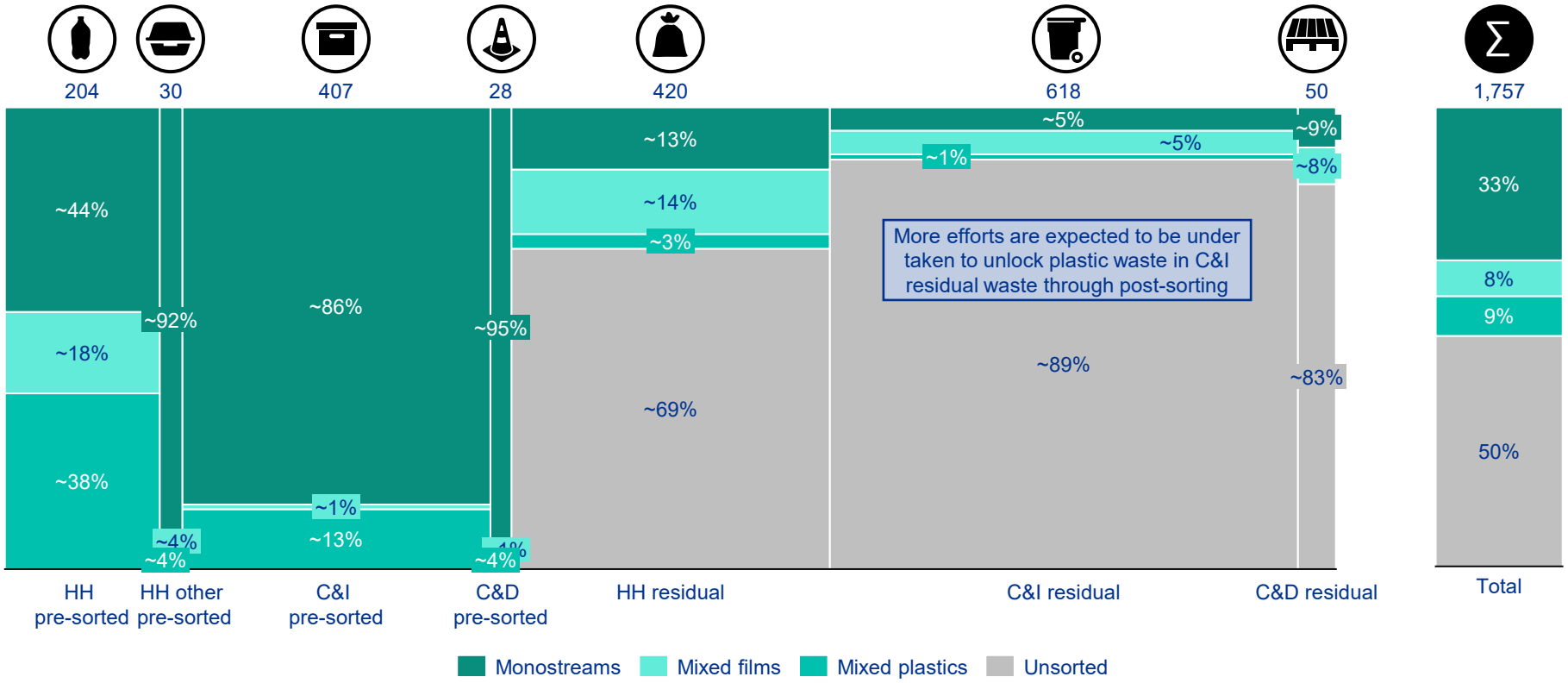
Increasing (post-)sorting leads to less unsorted plastics

Source: CBS; Eurostat; Interview programme; KPMG analysis.

For key underlying assumptions see page 56 and supporting sections

3.2 Sorting after collection of plastics often yield three output streams: monostreams, mixed plastics and mixed films – however, most plastics are unsorted with a huge untapped potential in residual waste which could either be unlocked by better pre-sorting or post-sorting residual waste. By 2030 it is expected that post-sorting of C&I residual waste will have taken it's big first step.

Overview of sorted type of plastic per waste stream[(a)], kt, 2030

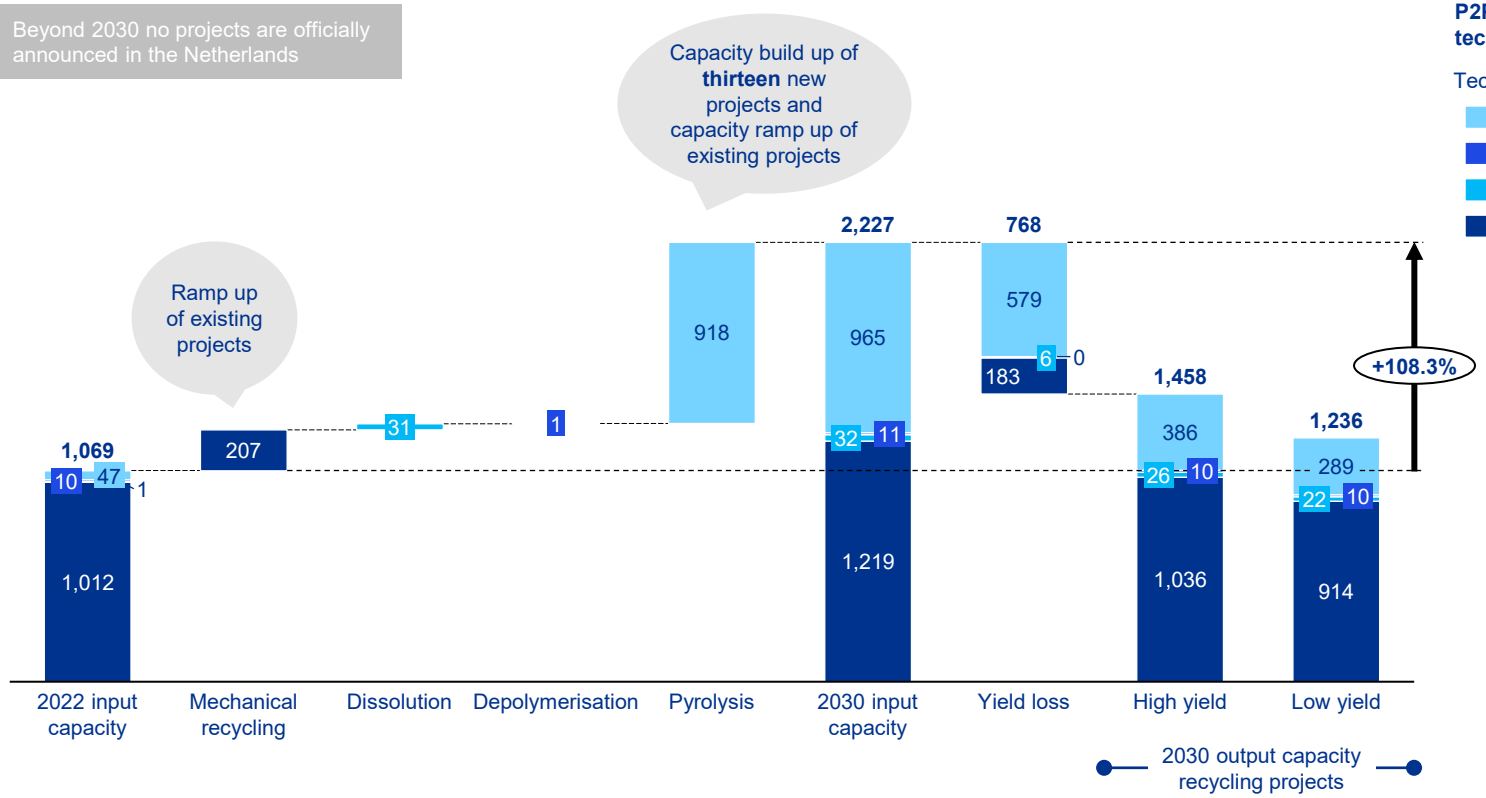


Note: (a) Impurities are still present in presented monostreams, mixed films and mixed plastics volumes as this are sorted bales volumes.
Source: CBS; Eurostat; Interview programme; KPMG analysis.

4.1 FEEDSTOCK DEMAND: Total announced feedstock input capacity for all recycling technologies is expected to equal 2.2 Mt in 2030, after which no projects have been announced yet. This is a doubling of 2022 capacity of which the majority of the increase will come from pyrolysis (+0.9 Mt). Many recyclers indicated that they aim to significantly increase capacity, however unclarity on (local) availability of feedstock and policies is delaying their investment decisions.

Overview of expected development of mechanical and chemical recycling input capacity[a,b], 2022-2030FC, kt

Beyond 2030 no projects are officially announced in the Netherlands



P2P (including pre-treatment) yield per technology

Technology	Low	High
Pyrolysis	30%	40%
Depolymerisation	90%	97%
Dissolution	70%	80%
Mechanical recycling	75%	85%

> We aim to build multiple recycling sites in Europe, where exactly will depend on feedstock availability and local regulations. For example, Dutch nitrogen restrictions make the Netherlands an unfavourable location."

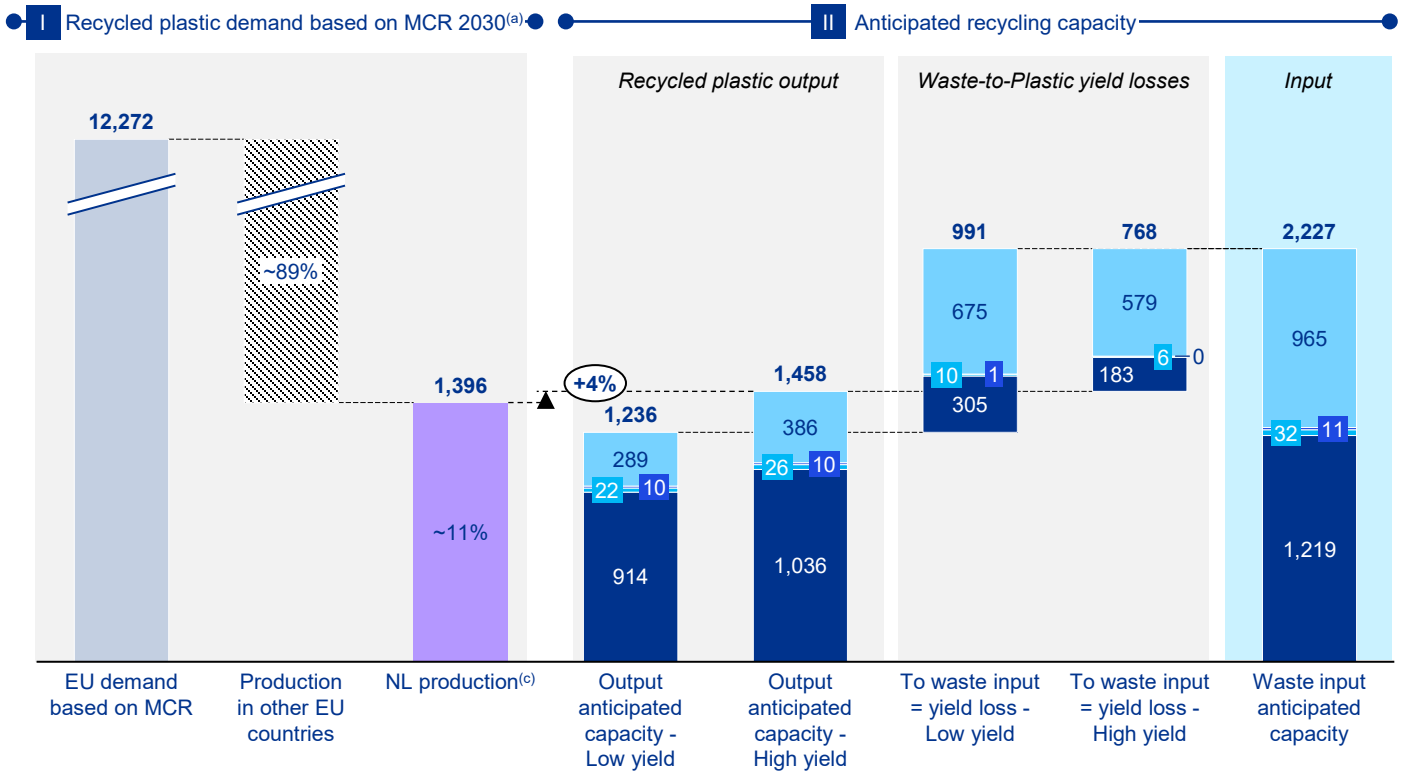
Note: (a) Based on a 95% capacity utilization for all recycling projects and 80% likelihood of construction for planned recycling projects;
(b) Realisation of recycling capacity is dependent on the acceptance of policies and legislation which would recognise the recycling methods as recycling and make the investments economically viable.

Source: Interview programme; KPMG analysis.

For key underlying assumptions see pages 118, 120-128

4.2 The anticipated recycling capacity in NL in 2030 (2.2 Mt) is currently approximately sufficient to meet demand resulting from mandatory content requirements (announced and illustrated) in 2030 across Europe and support the market position of the Netherlands in the European chemicals and recycling industry. As the Netherlands has one of the most mature recycling industries of the EU there is an opportunity to position the Dutch recycling industry as key engine of the EU's circularity agenda.

Estimated recycled plastic demand based on the European minimum content requirement (MCR) versus recycled plastic demand from announced recycling projects based on required plastic waste input, 2030FC, kt



P2P (including pre-treatment) yield per technology

Technology	Low	High
Pyrolysis	30%	40%
Depolymerisation	90%	97%
Dissolution	70%	80%
Mechanical recycling	75%	85%
Recycled plastic production EU		
Recycled plastic production non-NL		
Recycled plastic production NL		

Range indicates the waste-to-plastic yield based (if applicable) on a fuel exempt model, which includes loss of residue, contamination, operational losses and fuel

Note: (a) Besides packaging and automotive, no other MCR targets are currently announced. However, it is deemed realistic that these will be announced somewhere in the near future. Therefore an indicative MCR target of 20% in 2030 for all other industries has been taken into account
(b) Based on a 95% capacity utilisation for all recycling projects and 80% likelihood of construction for planned recycling projects
(c) NL production estimate based on Dutch chemical industry sales and cracking capacity

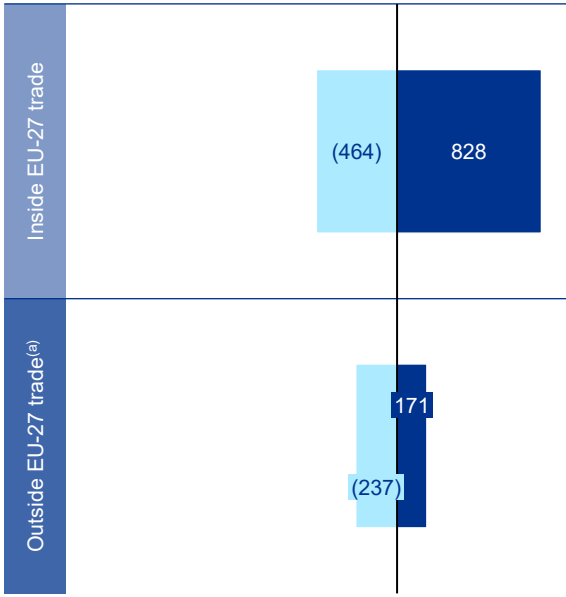
Source: Interview programme; Eurostat; European Union; Dutch Government; KPMG analysis.

For key underlying assumptions see pages 109, 111-119

5.1

As a net-importer of plastic waste the Netherlands plays a significant role in the European recycling landscape. The both significant imports and exports (~60% and ~40% of domestic supply) indicate a mature industry where specialisation of treatment ensures that plastic waste flows to where most value can be created. A significant share of current plastic waste exports could be retained in the Netherlands as future feedstock for recycling plants.

Overview of 2022 import and export volumes, incentives and retention possibilities for plastic waste in the Netherlands



Reason for trade	Retention possibilities of export volumes
Import and export volumes within the EU-27 are mainly the result of specialisation in processing methods (e.g. high quality recycling, incineration) and infrastructural facilities (e.g. re-export through the port of Rotterdam) leading to economic incentives for imports and exports	Retention of volumes currently exported towards countries inside the EU-27 can mainly obtained by increasing local plastic waste demand and treatment capacity (soft measures)
Import volumes from outside the EU-27 are mainly coming from European countries such as the UK, Switzerland, Iceland, etc. with similar cost-levels as the Netherlands and follow the same trade incentives as the inside EU-27 category **Export** volumes are predominantly going towards lower-cost processing countries such as Indonesia, Turkey, Vietnam and Malaysia as processing and transport costs are less expensive than in Europe	Retention of export volumes is possible due to (future) regulation making it harder or impossible to export plastic waste towards countries outside of the EU-27 (hard measure) Other retention incentives could come from additional local demand for plastic waste as a result of increased recycling standards (following regulations) resulting in higher willingness to pay for feedstock than in countries now exported to (soft measures)

Note: (a) Beware that UK is outside EU-27

Source: Interview programme; Eurostat; European Union; Dutch Government; KPMG analysis.

6.1

A combination of European and Dutch policies which are targeted at all areas of the value chain will spur the availability of Dutch plastic feedstock in the years to come. Most policies are already active and will be revised to include more ambitious targets, while new policies (such as for Ecodesign) can result in significantly higher amounts of available plastic waste.

SUPPLY impact: Selection of regulations with highest impact on feedstock supply

	Policy	Description	Chemical recycling supply impact	Mechanical recycling supply impact
I	Ecodesign for Sustainable Products Regulation	Harmonized design requirements for plastic and polymers – *Proposed European regulation*	Ability to disassemble plastic from products would ultimately generate a larger pool of potentially recyclable plastic for chemical recycling,	Ability to disassemble plastic from products would ultimately generate a larger pool of potentially recyclable plastic for mechanical recycling.
VI	Extended Producer Responsibility	Converter pays €1,050 excl. VAT per kg of plastic – *Active Dutch regulation*	More funding made available for sorting and collection through the new C&I EPR scheme and other schemes. Besides, tariffs based on the recyclability of plastics may also lead to more supply	more funding made available for sorting and collection through the new C&I EPR scheme and other schemes. Besides, tariffs based on the recyclability of plastics may also lead to more supply
XI	End-of-waste status	Rules for transportation of collected plastic waste vs products – *Active European directive which will be revised*	Supply might increase as EU harmonised standards facilitates more trade between EU countries, making the waste more accessible.	Supply might increase as EU harmonised standards facilitates more trade between EU countries, making the waste more accessible.
XII	ETS regulation for incineration	Incineration inclusion in ETS, raising costs (2028-2030) – *Proposed to be revised to include incinerators*	ETS inclusion increases WtE incineration costs, strengthening the case for post-sorting to reduce waste incineration which improves the supply of sorted mixed plastics/films.	ETS inclusion increases WtE incineration costs, strengthening the case for post-sorting to reduce waste incineration which improves the supply of sorted monostreams
XIII	Landfill directive	Landfill limit of 10% (2035) – *Active European directive which is revised limits landfilling of waste to 10%*	Large volumes of waste feedstock that were previously landfilled will be accessible to obtain for chemical recycling in the long-term (2035).	Large volumes of waste feedstock that were previously landfilled will be accessible to obtain for mechanical recycling in the long-term (2035).
XIV	Waste disposal levy	Higher levy paid for NL waste sent to incinerator and abroad – *Active Dutch regulation*	Higher incineration and landfilling costs strengthen the case for post-sorting improving accessibility of sorted mixed plastics/films and low quality recycling.	Higher incineration and landfilling costs strengthen the case for post-sorting improving accessibility of monostreams.
XV	Plastics recycling rate targets	Plastic packaging recycling rate 50% (2025) / 55% (2030) – *Active European regulation*	Sorting companies to sort (relatively) more mono-streams (also dependent on chemical recycling acceptance), reducing the supply of mixed plastics/films waste.	The recycling targets incentivises sorting companies to sort more monostreams and thus more feedstock will become available for mechanical recycling
XVIII	CO2 levy	Yearly increasing levy to 125 euro per tonne CO2 in 2030 – *Active Dutch regulation*	Due to higher incineration cost, post-sorting is encouraged, ultimately unlocking more usable feedstock for recycling	Due to higher incineration cost, post-sorting is encouraged, ultimately unlocking more usable feedstock for recycling

See chapter policy for all identified policies

Key: Expected impact: Very positive; Slightly positive; Limited or no effect; Slightly negative; Negative.

Source: European Commission; Plastics Europe; KPMG analysis.

6.2

European and Dutch policies are the single most important driver for feedstock demand where most policies are still under debate, making it hard to determine the exact impact these will have on demand. The minimum recycled content requirements for products is expected to have the largest impact on the entire plastic waste value chain.

DEMAND impact: Selection of regulations with highest impact on feedstock demand

	Regulation	Description	Chemical recycling demand impact	Mechanical recycling demand impact
I	Ecodesign for Sustainable Products Regulation	Harmonized design requirements for plastic and polymers – *Proposed European regulation*	Increased in demand for (mostly very high quality or contact sensitive) recycled plastics, if a minimum recycled content is introduced, which (some not-all) chemical recycling can produce.	Ecodesign is expected to lead to more demand for single-material plastic products, which can more easily be made from mechanical recycling than multi-material products.
II	Minimum recycled content	Minimum share of recycled material quote of 10-35% – *Proposed European regulation*	Strong increased demand for (mostly very high quality or contact sensitive) recycled plastics, which (some not-all) chemical recycling can produce.	Strong increase in demand for recycled non-contact sensitive packaging and single-use beverage plastics bottles.
III	Levy for unrecycled plastic	Countries must contribute 800 EUR/t for unrecycled plastics – *Proposed European regulation*	Increase of recycling demand, if levy is charged to producers/ consumers, as virgin plastics become more expensive and thereby recycled material more competitive	Increase of recycling demand, if levy is charged to producers/ consumers, as virgin plastics become more expensive and thereby recycled material more competitive
V	ELV proposal for regulation	Recycled plastic content share in cars to be 25% (2030) – *Proposed European regulation*	Increased demand, for high quality or recycled plastics.	Strong increase as it will be easiest way to meet the recycling target.
XVI	Acceptance of chemical recycling	Acceptance of chemical recycling and calculation method – *Proposed European regulation*	When chemical recycling will count towards reaching recycling rates, the demand for chemically recycled plastics is expected to increase, of which the extent is depending on the chosen measuring point and improvement in yield.	No significant effect expected.
XVII	Minimum recycled content	All plastics to be comprised of 25%-30% reused/ bio material – *Proposed Dutch regulation*	Depending on how the regulations take shape, chemical recycling demand will be driven for use in high quality and contact sensitive products.	Although the exact scope of the regulations are still uncertain, it is expected that a significant share of the recycled material will be processed through low-grade/ easily recyclable plastic groups through mechanical recycling

Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Source: European Commission; Plastics Europe; KPMG analysis.

See chapter policy for all identified policies

2. Introduction

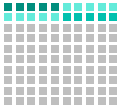
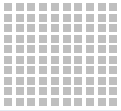
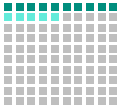
The majority of post-consumer plastic waste is collected/supplied from four sources and in two different systems

Overview of post-consumer plastic waste streams in Europe

	Pre-sorted waste		Residual waste	
	Sorted at the source where it is produced into separate streams of materials.		Generally not sorted.	
Household (HH)		**1. Household pre-sorted (LWP + deposit scheme)**		**5. Household residual waste**
Other consumer		**2. Other pre-sorted consumer waste**		N/a
Commercial & industrial (C&I)		**3. Commercial & industrial pre-sorted waste** Services Manufacturing Agriculture, forestry and fishing		**6. Commercial & industrial residual waste** Services Manufacturing Agriculture, forestry and fishing
Construction & Demolition (C&D)		**4. C&D pre-sorted waste**		**7. C&D residual waste**
Out of scope waste streams		Plastic that ends up in other waste streams such as in the organic- or paper waste stream. Automotive-, electrical & electronics waste		Expired products in retail.

Source: Interview programme; KPMG analysis.

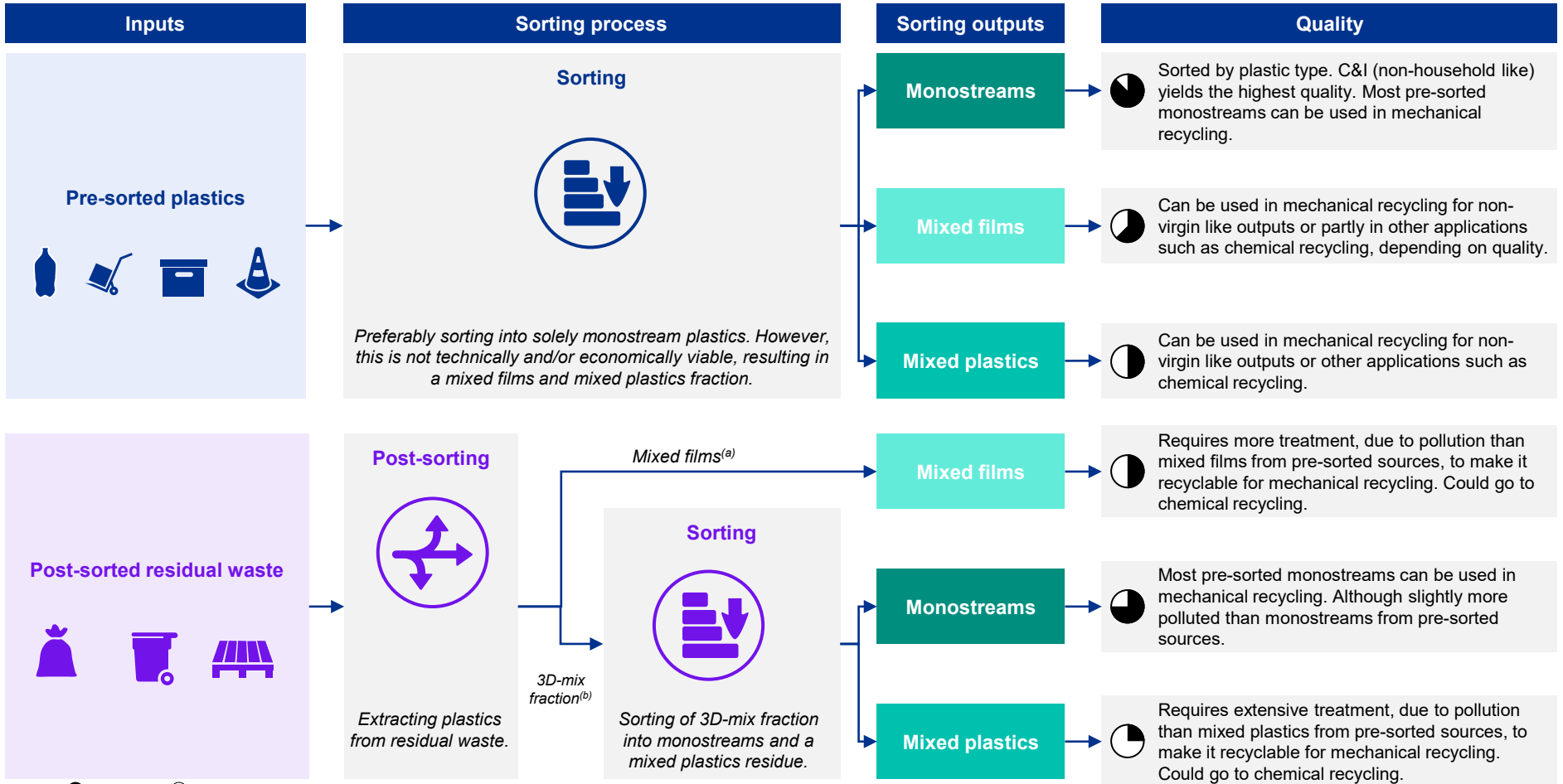
Waste streams differ significantly in plastic share and share of monostreams, mixed plastics and mixed films in sorting output

Stream type	Description	Share of plastics, %[(a)]	Typical plastic sorting output
Household pre-sorted	The household pre-sorted waste stream mainly includes EPR-driven PMD (packaging) waste: **Plastic packaging**, metal packaging and beverage cartons (composite packaging). Deposit schemes contain pre-sorted monostream plastics as PET-bottles.		 ~40% Monostreams ~20% Mixed films ~40% Mixed plastics
Other pre-sorted consumer waste	This stream contains plastics from sorted streams other than the pre-sorted and residual waste (e.g. bulky waste and civil amenities) and mainly contains **plastic rigids** and to a smaller degree **Styrofoam**.		 ~90% Monostreams ~5% Mixed films ~5% Mixed plastics
Commercial pre-sorted waste	The pre-sorted commercial waste stream contains different plastic materials which are relatively easy to separate (e.g. **plastic packaging material**) and are less contaminated than household materials.		 ~85% Monostreams ~15% Mixed Plastics
C&D pre-sorted waste	Pre-sorted C&D plastic waste contain plastics that are separated at a building and construction or demolition site. These plastics often contain a relatively large share of **PVC**.		 ~95% Monostreams ~1% Mixed films ~4% Mixed plastics
Household residual waste	The household residual stream contains many different materials (e.g. organic waste, paper and cardboard, **plastics**, glass, metals, incontinence materials, etc.). There are two types of household residual waste streams: (i) originating from municipalities with a pre-sorting system (containing relatively less plastics), and (ii) originating from municipalities with a post-sorting system (containing more plastics).		 ~5% Monostreams ~10% Mixed films ~5% Mixed plastics ~80% Unsorted
C&I residual waste	The commercial residual stream is similar to the household residual waste stream and contains many different materials (e.g. organic waste, paper and cardboard, **plastics**, glass, metals, etc.).		 ~100% Unsorted[(b)]
C&D residual waste	The C&D residual stream accounts for a relatively small share of plastic waste, which primarily contains **minerals** and **wood**.		 ~10% Monostream ~5% Mixed Films ~85% Unsorted

Key: (a) % stream type contribution to total plastics in the Netherlands;
(b) Plastics from residual waste are generally not yet (post-)sorted, hence no typical plastic sorting output is provided.

Source: Interview programme; KPMG analysis..

The several plastic input streams follow different sorting processes leading to monostreams, mixed films and mixed plastics as outputs in different qualities



Key: ● High quality ○ Low quality

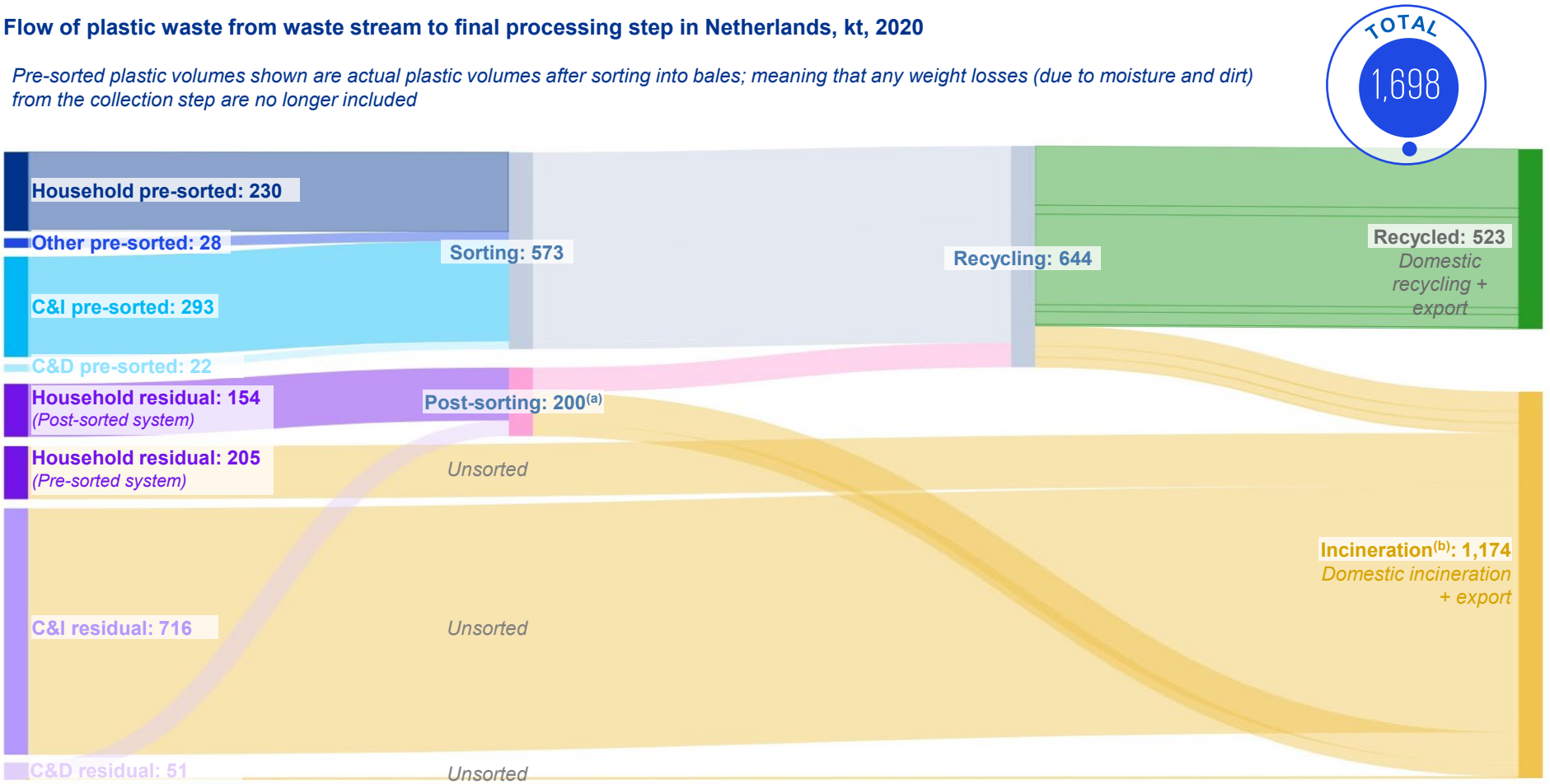
Note: (a) Mixed films from post-sorted household residual waste is also called DKR-310 and by some also referred to as a monostream;
(b) 3D-mix fraction is a primarily combined rigids fraction.

Source: Interview programme; KPMG analysis..

The majority of plastic waste is sent to energy-from-waste facilities while only ~30% is recycled

Flow of plastic waste from waste stream to final processing step in Netherlands, kt, 2020

Pre-sorted plastic volumes shown are actual plastic volumes after sorting into bales; meaning that any weight losses (due to moisture and dirt) from the collection step are no longer included

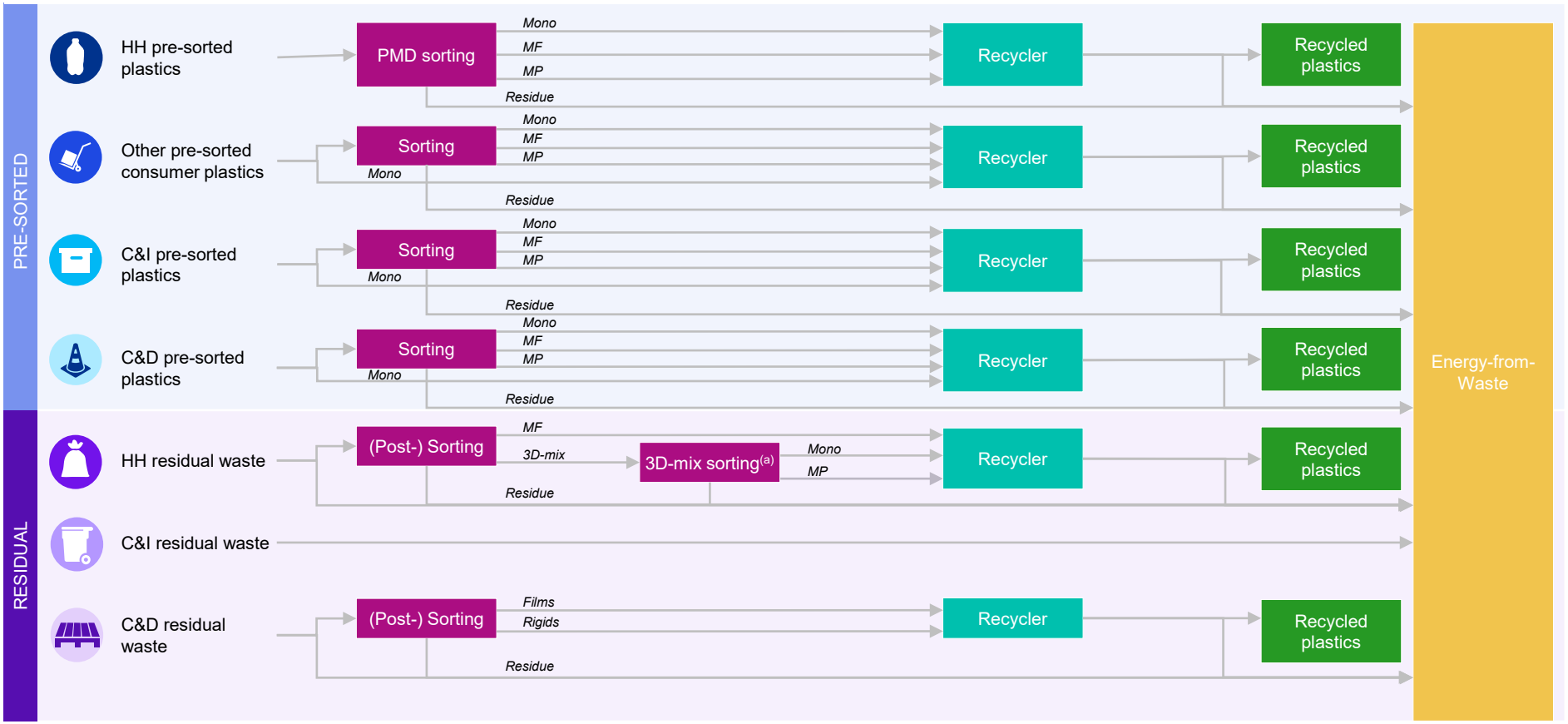


Note: (a) A large share of available plastics in residual waste streams that are sent to recycling, are ultimately not sorted out (due to sorting inefficiencies). The fraction residual waste fraction that is not sorted out is sent directly to mostly incineration;
(b) Incineration is Energy-from-Waste and SRF/RDF.

Sources: CBS; Eurostat; Interview programme; KPMG analysis

The Netherlands has multiple advanced collection and sorting systems in place and is unique in post-sorting plastics from household residual waste on scale

Simplified visualisation of plastic waste value streams

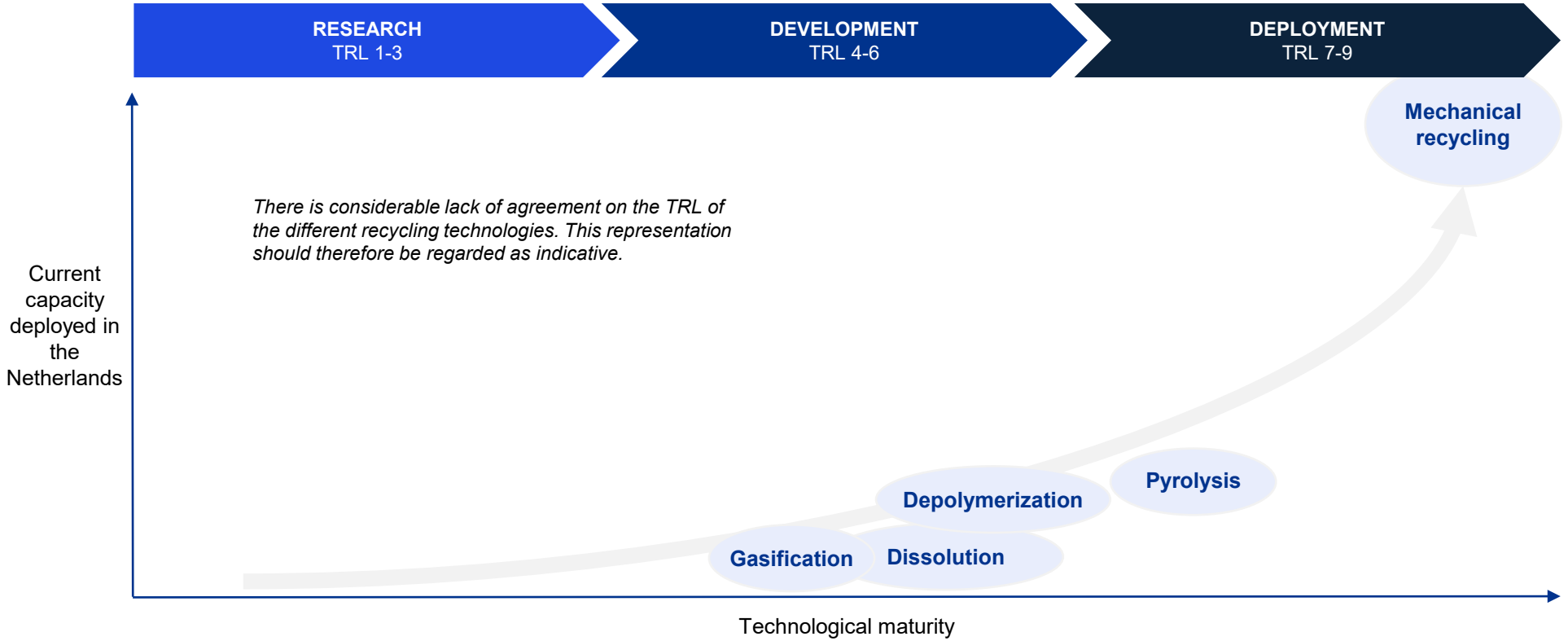


Note: (a) Sorting of the 3D-mix fraction which is a primarily combined rigids fraction resulting from post-sorting installation.

Sources: Interview programme; KPMG analysis.

Mechanical recycling is the most mature and common recycling method, other technologies are maturing and being deployed

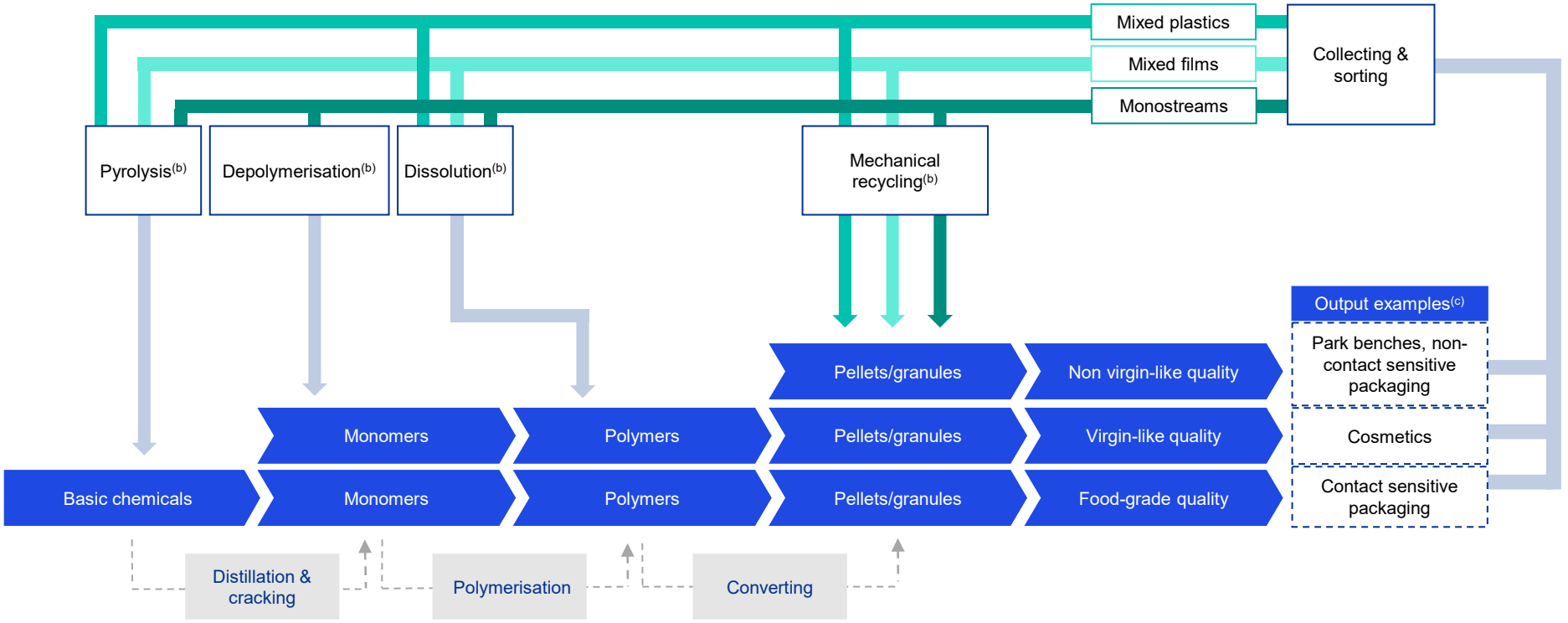
Maturity of plastic recycling technologies, Technology readiness level (TRL) – Indicative and non-exhaustive



Source: Arena & Ardolino (2022); Interview programme; KPMG analysis.

Different recycling methods can be used as complements and vary from each other to which step they return the plastic waste to the value chain

Overview of plastic value chain and recycling processes[a]



Note: (a) See the Demand section for a detailed overview of each recycling technology; A larger share of long-loop recycling technologies result in lower environmental benefits and reduced maximum recycling rates. Although long-loop recycling is desirable in some cases (in particular for waste that cannot be recycled mechanically or short loop), it is important that long-loop chemical recycling is not becoming dominant and competes for waste that can be recycled mechanically,

(b) May require pre-treatment;

(c) Quality requirements for recycled plastics outputs differ, leading to several complementary recycling technologies.

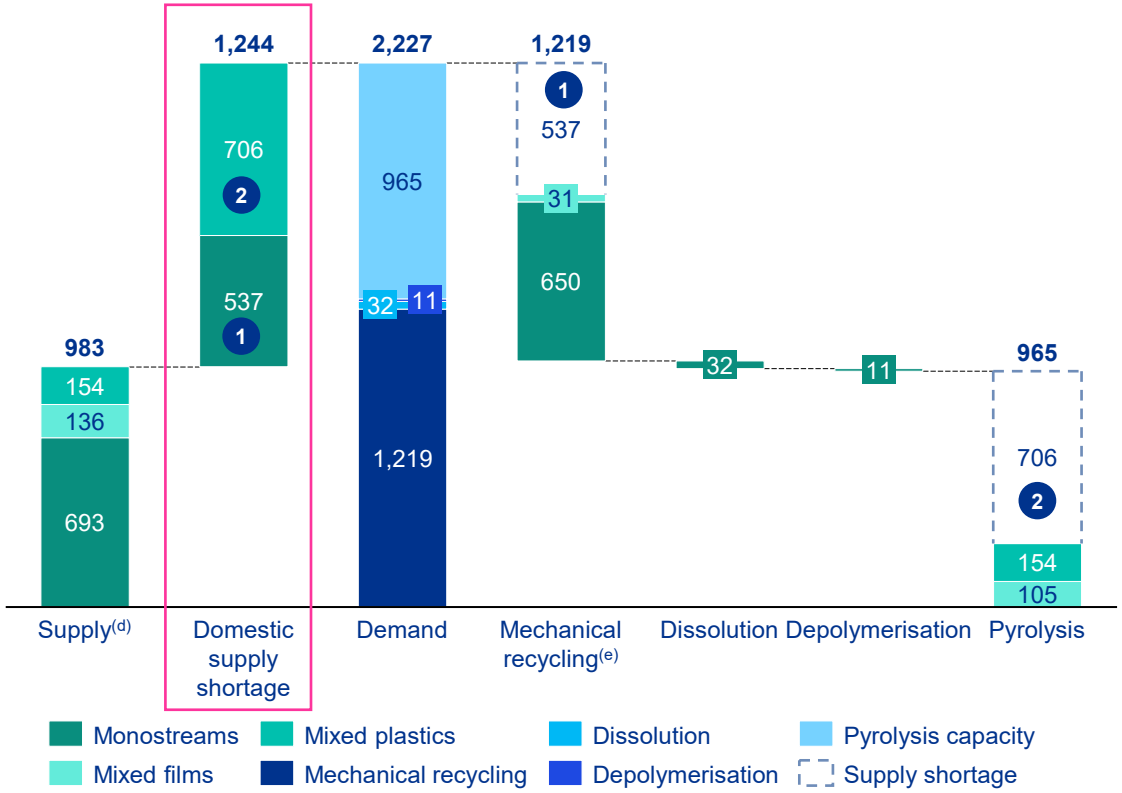
Source: Interview programme; CE Delft; KPMG analysis.

3.

Supply & demand (im)balance and opportunities

When continuing on the current trajectory there will be a shortage of waste feedstock of 1,244kt in 2030 to be able serve the Dutch recycling industry

Status quo 2030: Domestic supply and demand (im)balance per recycling technology, 2030, kt feedstock per year



Supply	Demand	Allocation share
Monostreams	Mechanical recycling	97%
	Dissolution[a]	1%
	Depolymerisation[b]	2%
Mixed films (pre-sorted)	Mechanical recycling	75%
	Pyrolysis	25%
Mixed films (post-sorted)[c]	Pyrolysis	100%
Mixed plastics	Pyrolysis	100%

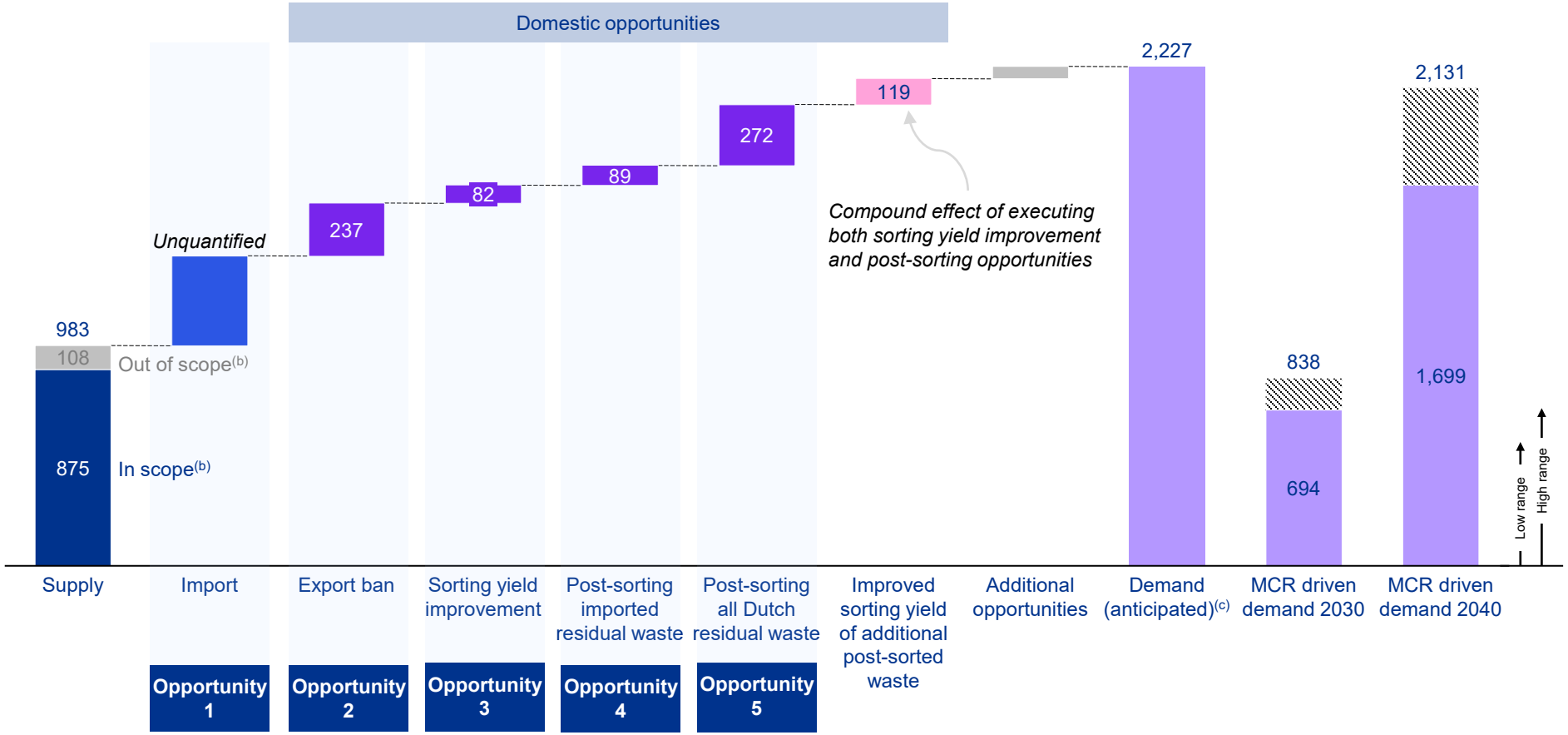
1. Unmet mechanical recycling feedstock demand likely to be filled by *monostreams*
2. Unmet pyrolysis feedstock demand likely to be filled by *mixed plastics* and/or *mixed films*

Note: (a) Dissolution demand supplied by PS monostreams;
(b) Depolymerisation demand supplied by PET monostreams;
(c) Post-sorted mixed films generally more polluted than pre-sorted mixed films. Hence, post-sorted mixed films are more likely to be sent to pyrolysis;
(d) Plastics from *'other waste streams'* (refer to first page of feedstock availability section) included as monostreams and allocated to mechanical recycling;
(e) Mechanical recycling shortage is an underestimated as recyclers specialise in certain types of plastics and qualities and the 'fulfilled' demand likely does not fully match with supply.

Source: Interview programme; KPMG analyses

There are several opportunities that could boost domestic feedstock availability, however a significant share still needs to be sourced from abroad

Total overview of opportunities to increase supply (mass balance)[(a)], 2030, kt



Note: (a) Shortage is an underestimated as recyclers specialise in certain types of plastics and qualities and the 'fulfilled' demand likely does not fully match with supply.
(b) Total is shown to give a more accurate view of mass balance. Supply in scope refers to volumes forecasted in this study, out of scope volumes represent Automotive or Electrical & Electronics volumes which have not been forecasted in this study and therefore 2020 volumes (p. 48) have been added including a 1% CAGR (in line with total plastic waste volume) to get a 2030 estimate.
(c) Based on existing and announced capacity.

Source: Interview programme; KPMG analyses

There is no easy way to satisfy the Dutch recycling demand – investments and tailored policies will be required to substantially increase the supply of plastic waste

Potential opportunities to close the supply/demand gap

	Opportunity	Additional plastic feedstock[(a)], kt	Quality of additional plastics	Return on investment	Ease of implementation	Opportunity description
2	**Implementation of extra EU-27 export ban[(b)]**	237	◔	●	◕	European Environmental committee is considering a proposal to ban all exports of plastic waste to non-OECD countries followed by an export ban towards non-EU OECD countries within 4 years.
3	**Sorting yield improvement**	82	◑	◑	◔	Stimulating or obligating design for recycling and investments in improved separation technologies.
4	**Post-sorting of imported residual waste**	89 – 119	◔	◕	◕	Post-sorting of imported residual waste from other countries.
5	**Post-sorting all collected Dutch residual waste**	272 – 361	◔	◕	◕	Post-sorting of residual waste from households, C&I and C&D, generated in the Netherlands which is currently not sorted.
	Additional opportunities (unquantified)					
	Mining landfills	◕	◔	◔	◔	Landfills could contain between 4-8% plastics which could be utilised together with other resources.
	Importing waste from (extra) EU-27 countries	◕	TBD	◕	◕	Enabling import of plastic waste from countries with a less sophisticated waste infrastructure might be an opportunity to fulfil demand.
	Leakage in other waste streams	◔	◔	◕	◑	Better educating the population on disposal of material in the correct waste bin could prevent leakage of plastics into other waste streams.
	Expired products in retail	◔	◔	◕	◕	Expired products (~6kt of plastics per year) go to incineration now and could be sorted and directed towards recycling instead.

Legend: ● High ○ Low

Note: (a) When range is give the higher volume indicates the compound effect of executing multiple initiatives.

(b) The implementation of extra EU-27 export ban may lead to undesirable consequences when plastics that is exported for mechanical recycling is used for chemical recycling in the Netherlands after implementation of the ban.

Source: Interview programme; KPMG analyses

Importing feedstock: Making it easier to import feedstock should be the one of the core focus of the Dutch recycling value chain in order to fulfil feedstock demand

Opportunity 1: Importing feedstock

Ensure a level playing field within the European Union for the internal traffic of plastic feedstock – i.e. avoid in-country treatment requirements by EPRs and governments, as these undermine the common market.

Ensure easy cross border transport of plastic waste feedstock (and derivatives such as pyrolysis oil).

Standardisation of waste could help to better match supply and demand by making the market more liquid and import & export more easy.

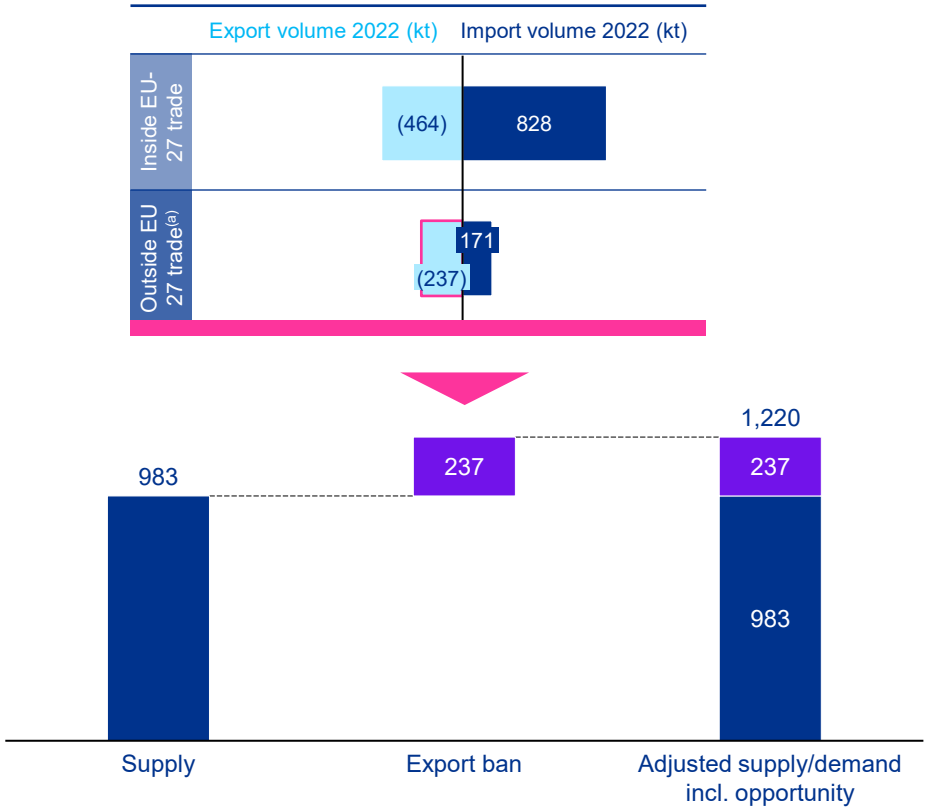
Suspension of import tax for combustible waste which contains significant amounts of plastics in case this waste is post-sorting.

Source: Interview programme; KPMG analysis.

Extra EU-27 export ban: relatively easy to implement opportunity leading to a significant (low quality) feedstock availability increase with a high chance of success

Opportunity 2: Implementation of extra EU-27 export ban

Overview of 2022 import and export volumes



Opportunity description

European Environmental committee already adopted proposal to ban all exports of plastic waste to non-OECD countries followed by an export ban towards non-EU OECD countries within 4 years.

Caveats to take into account regarding opportunity size:

- Growth/decline of exports outside EU: Uncertain, but given that the industry is further maturing and specialising export growth is likely.
- Re-exports of volumes: The Netherlands is a large logistical hub and a substantial part of volumes are re-exports which cannot be precisely indicated due to a lack of data.
- Shift towards other EU countries: It is likely that in case of a ban volumes will shift to EU countries with lower cost levels such as in Eastern Europe.

The ensure volumes become available in the Netherlands, instead of going to other EU countries, additional national policy regarding import/export will be required.

Opportunity assessment

Quality of additional plastics	◔	Quality is generally lower and very suitable for pyrolysis as most is PE and PP.
Return on investment	●	Limited investments required.
Ease of implementation	◔	Relatively high, it will require lobbying to implement regulations.

Note: (a) Beware that UK is outside EU-27;
(b) The lion share of plastics exported to Extra EU-27 countries primarily are relative low quality (PE) plastic films, that are hand sorted in the primarily low labour costs Extra EU countries.

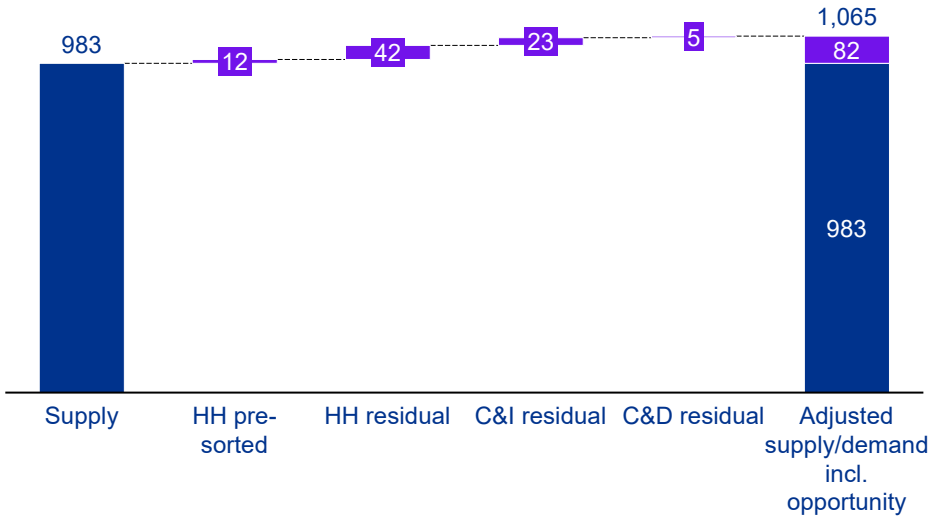
Source: Interview programme; Eurostat; European Union; Dutch Government; KPMG analysis.

Legend: ● High ○ Low

Yield improvement in sorting of plastic waste: through design for recycling or improved separation technology additional plastics can be made available

Opportunity 3: Sorting yield improvements

Average yield as-is[(b)]	85%	45%	45%	18%
Improved yield	90%	60%	60%	30%
Sorted plastic per percentage point increase (kt)	2.4	2.4	1.5	0.5



Opportunity description

Multiple actions could be taken to increase sorting yield:

i) Stimulating or obligating design for recycling: Design for recycling can improve the recognizability of plastics, leading to higher sorting yields;

ii) Investments in improved separation technologies.

The as-is average sorting yield already includes a predicted increase from 2022 to 2030.

The indicated improvement in sorting yield is based on interview feedback.

Opportunity assessment

Quality of additional plastics	◑	Quality is relatively similar to current outputs per waste stream.
Return on investment	◑	Investments can be substantial – both for plastics- as well as recycling industry.
Ease of implementation	◔	Cross-industry collaboration is required in combination with new policies and regulations which can be cumbersome.

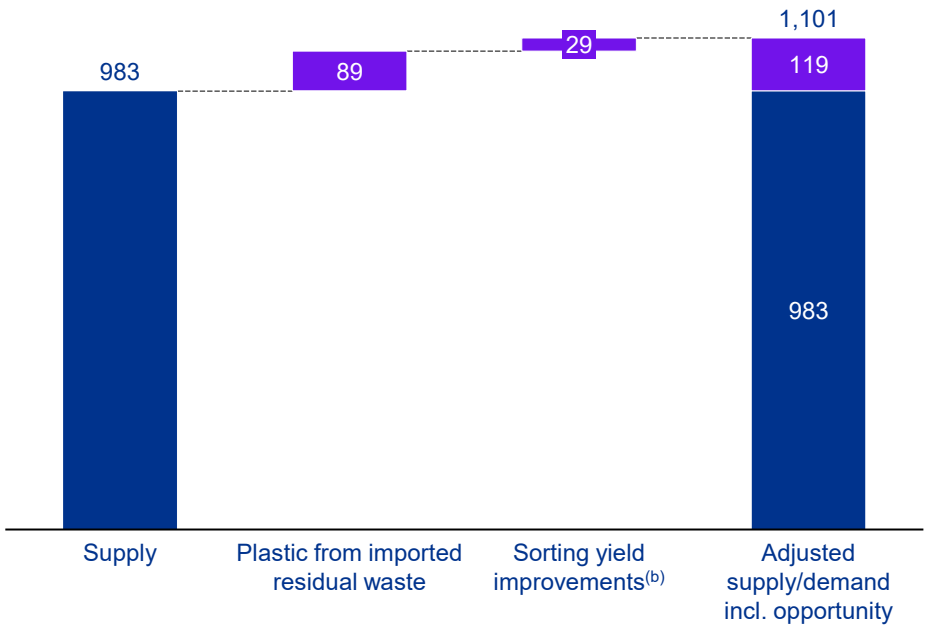
Legend: ● High ○ Low

Note: (a) Sorting yield is defined as the share of plastics that can be separated from the waste for recycling;
(b) Forecasted 2030 as-is situation.

Source: Interview programme; Eurostat; European Union; Dutch Government; KPMG analysis.

Post-sorting of imported foreign residual waste: can offer benefits when applied to residual waste containing a higher share of plastics

Opportunity 4: Post-sorting of imported residual waste[(a)]



Opportunity description

- Residual waste is imported to utilise overcapacity at Energy-from-Waste (EfW) facilities and is often sourced from countries with an EfW under capacity.
- Imported residual waste volumes are estimated at ~1.3Mt in 2020 and are assumed to remain constant towards 2030.
- It is assumed that imported residual waste on average contains 15% plastic[(a)] in 2030. Average post-sorting yield of imported residual waste assumed to be equal to the residual household waste post-sorting yield of 45%.
- Post-sorting can also be conducted selectively per batch of imported residual waste depending on plastic share[(c)], improving the return on investments.

Opportunity assessment

Quality of additional plastics	◔	Quality of post-sorted imported residual waste is generally low due to relative high pollution levels. However, plastics can still be upgraded to higher quality after sorting.
Return on investment	◕	Investment in additional post-sorting capacity will be required, while return will increase when incineration is taxed under ETS.
Ease of implementation	◕	Can be enforced through regulation or by cross-industry collaboration.

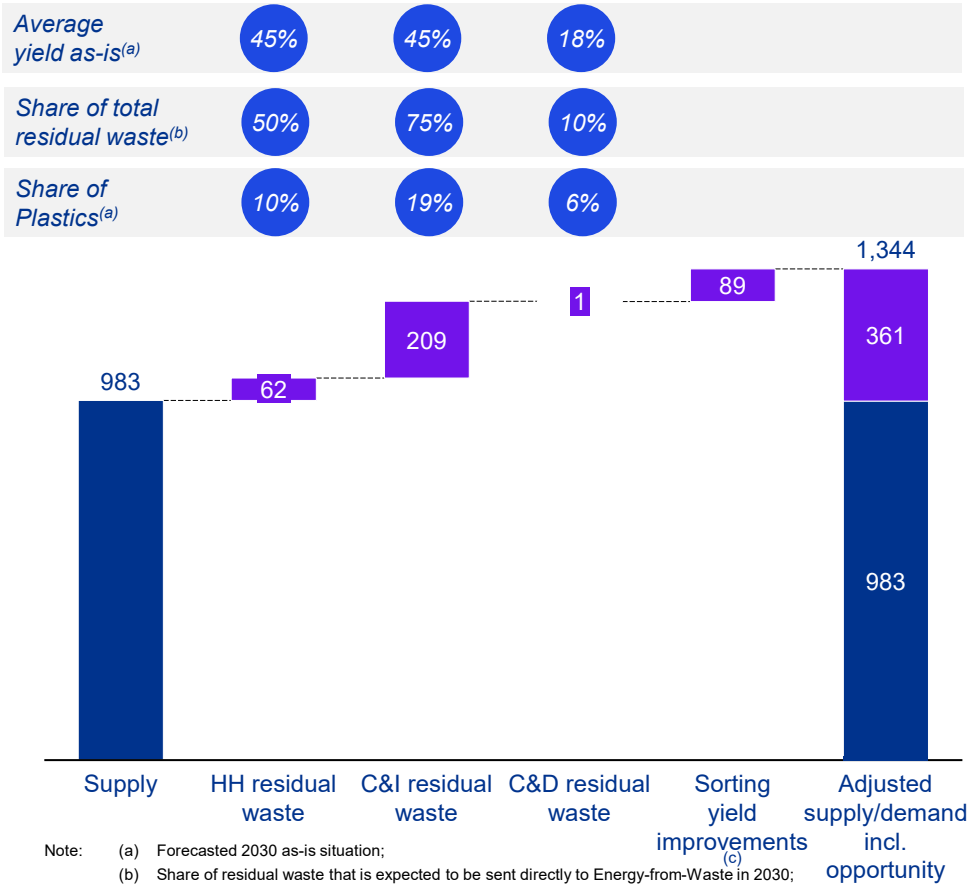
Legend: ● High ○ Low

Note: (a) Assuming that most imported residual waste originates from households;
(b) See opportunity 2;
(c) Dependent on level of pre-treatment before being exported.

Source: Interview programme; Eurostat; European Union; Dutch Government; KPMG analysis.

Post-sort all residual waste generated in the Netherlands: unsorted residual waste still accounts for a substantial volume of plastic waste

Opportunity 5: Post-sorting all collected Dutch residual waste *(household residual waste, C&I residual waste, C&D residual waste)*



Note: (a) Forecasted 2030 as-is situation;
(b) Share of residual waste that is expected to be sent directly to Energy-from-Waste in 2030;
(c) See opportunity 2.

Source: Interview programme; Eurostat; European Union; Dutch Government; KPMG analysis.

Opportunity description

- Post-sorting of all residual waste from households, C&I and C&D, generated in the Netherlands which is currently not sorted.
- Household waste from pre-sorting municipalities has an unsorted share which goes straight to incineration and could be sorted. Although experts indicate that the return on investment may not be viable, as the share of plastics within this unsorted share is lower.
- Almost all of the C&I residual waste goes straight to incineration. As residual waste composition can vary significantly depending on the source selective post-sorting could be an interesting opportunity. This could be achieved through smart routing of collection, accumulating residual waste with high plastic share for post-sorting.
- Selective post-sorting could be an opportunity for C&D waste, however share of plastics is significantly lower and return on investment is also lower.

Opportunity assessment

Quality of additional plastics	◔	Quality of post-sorted imported residual waste is generally low due to relative high pollution levels. However, plastics can still be upgraded to higher quality after sorting.
Return on investment	◕	Investment in additional post-sorting capacity will be required, while return will increase when incineration is taxed under ETS.
Ease of implementation	◕	Can be enforced through regulation or by cross-industry collaboration.

Legend: ● High ○ Low

Additional opportunities exist that could help to bridge the supply/demand gap, varying in size and ease of implementation

Additional opportunities (unquantified)

Additional opportunities (unquantified)	Description	Volume	Quality of additional plastics	Return on investment	Ease of implementation
Mining landfills	Landfills (primarily those with household waste) could contain between 4-8% plastics which could be utilised together with other resources. The quality of plastics is low (due to heavy contamination) and may be used for chemical recycling.	◕	◔	◔	◔
Importing plastic waste from (extra) EU countries	Developing countries and EU countries with less sophisticated waste infrastructure consume and dispose of significant volumes of plastic. Enabling import of this plastics waste might be required to fulfil Dutch recycling demand for plastics. This could also be a waste solution for these countries.	◕	TBD	◕	◕
Leakage in other waste streams	Better educating the population on correct disposal of material in the correct waste bin could prevent leakage of plastics into other waste streams. E.g. ~11kt of plastics end up in the organic waste stream per year.	◔	◔	◕	◑
Expired products in retail	These products (~6kt of plastics per year) go to incineration now and could be sorted and directed towards recycling instead.	◔	◔	◕	◕

Legend: ● High ○ Low

Source: Interview programme; Verkenning verduurzaming en mining voormalige stortplaatsen in Nederland; KPMG analysis.

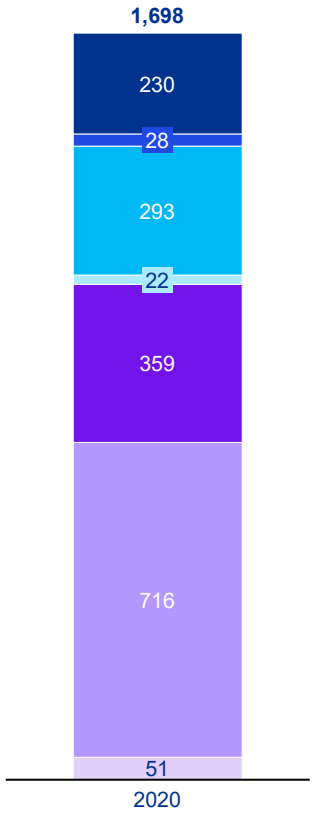
4.

Feedstock availability

Overview

Post consumer plastic waste can be categorised into seven different streams of which the residual accounts for the largest share

Overview of available post-consumer residual and addressable pre-sorted plastic waste value streams in the Netherlands[a], kt, 2020

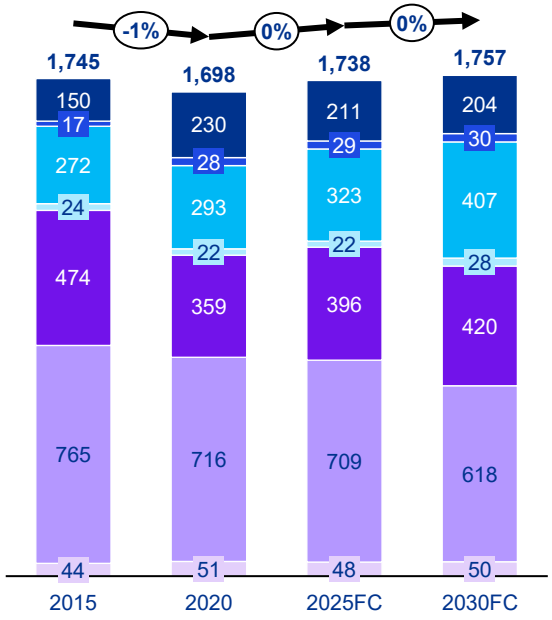


Stream type	Description
PRE-SORTED	
Household pre-sorted	The household pre-sorted waste stream mainly includes EPR-driven PMD (packaging) waste: **Plastic packaging**, metal packaging and beverage cartons (composite packaging). Deposit schemes contain pre-sorted monostream plastics as PET-bottles.
Other pre-sorted consumer waste	This stream contains plastics from sorted streams other than the pre-sorted and residual waste (e.g. bulky waste and civil amenities) and mainly contains **plastic rigids** and to a smaller degree **Styrofoam**.
Commercial pre-sorted waste	The pre-sorted commercial waste stream contains different plastic materials which are relatively easy to separate (e.g. **plastic packaging material**) and are less contaminated than household materials.
C&D pre-sorted waste	Pre-sorted C&D plastic waste contain plastics that are separated at a building and construction or demolition site. These plastics often contain a relatively large share of **PVC** in comparison to other waste streams.
RESIDUAL	
Household residual waste	The household residual stream contains many different materials (e.g. organic waste, paper and cardboard, **plastics**, glass, metals, incontinence materials, etc.). There are two types of household residual waste streams: (i) originating from municipalities with a pre-sorting system (containing relatively less plastics), and (ii) originating from municipalities with a post-sorting system (containing more plastics).
C&I residual waste	The commercial residual stream is similar to the household residual waste stream and contains many different materials (e.g. organic waste, paper and cardboard, **plastics**, glass, metals, etc.).
C&D residual waste	The C&D residual stream accounts for a relatively small share of plastic waste, which primarily contains **minerals** and **wood**.
Other waste streams[b]	*Plastics from other waste streams that fall outside the scope of this study, but do contain significant volumes of plastics (e.g. Automotive or Electrical & Electronics) – estimated around 104 kt in 2020*

Note: (a) Pre-sorted plastic volumes shown are actual plastic volumes after sorting into bales; This means that any weight losses (due to moisture and dirt) from the collection step are no longer included;
(b) Other waste streams are not further featured in the feedstock availability section of this report. Reported figure is sourced from Plastics Europe.
Source: CBS; Eurostat; Interview programme; KPMG analysis.

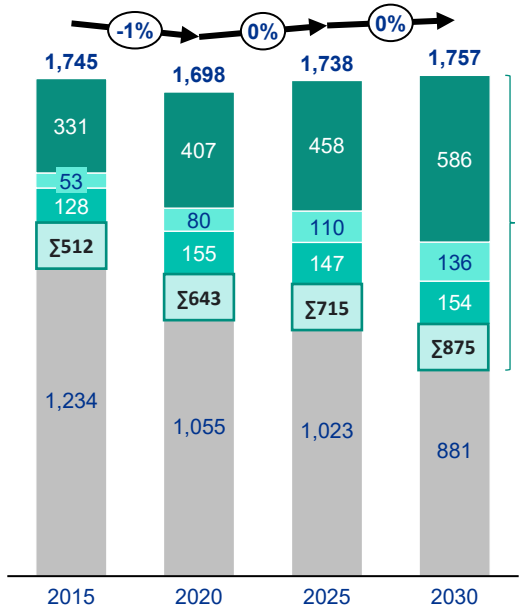
Total plastic feedstock in the Netherlands is expected to slightly increase, with increasing share of C&I pre-sorted and plastics from household residual waste

Overview of total plastics per waste stream, kt, 2015-2030FC



CAGR (%)	'15-'20	'20-'30FC
HH pre-sorted	8.9	(1.2)
Other pre-sorted	10.3	0.6
C&I pre-sorted	1.5	3.4
C&D pre-sorted	(2.3)	2.6
HH residual	(5.4)	1.6
C&I residual	(1.3)	(1.5)
C&D residual	2.6	(0.1)

Overview of sorting output available for recycling, kt, 2015-2030FC



Plastics available for reycling

CAGR (%)	'15-'20	'20-'30FC
Monostream	4.3	3.7
Mixed films	8.6	5.4
Mixed plastics	3.9	(0.1)
∑ Available	4.7	3.1
Unsorted	(3.1)	(1.8)

Shift from pre-sorting to post-sorting residual (households)

Shift from residual to pre-sorting (C&I)

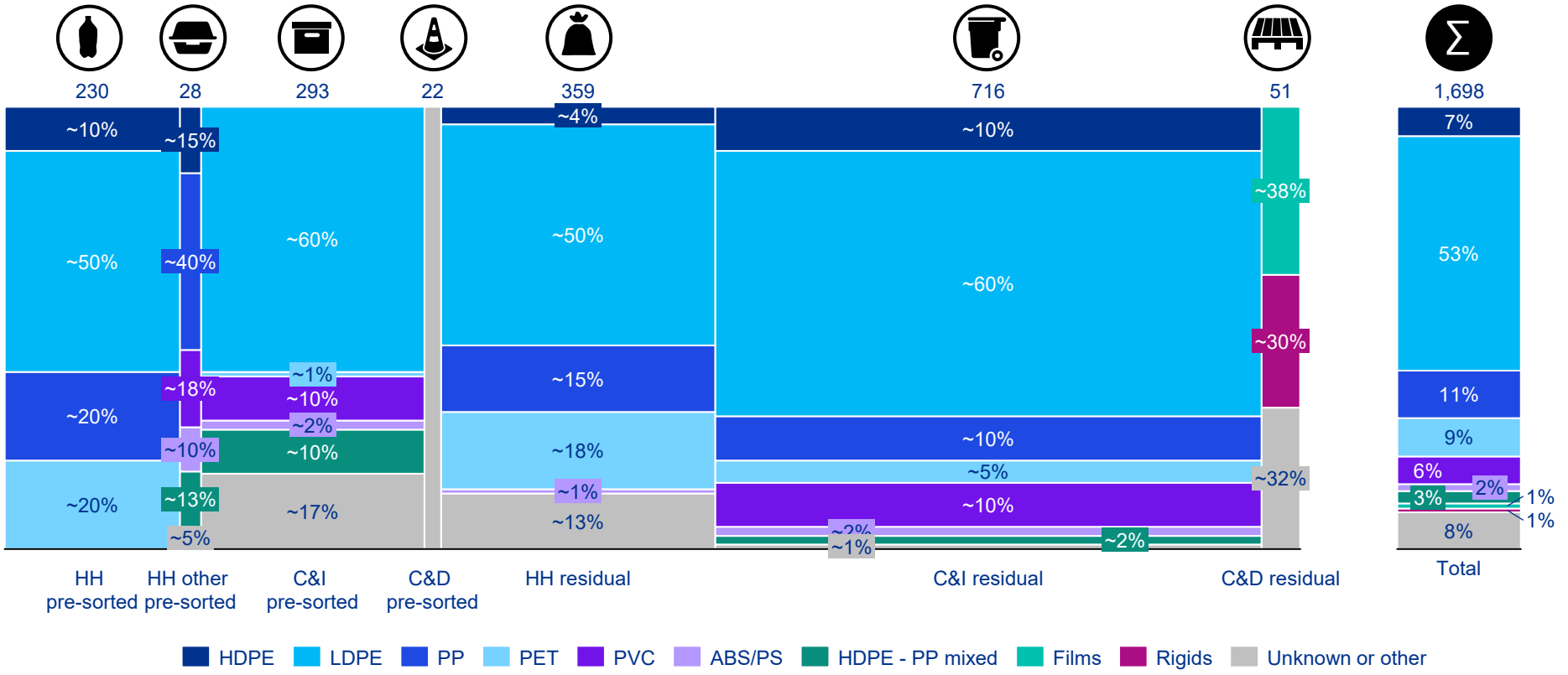
Improving sorting efficiency (for pre-sorting), design for recycling, increasing value of plastic waste

Increasing (post-)sorting leads to less unsorted plastics

Source: CBS; Eurostat; Interview programme; KPMG analysis.

Polyolefins (being LDPE, HDPE, and PP) account for the largest share of plastic waste with LDPE representing more than half of total plastic waste

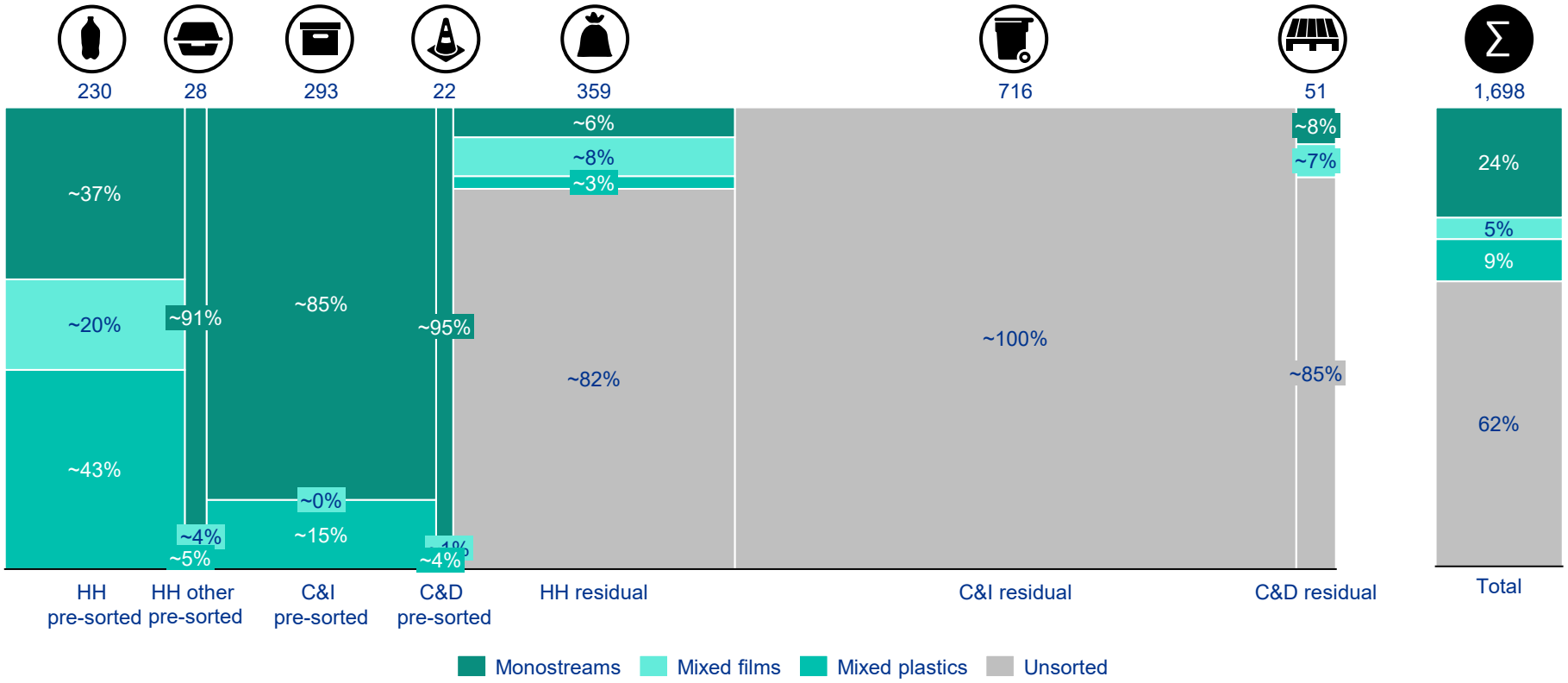
Overview of type of plastic per waste stream, kt, 2020



Source: CBS; Eurostat; Interview programme; KPMG analysis.

Sorting after collection of plastics often yield three output streams: monostreams, mixed plastics and mixed films – however, most plastics are unsorted

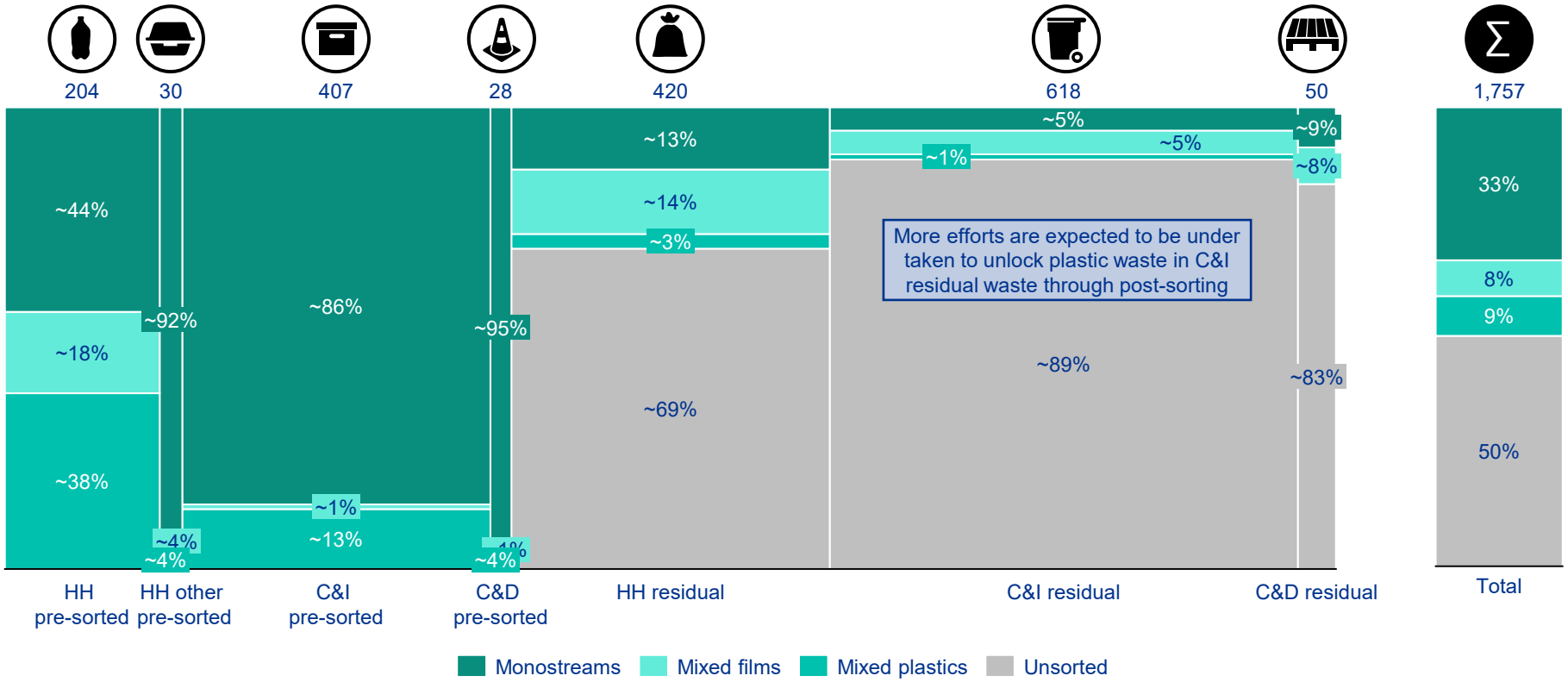
Overview of sorted type of plastic per waste stream[(a)], kt, 2020



Note: (a) Impurities are still present in presented monostreams, mixed films and mixed plastics volumes as this are sorted bales volumes.
Source: CBS; Eurostat; Interview programme; KPMG analysis.

By 2030 it is expected that post-sorting of C&I residual waste will have taken it's big first step

Overview of sorted type of plastic per waste stream[(a)], kt, 2030



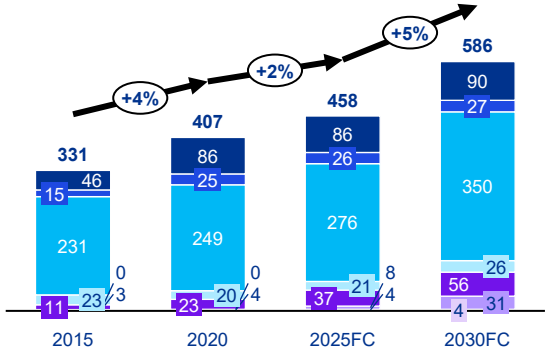
Note: (a) Impurities are still present in presented monostreams, mixed films and mixed plastics volumes as this are sorted bales volumes.
Source: CBS; Eurostat; Interview programme; KPMG analysis.

The share of plastics that will available as monostreams, mixed plastics, or mixed films is expected to increase as residual waste shifts to pre-sorting

Overview of monostream plastics, mixed plastics, mixed films, and unsorted plastics per waste stream, kt, 2015-2030FC

Total monostreams, kt

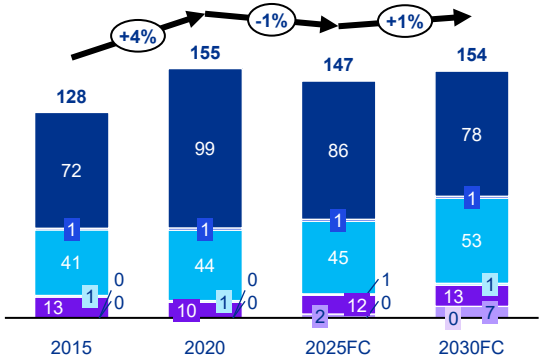
Est. share of monostreams in plastics, %



CAGR (%)	'20-'30FC
HH pre-sorted	0.6
Other pre-sorted	0.7
C&I pre-sorted	3.5
C&D pre-sorted	2.6
HH residual	9.4
C&I residual	n/a
C&D residual	0.8

Total mixed plastics, kt

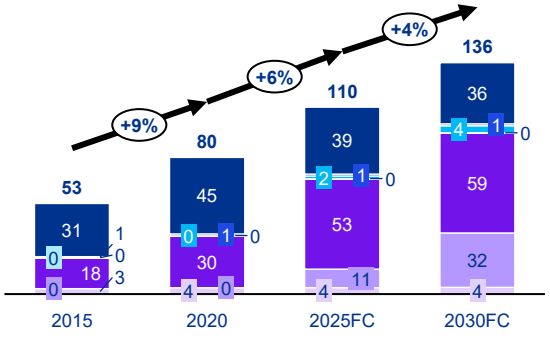
Est. share of mixed plastics in plastics, %



CAGR (%)	'20-'30FC
HH pre-sorted	(2.4)
Other pre-sorted	(1.6)
C&I pre-sorted	1.9
C&D pre-sorted	2.1
HH residual	3.0
C&I residual	n/a
C&D residual	n/a

Total mixed films, kt

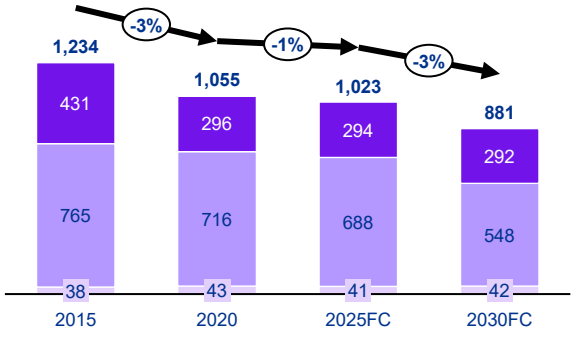
Est. share of mixed films in plastics, %



CAGR (%)	'20-'30FC
HH pre-sorted	(2.2)
Other pre-sorted	0.6
C&I pre-sorted	n/a
C&D pre-sorted	1.3
HH residual	6.8
C&I residual	n/a
C&D residual	0.8

Total unsorted plastics, kt

Est. share of unsorted plastics, %

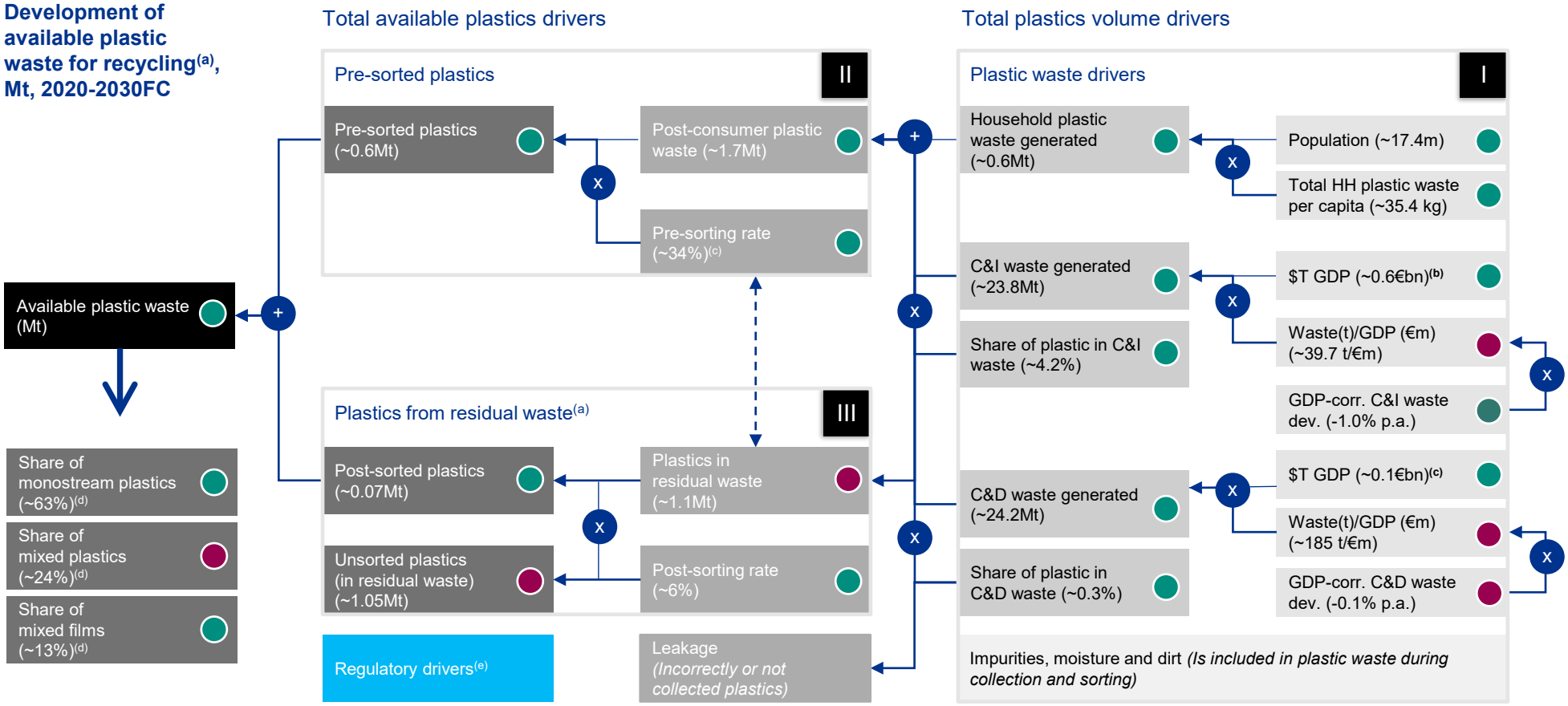


CAGR (%)	'20-'30FC
HH residual	(0.1)
C&I residual	(2.6)
C&D residual	(0.3)

Source: CBS; Eurostat; Interview programme; KPMG analysis.

Availability of plastic waste for recycling is expected to increase where increasing post-sorting will offset better sorting into monostreams

Development of available plastic waste for recycling[a], Mt, 2020-2030FC



Legend: Expected development: ● Increase ● Neutral ● Decrease.

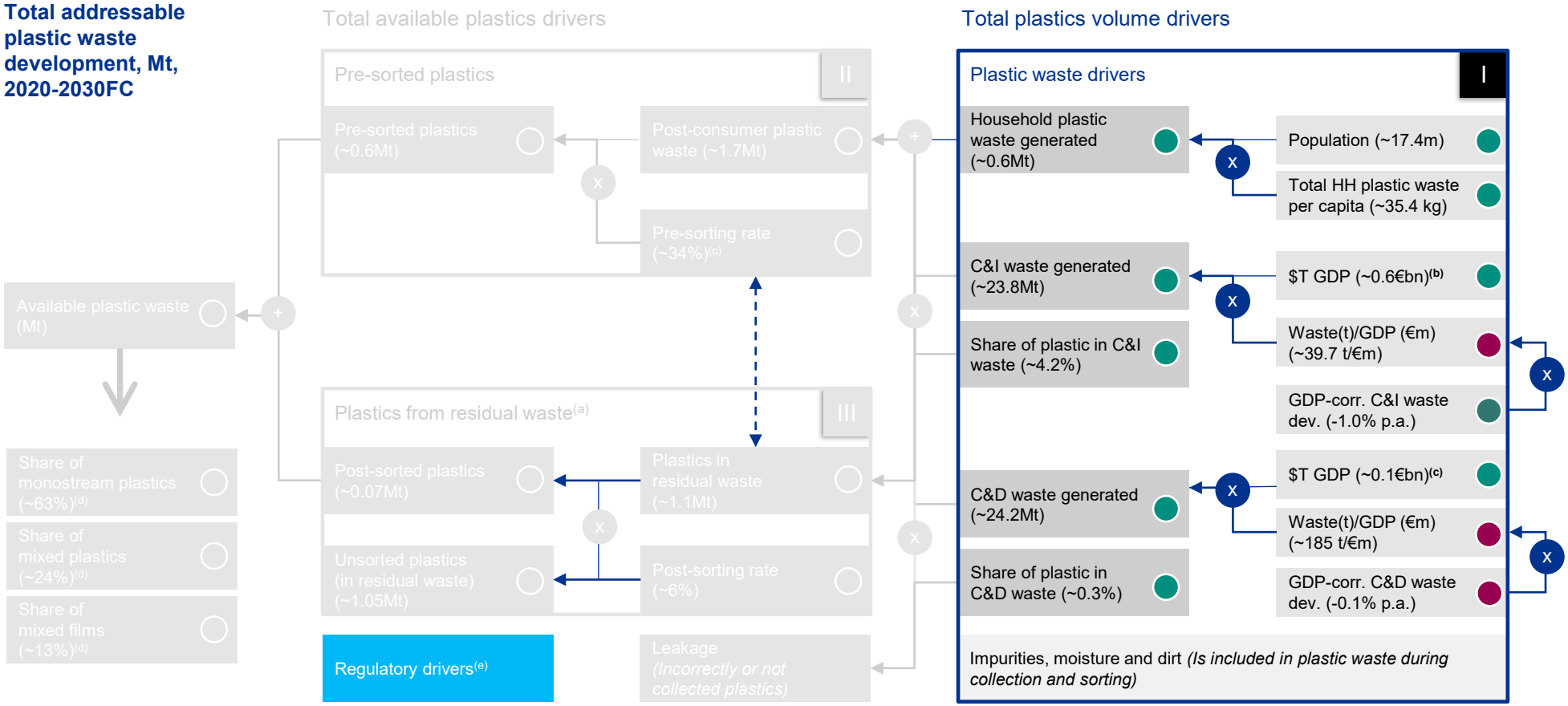
Note: (a) All plastic volumes that are presented are actual plastic volumes after sorting into bales – this means that weight from impurities, moisture and dirt are included; (b) Total GDP for C&I sectors (services, manufacturing and agriculture); (c) Total GDP for C&D sector (construction industry); (d) Concerns the weighted total % for both households, C&I and C&D together (e) Regulatory drivers affect the entire plastic waste value chain.

Source: CBS, Eurostat, Interview programme, KPMG analysis.

Plastic waste drivers

Total plastics put in the markets are expected to increase as population (household) and GDP (C&I, C&D) are expected to grow with some slowdown due to less plastic use

Total addressable plastic waste development, Mt, 2020-2030FC



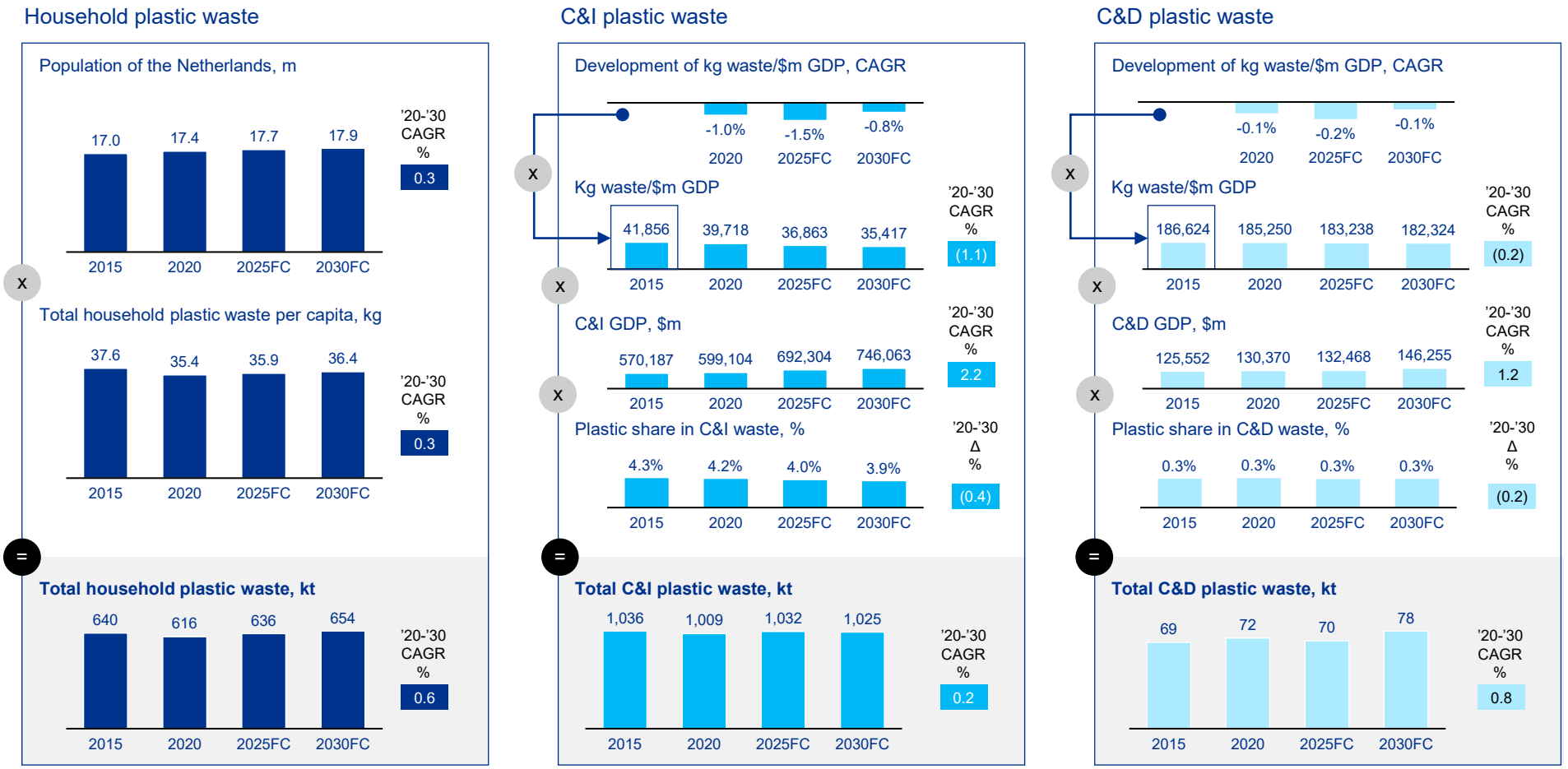
Legend: Expected development: ● Increase ● Neutral ● Decrease.

Note: (a) All plastic volumes that are presented are actual plastic volumes after sorting into bales – this means that weight from impurities, moisture and dirt are included; (b) Total GDP for C&I sectors (services, manufacturing and agriculture); (c) Total GDP for C&D sector (construction industry); (d) Concerns the weighted total % for both households, C&I and C&D together (e) Regulatory drivers affect the entire plastic waste value chain.

Source: CBS, Eurostat, Interview programme, KPMG analysis.

Post-consumer plastic waste is estimated to increase, primarily driven by growing population, plastic waste per capita, commercial GDP and construction GDP

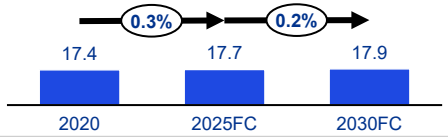
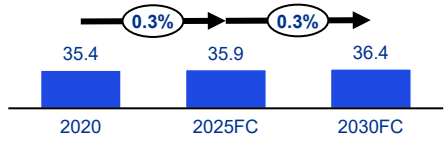
Build-up of forecast household, C&I and C&D plastic waste, 2015-2030FC



Source: Eurostat; United Nations; IMF; OECD; interview programme; KPMG analysis.

Plastic consumption per capita is expected to grow slightly as plastic remains a valuable product, however regulatory- and sustainability trends pressures demand

Key underlying drivers impacting the demand for household plastic consumption

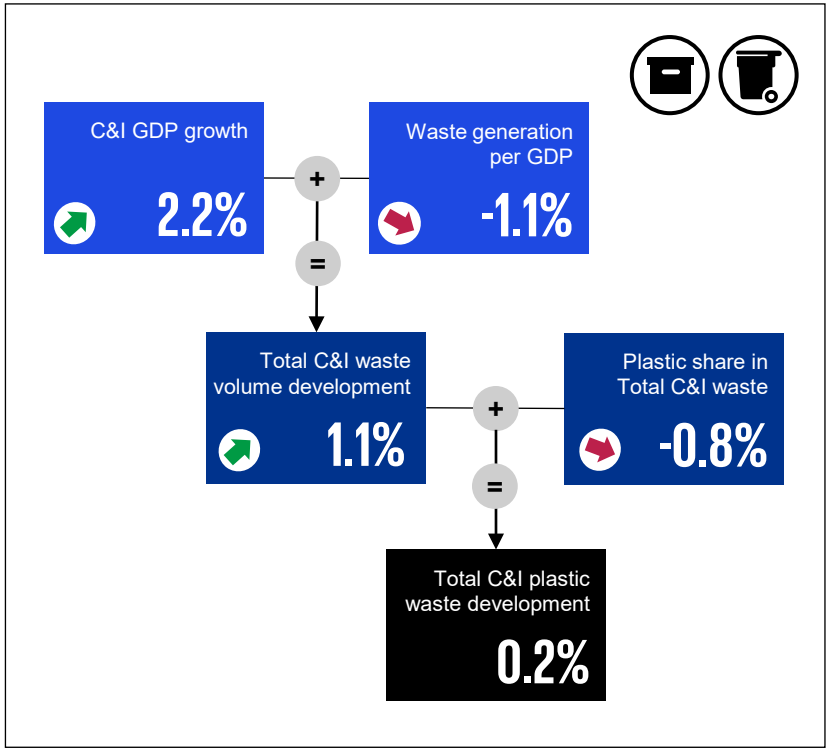
Main driver	Description	Impact on demand: Direction	Impact on demand: Degree	Selected interview feedback and supporting observations
Population growth	• The Dutch population is expected to increase by ~ 0.3% p.a. • The combined effects of positive net migration and an aging population lead to a relatively stable population growth.	●	◑	Dutch population, #m, 2020-2030FC 
Household plastic waste per capita	• Despite expected decreasing household waste generation towards 2030, plastic household waste per capita is expected to increase 0.3% p.a. towards 2030. • Increased regulation against plastic usage could have a large impact on plastic waste generation up to and beyond 2030.	●	◕	Dutch household plastic waste per capita, kg, 2020-2030FC 
Consumer and producer awareness	• Over the last decade, both consumers and producers have become increasingly aware about the impact of their behaviour on the environment. • As a result, initiatives have been started to reduce the use of (single-use) plastics. These initiatives are aimed at both consumers and producers. This trend is expected to continue going forward.	●	◔	*"As Unilever we have defined a number of ambitious goals, such as decreasing the volume of new plastics with 50%, making increased use of recycled plastic, and increasing renewable packaging."* – Unilever *"The new deposit system has officially began on the 1st of July 2021. Since this date consumers have to pay (and can receive back) 0.15 eurocents for each small plastic bottle of 0.5 litres and 0.25 eurocents for larger bottles."* – Statiegeld Nederland
Risk of plastic substitution	• In many cases, plastics often does not have any cost-competitive and/or functional alternatives in its core applications such as packaging. • Additionally, interview feedback suggests that from a carbon footprint point of view, plastics can still outperform other materials.	●	◑	*"Plastics are used because they are extremely useful and versatile as a material, you cannot simply replace them in many applications."* – Dutch waste management company *"Yes, through waste leakage in oceans, plastics causes significant environmental concerns. However, its carbon footprint is actually smaller than for instance glass in packaging."* – Dutch recycler
Digital economy	• The Netherlands is one of the frontrunners in Europe with respect to the digitalisation of its economy, which negatively impacts the use of tangible plastic goods.	●	◔	*"Digitalisation is important now and in the long-term for the welfare of citizens in the Netherlands; we aim to increase digitalisation in the manufacturing industry, healthcare, energy and mobility sectors as part of the digital agenda."* – Dutch government
Regulation	• New EU and Dutch regulations are focusing on 'reducing and reusing' of plastics.	●	◕	*"Since July 2021 there is a Dutch ban on the sale of a selection of single use plastic products."* – Dutch government

Key: ● Increase ● Decrease ● High impact ○ Low impact.

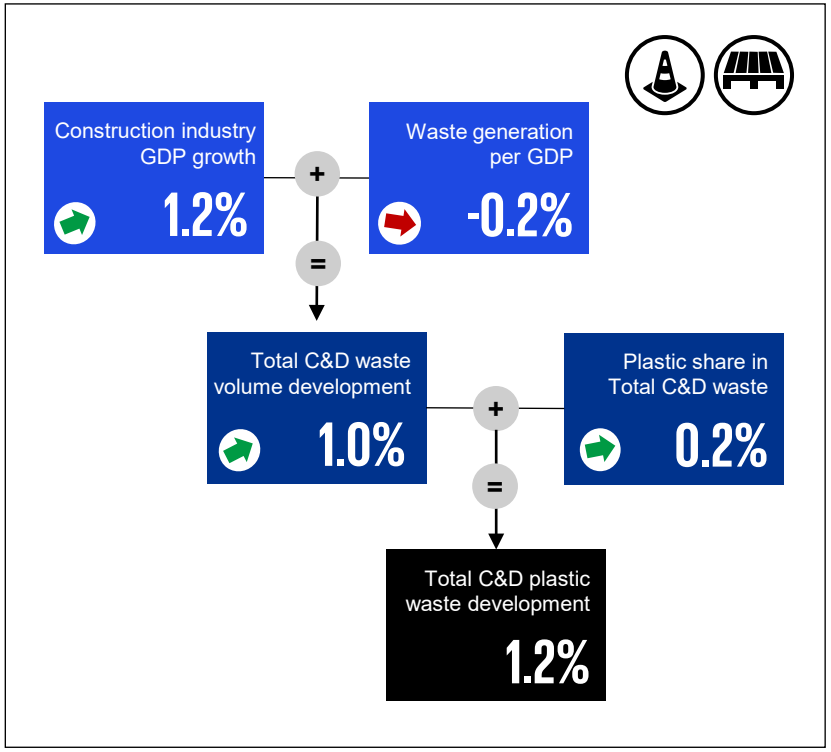
Source: Interview programme; CBS; Eurostat; Rijksoverheid; Statiegeld Nederland; United Nations; Statista; Unilever; KPMG analysis.

C&I and C&D plastic waste generation are both projected to increase driven by economic improvement which is slowed down by decreasing waste generation per GDP

Build-up of forecast CAGR for total C&I plastic waste generation, 2020-2030FC



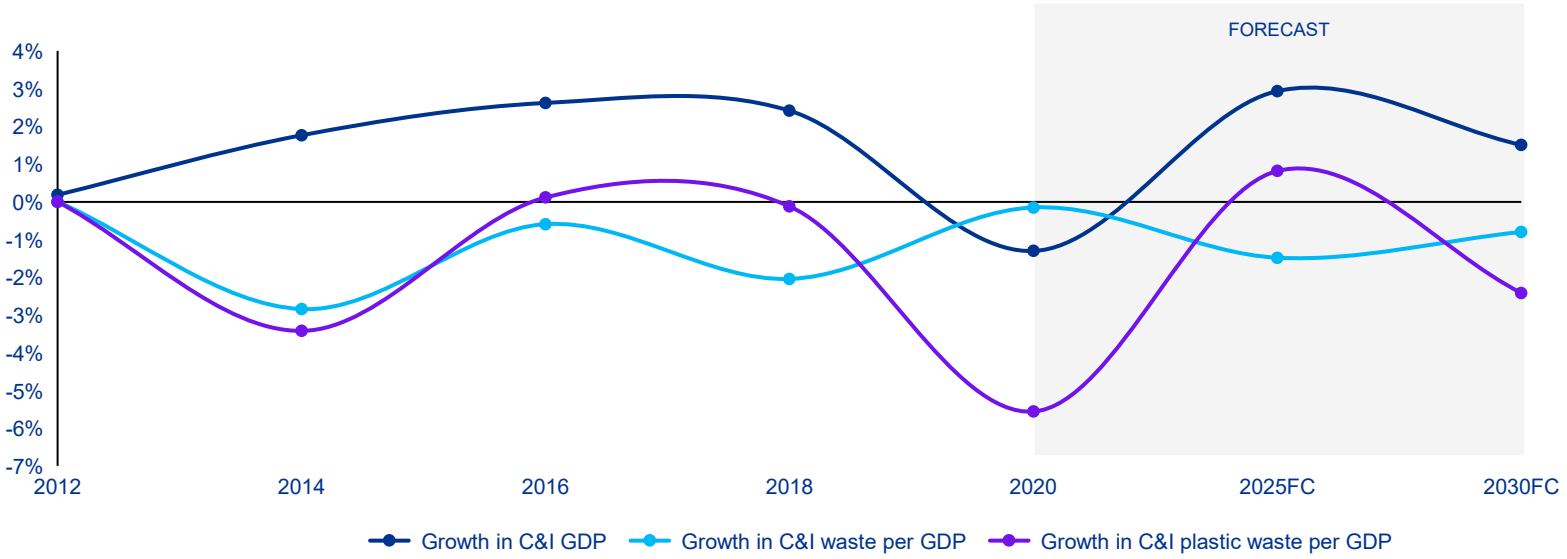
Build-up of forecast CAGR for total C&D plastic waste generation, 2020-2030FC



Source: Interview programme; CBS; Eurostat; Statista; KPMG analysis.

C&I plastic waste per GDP has mostly decreased and is expected to continue doing so in line with increasing environmental awareness, regulations and digitalisation efforts

Annual growth of C&I (plastic) waste and real GDP per capita, %



Historic: Increasing environmental awareness, regulations and digitalisation efforts have historically led to decreasing C&I plastic waste per GDP between 0% and 6%. Covid caused a steep short-term drop in C&I plastic waste generation per €m of GDP.

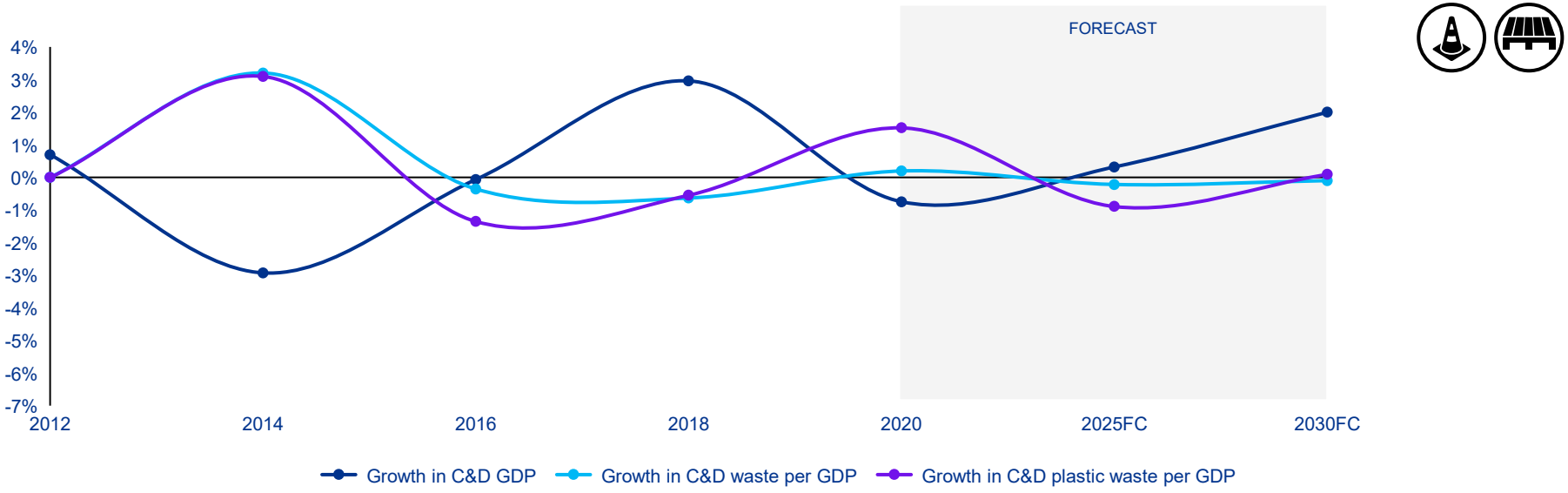
Despite a significant drop caused by covid (one-off) it is expected that this will normalise to pre-covid levels.

Future: Dutch companies are expected to produce relatively less waste per €m of GDP, particularly in the services and manufacturing industries. GDP is expected to grow again while increased environmental awareness, regulation and digitalisation are drivers for reducing underlying (plastic) waste generation.

Source: Eurostat; IMF; OECD; KPMG analysis.

C&D (plastic) waste per GDP has been decreasing due to increased environmental awareness but is expected to be offset by the increasing application of plastics

Annual growth of C&D (plastic) waste and real GDP per capita, %



Historic: Environmental awareness has been driving down C&D plastic waste per GDP. However, over the past decades plastics have been increasingly applied in the building and construction sector, resulting in an expected slight increase of C&D plastic waste per GDP The construction industry has been growing since 2014 until the PFAS/nitrogen crisis in 2019.

Future: C&D GDP is expected to normalise towards 2025 despite the PFAS/nitrogen crisis. C&D waste per GDP increased in 2020 as a direct result of an increase in renovation waste, caused by the covid crisis.

Underlying plastic share within C&D waste has slightly decreased historically driven by environmental awareness at C&D companies (plastic packaging), but is expected to slightly increase due to increasing plastic application in building and construction materials.

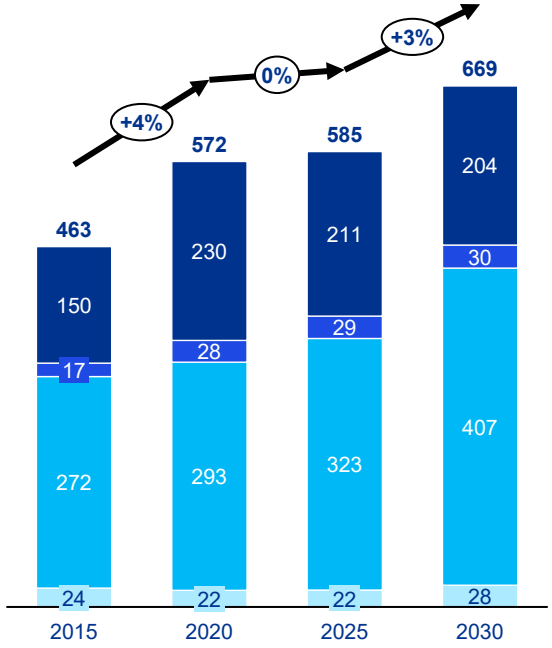
Source: Eurostat; IMF; OECD; KPMG analysis.

Pre-sorted plastics

Pre-sorted plastic volumes are expected to increase significantly driven mainly by more source separation by the industry

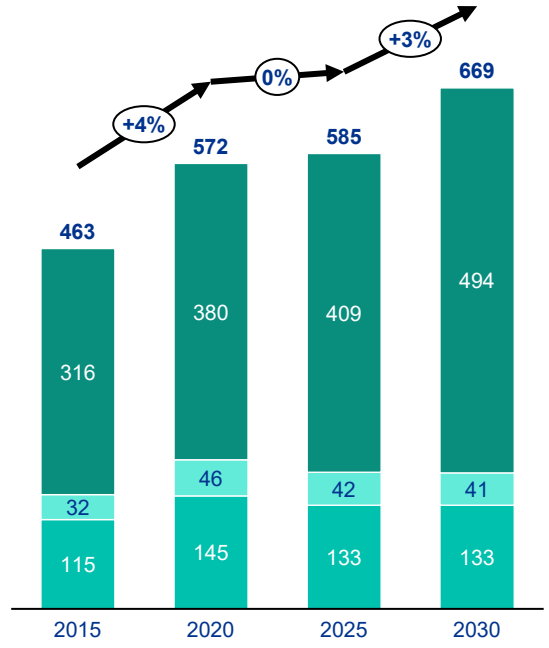
Overview of household, C&I and C&D residual plastics volumes, mixed plastics and mixed films volumes, kt, 2015-2030FC

Pre-sorted waste plastics, kt



CAGR (%)	'20-'30FC
HH pre-sorted	(1.2)
Other pre-sorted	0.6
C&I pre-sorted	3.4
C&D pre-sorted	2.6

Mixed plastics, mixed films and monostream development, kt



CAGR (%)	'20-'30FC
Monostream	2.7
Mixed films	(1.1)
Mixed plastics	(0.9)

Source: CBS; Eurostat; Interview programme; KPMG analysis.

The majority of the pre-sorted plastics in the Netherlands are sent to recycling as these streams are the most easiest to sort and upgrade

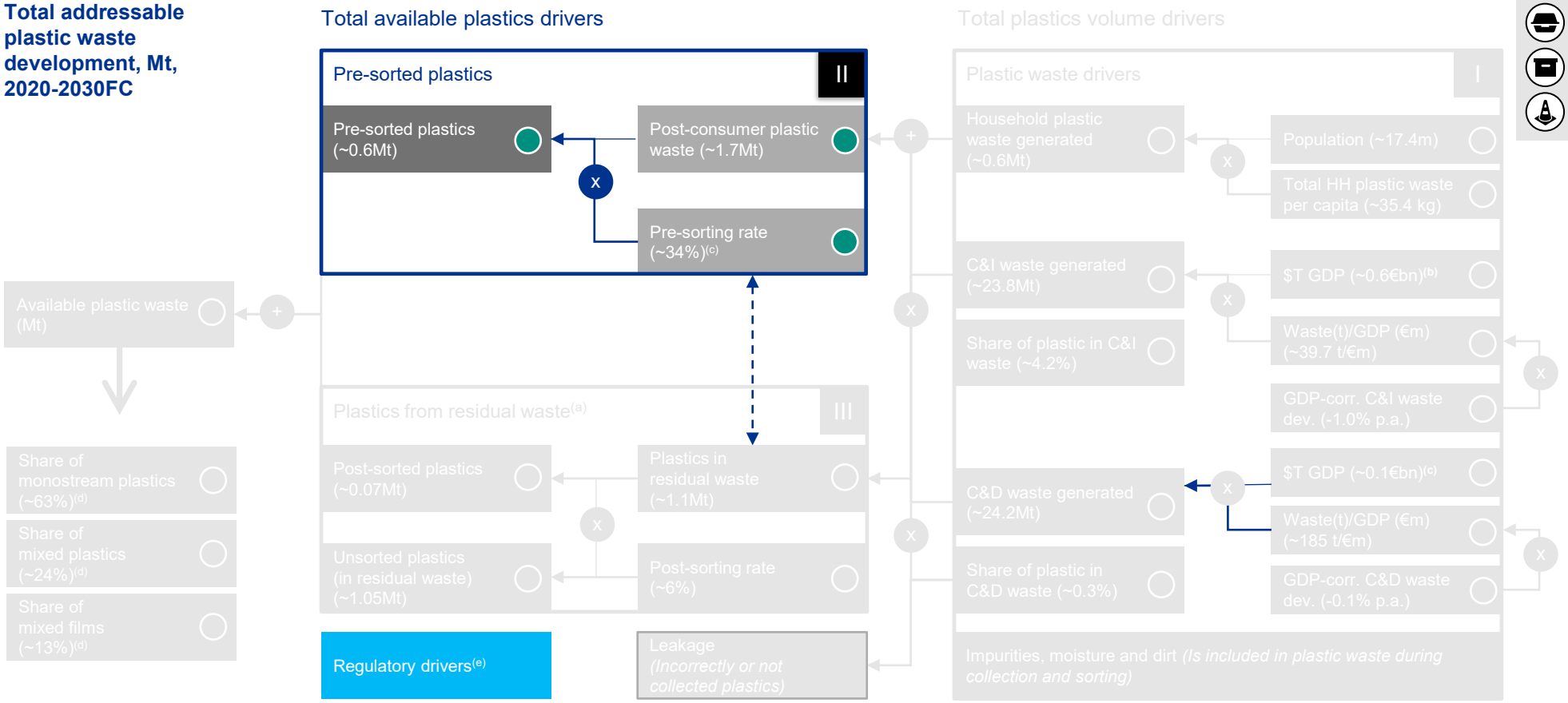
Flow of post-consumer plastic waste from pre-sorted waste streams to final processing step in Netherlands, kt, 2020

Pre-sorted plastic volumes shown are actual plastic volumes after sorting into bales; meaning that any weight losses (due to moisture and dirt) from the collection step are no longer included

Note: (a) Pre-sorted plastic volumes shown are actual plastic volumes after sorting into bales; This means that any weight losses (due to moisture and dirt) from the collection step are no longer included.
Source: CBS; Eurostat; Interview programme; KPMG analysis.

Pre-sorted plastics volumes are expected to increase, primarily driven by the increasing pre-sorting rate of C&I plastics

Total addressable plastic waste development, Mt, 2020-2030FC



Legend: Expected development: ● Increase ● Neutral ● Decrease.

Note: (a) All plastic volumes that are presented are actual plastic volumes after sorting into bales – this means that weight from impurities, moisture and dirt are included; (b) Total GDP for C&I sectors (services, manufacturing and agriculture); (c) Total GDP for C&D sector (construction industry); (d) Concerns the weighted total % for both households, C&I and C&D together (e) Regulatory drivers affect the entire plastic waste value chain.

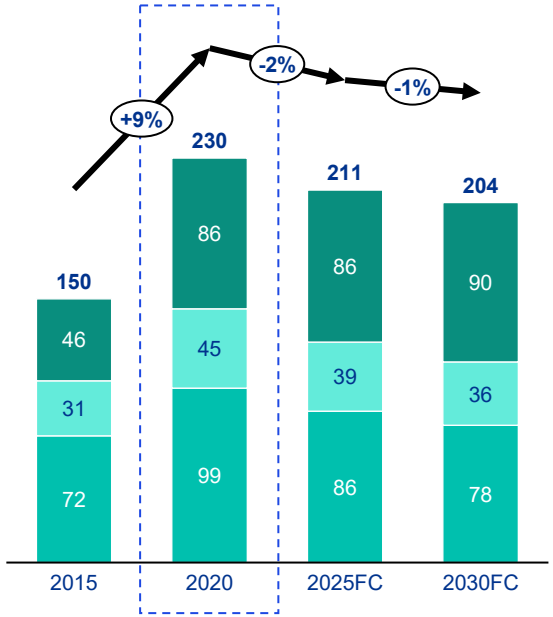
Source: CBS, Eurostat, Interview programme, KPMG analysis.

KPMG

Household pre-sorted

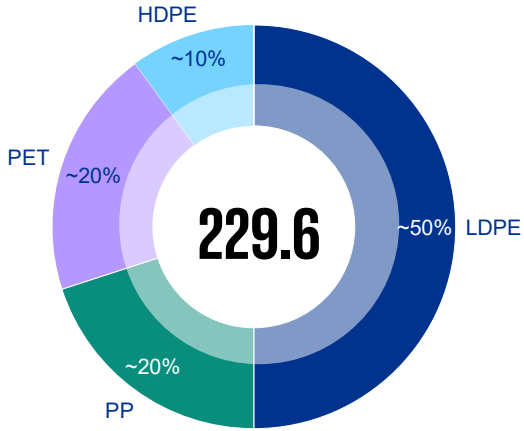
The household pre-sorted plastic waste stream is a mature stream which is expected to yield a higher share of monostreams towards 2030

Household pre-sorted plastics: sorting output, kt, 2015-2030FC



CAGR (%)	'20-'30FC
Monostream	0.6
Mixed films	(2.2)
Mixed plastics	(2.4)

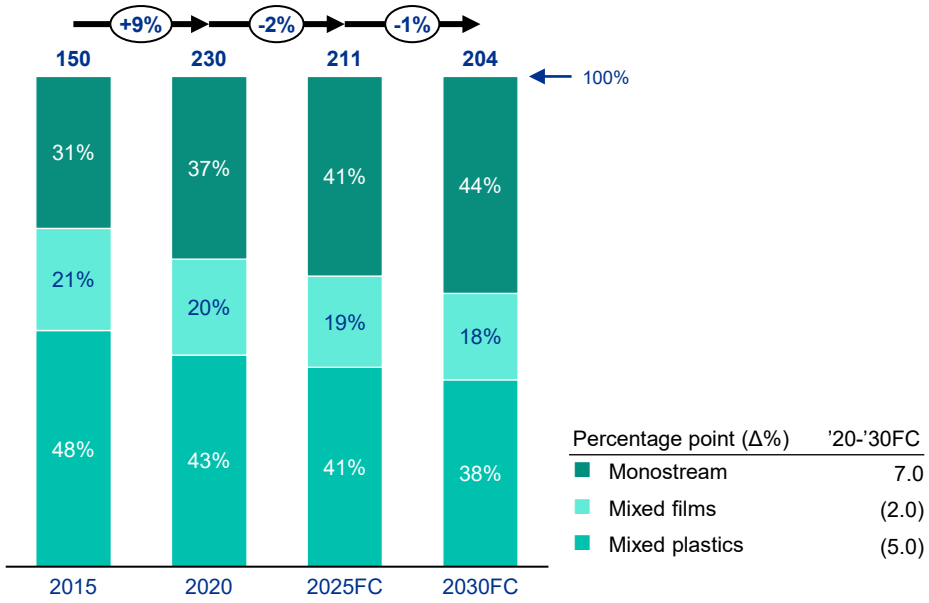
Composition of household pre-sorted plastic waste[(a)], kt, 2020



Note: (a) Rounded for data confidentiality purposes.
Source: Eurostat; IMF; OECD; Interview programme; KPMG analysis.

Share of monostreams are expected to increase towards 2030 at the expense of MP and MF, driven by technological advancements and design of plastics

Mixed plastics, mixed films and monostreams in HH pre-sorted plastic waste, %, kt, 2015-2030FC



Percentage point (Δ%)	'20-'30FC
Monostream	7.0
Mixed films	(2.0)
Mixed plastics	(5.0)

The share of mixed plastics and mixed films in household pre-sorted is expected to decrease towards 2030 driven by a variety of factors

Technological advancements are expected to increase sorting yield.

Design for recycling initiatives are expected to enhance ease of sorting.

> We are adding good quality plastics to the mixed plastics stream to make sure these are on spec." – Waste management company

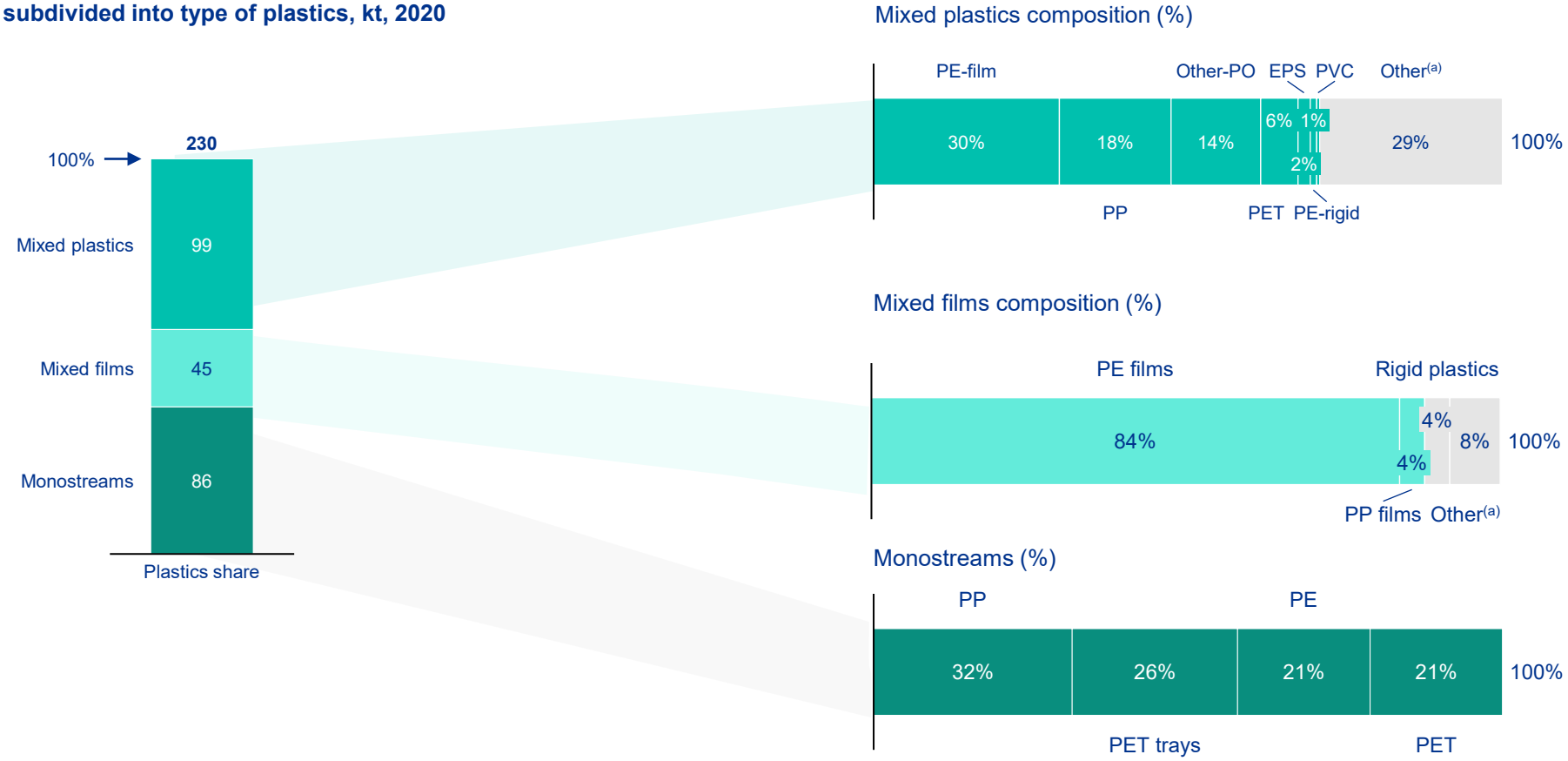
"Regarding the share of monostreams in household pre-sorted waste, I would say around 60-70%. There will always be plastics which cannot be sorted into monostreams such as multilayer plastics or other 'non-sortables' such as black plastics." – Professor Circular Plastics

"The share of the mixed plastics stream will decrease over time due to technological advancements of sorting equipment." – Large plastics sorting company

Source: CE Delft; Interview feedback; KPMG analysis.

Plastics from pre-sorted PMD currently breaks down into 99kt mixed plastics, 45kt mixed films and 86kt monostreams with their own specific plastic composition

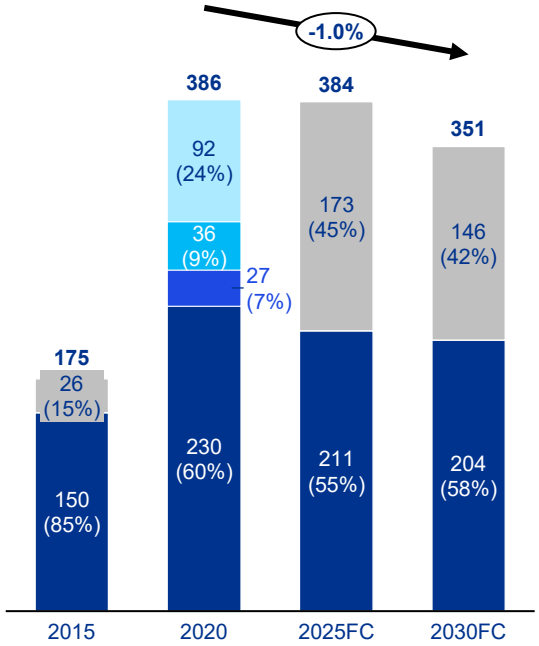
Overview of household pre-sorted waste after sorting of PMD, subdivided into type of plastics, kt, 2020



Note: (a) Other includes other plastics, metals, paper/ cardboard and residues.
Source: Interview programme; CBS; NTCP; CE Delft; Eurostat; KPMG analysis..

Household pre-sorted PMD and share of plastics within PMD are both expected to decrease over time, primarily driven by increased post-sorting

Household pre-sorted waste volumes and composition, kt, 2015-2030FC



CAGR (%)	'15-'20	'20-'25FC	'25-'30FC
Residue	n/a	n/a	n/a
Paper and cardboard	n/a	n/a	n/a
Metal	n/a	n/a	n/a
Other fractions	43.4	2.1	(3.3)
Plastics	9.0	(1.7)	(0.7)

The HH pre-sorted waste stream is expected to decrease with 1.0% p.a. until 2030 – share of plastics within household pre-sorted waste is expected to decrease towards 2025 and to recover afterwards

Expected significant increase in post-sorting of HH waste causes household pre-sorted volumes to slightly decrease. Refer to next pages for further explanation on increase in post-sorting.

Since 2015 there has been a large increase in plastic, paper and metal pre-sorted packaging due the introduction of the PMD system in the Netherlands. However, the share of residue within PMD (i.e. PMD pollution) has gradually increased. The gradual increase of residue has multiple causes, among which the increasing introduction of the diftar system at municipalities and offering PMD waste in opaque instead of transparent bags.

Decrease in share of plastics within PMD is partly offset by expected decrease in share of metal packaging, driven by the implementation of a deposit scheme for metal cans in 2023. New Nedvang policies are expected to decrease pollution towards 2030.

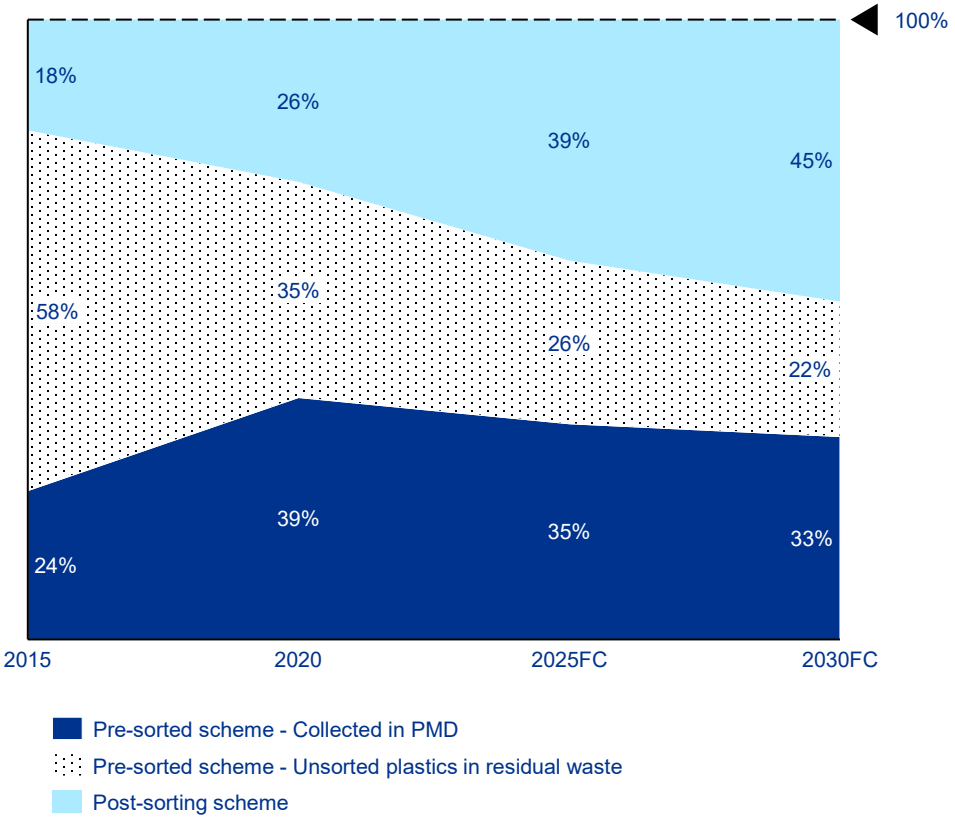
> "The residue fraction has significantly increased over the past years, caused by increased residual waste costs which encouraged pollution in other waste streams" – Waste management expert

"The plastic share within household pre-sorted waste is definitely largest compared to metal and paper and cardboard." – Industry expert

Source: Eurostat; CBS; KPMG analysis; Interview programme.

Plastics collected for further sorting and recycling is expected to increase towards 2030, primarily driven by increasing post-sorting at the expense of pre-sorting

Historical development and forecast of household plastics waste sorting[(a)], %, 2015-2030FC – Indicative



The household pre-sorted waste stream is expected to decrease due to increasing share of post-sorting

The household pre-sorted stream is dependent on the share of municipalities which opt for pre-sorting waste rather than post-sorting.

Since 2015 there has been a large increase in plastic, paper and metal pre-sorted packaging due the introduction of the PMD system in the Netherlands.

Within municipalities with a pre-sorting scheme, plastic pre-sorting rate is expected to increase to ~60% in 2030, based on pre-sorting rates of more mature waste materials.

> "The introduction of PMD in 2015 has increased the pre-sorting rate, however there is still room for improvement." – Waste collector

"Even in municipalities opting for pre-sorting schemes, a lot of (plastic) waste still ends up in the residual bin." – Industry expert

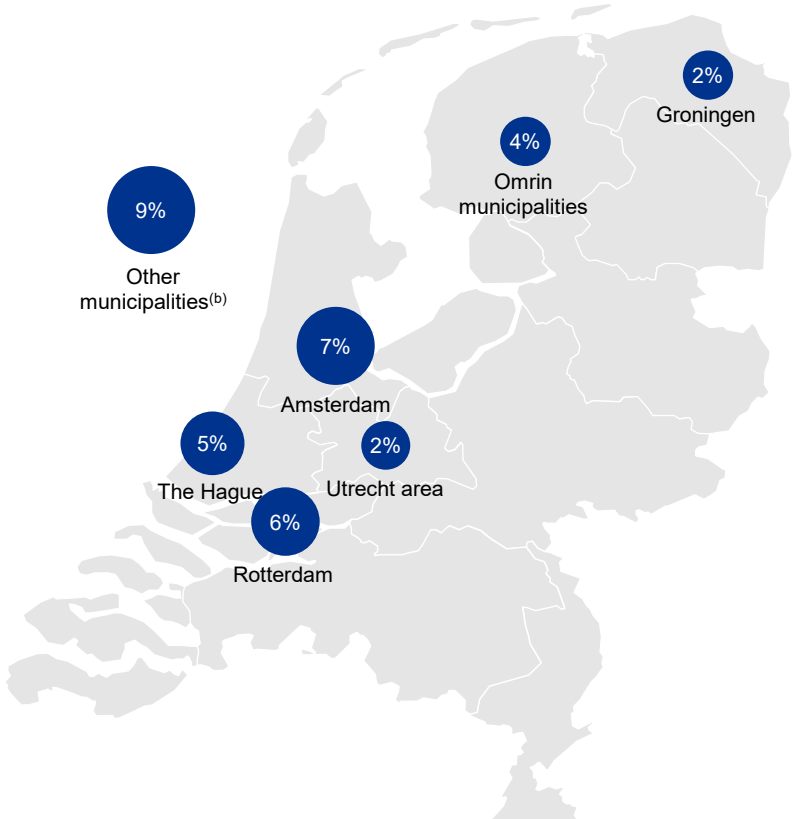
"The quality of the pre-sorted stream is highly dependent on the sorting discipline of households. Due to increased consumer awareness this quality gets better." – Waste collector

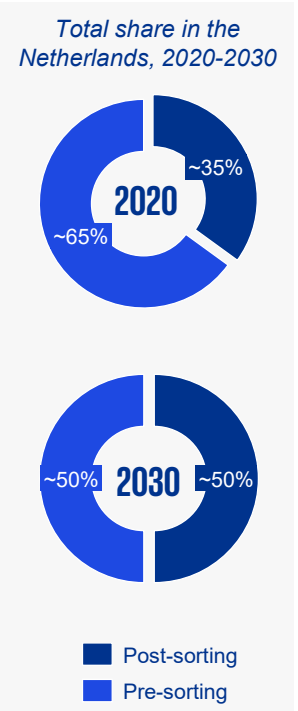
Note: (a) Municipalities that opt for a post-sorting system have, generally speaking, higher residual waste volumes, because PMD and other (heavier) waste fractions (such as organic waste) end up in residual waste. Hence, share of plastics ending up in a post-sorting scheme is lower than share of total residual waste being post-sorted.

Source: Eurostat; IMF; OECD; Interview programme; KPMG analysis.

Approximately 35% of residual waste in the Netherlands is produced in municipalities that have opted for post-sorting, this is expected to increase towards 50% in 2030

Share of total household residual waste in the Netherlands of municipalities that have opted for post-sorting (%), 2020-2030FC[a] – Indicative





> I expect some additional municipalities to opt for post-sorting in the next 10 years, however many municipalities will likely stick with pre-sorting as they have historically developed good pre-sorting systems and discipline." – Post-sorting expert

> Currently, some municipalities still apply both pre- and post-sorting for plastics. It is however preferred and expected that municipalities will choose either option." – Industry expert

> Post-sorting is the significantly less costly option for municipalities, and also has environmental benefits in terms of fewer transport emissions." – Industry expert

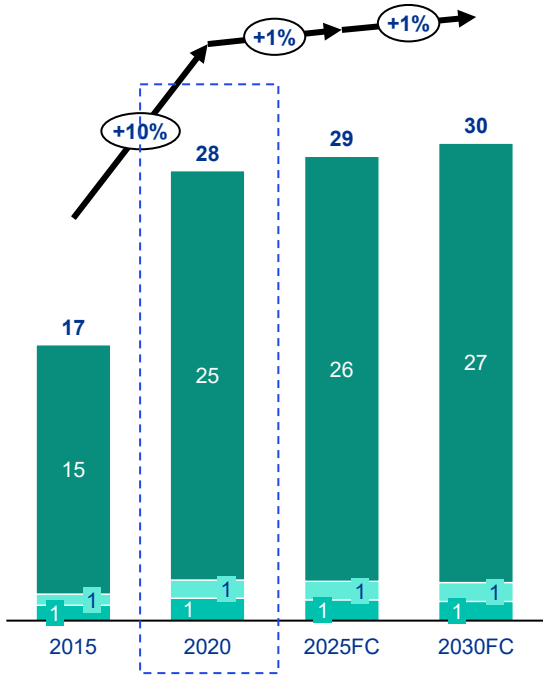
> Post-sorting is a good alternative for municipalities with inherently poor pre-sorting rates due to for instance lower literacy or higher non-native populations, often in highly urban areas." – Post-sorting expert

Note: (a) Some municipalities currently apply a mix of both pre- and post-sorting;
(b) Other municipalities mainly concern smaller municipalities located in the Randstad area.
Source: CBS; Eurostat; Interview programme; KPMG analysis.

Other pre-sorted consumer

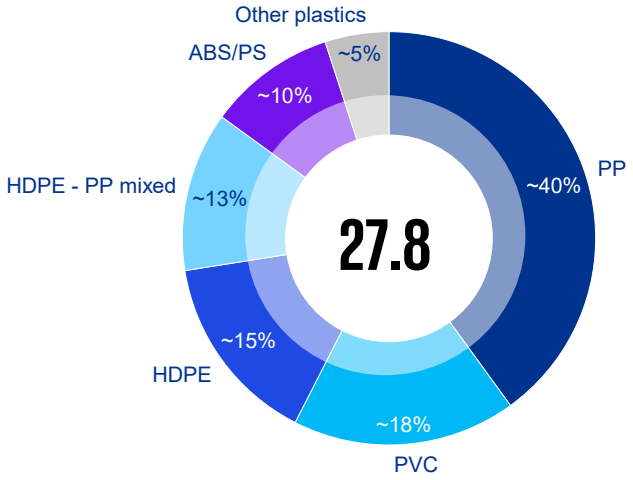
Other pre-sorted plastics is a small stream of plastics primarily originating from civic amenities with a high share of monostreams

Other pre-sorted plastics: sorting output, kt, 2015-2030FC



CAGR (%)	'20-'30FC
Monostream	0.7
Mixed films	0.6
Mixed plastics	(1.6)

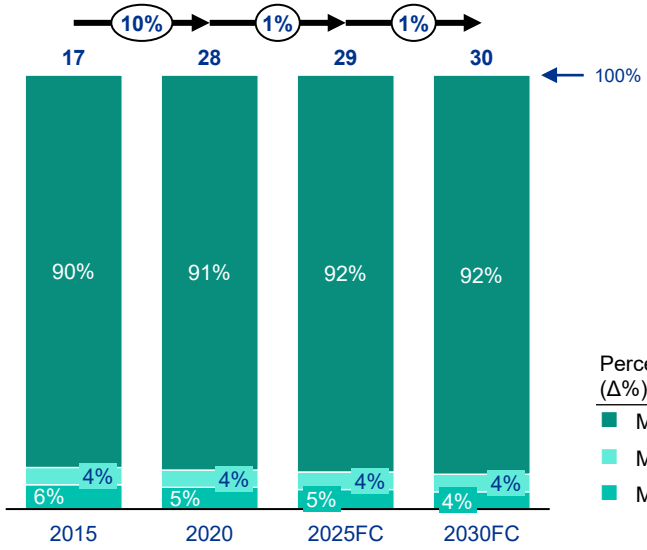
Composition of Other pre-sorted plastic waste[(a)], kt, 2020



Note: (a) Rounded for data confidentiality purposes.
Source: Eurostat; IMF; OECD; Interview programme; KPMG analysis.

Both mixed plastics as mixed films are expected to remain a small share of the total other pre-sorted plastic volumes given the maturity of the waste stream

Mixed plastics and mixed films and monostreams in other pre-sorted plastics, kt, 2015-2030FC



Percentage point (Δ%)	'20-'30FC
Monostream	1.0
Mixed films	0.0
Mixed plastics	(1.0)

Further break-down into plastic types within monostream, mixed films or mixed plastics is unavailable

The volume of plastics from other pre-sorted waste from households will increase slightly over time, however total volumes are negligible

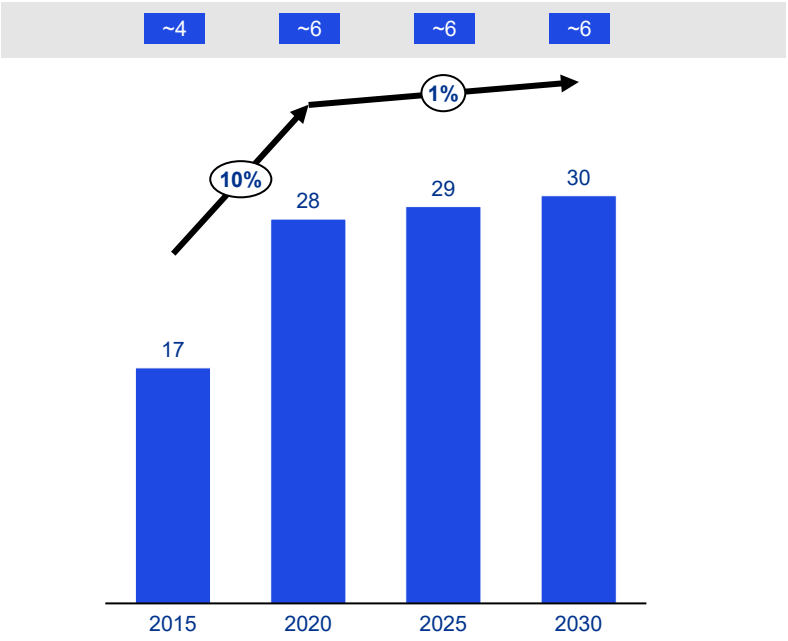
In general, collected Other pre-sorted plastics (primarily from civic amenities) are not heavily polluted, resulting in a higher share of monostreams.

Types of polyolefins present in the household pre-sorted waste stream are mostly PP and HDPE. These types can be found in for example garden furniture or toys.

Source: CBS; Eurostat; Interview programme; KPMG analysis..

Total generated other pre-sorted plastic waste is expected to slightly increase towards 2030, primarily driven by underlying consumption

Other pre-sorted plastics, kt, 2015-2030FC



Estimated plastics share in total household other pre-sorted waste (%)

Separate collection of other pre-sorted household waste (i.e. bulky waste, civic amenities, domestic appliances) is already relatively mature and is mainly driven by the underlying consumption of these goods which is expected to slightly increase alongside GDP.

"There is only a small share of plastics in other pre-sorted household waste. " – Industry expert

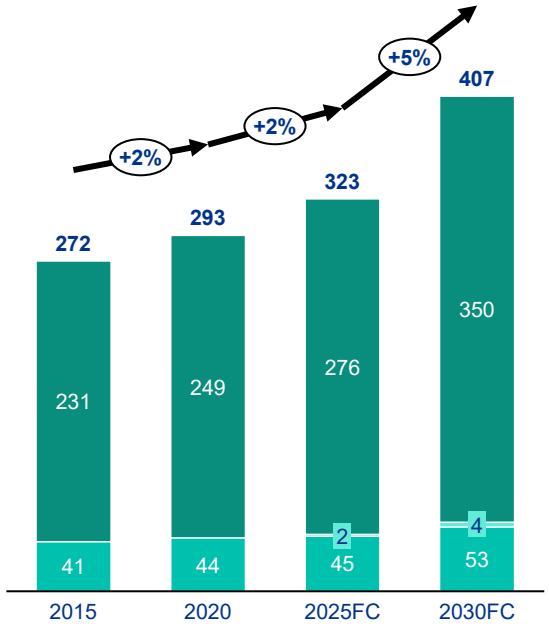
Source: CBS; Eurostat; Interview programme; KPMG analysis.

KPMG

C&I pre-sorted

The C&I pre-sorted stream is the largest plastic stream of which a high share can be sorted into monostreams which will grow with the newly introduced EPR scheme

C&I pre-sorted plastics: sorting output[(a)], kt, 2015-2030FC

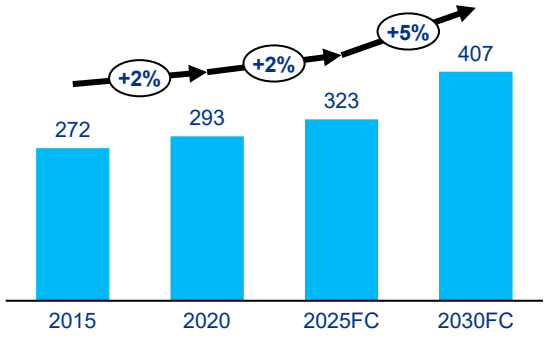


CAGR (%)	'20-'30FC
Monostream	3.5
Mixed films[(b)]	n/a
Mixed plastics	1.9

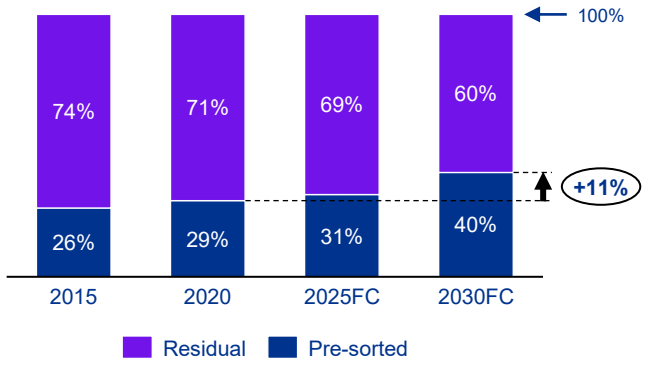
Note: (a) Not all C&I originating plastic waste streams are sorted into bales by a sorter, as some plastics are directly sent to recycling after collection due to their high quality;
(b) Newly introduced EPR scheme will likely cause a mixed films fraction to develop, as polluted films fractions are sorted together with other plastic fractions.
Source: Eurostat; IMF; OECD; Interview programme; KPMG analysis.

A shift is expected from residual to pre-sorted waste resulting in significantly more pre-sorted plastic volumes from C&I sources...

Plastics from C&I pre-sorted waste, kt, 2015-2030FC



C&I pre-sorted plastics versus plastics in C&I residual waste, 2015-2030FC



By far the most important driver of commercial waste volumes forecast is increased pre-sorting driven by the introduction of an EPR scheme for commercial waste in 2023.

Due to the introduction of an EPR scheme on commercial waste, producers and importers of PMD products are obligated to fund the collection, sorting and treatment of commercial PMD waste in the Netherlands.

Expected regulation from the government to ban incineration of recyclable materials or the potential implementation of an EPR on agriculture plastics, might also have a major impact of the shift from residual to pre-sorted waste.

> "The manufacturing industry can still do better in terms of plastics pre-sorting." – Industry expert

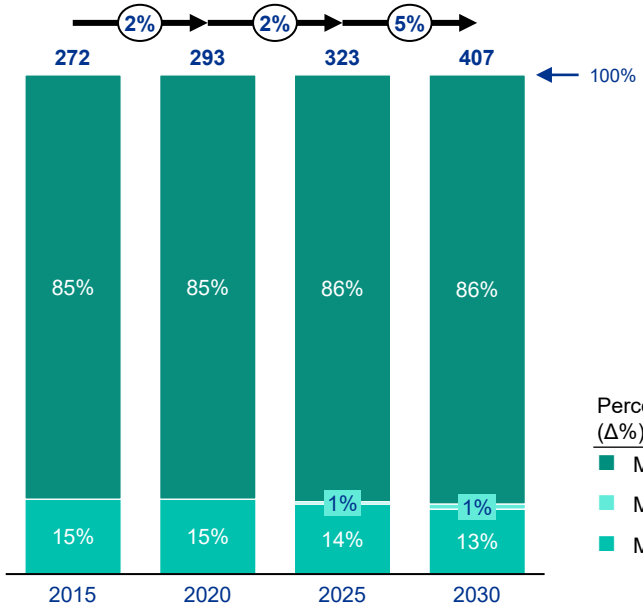
"The introduction of the EPR scheme will likely give a much-needed boost to commercial pre-sorting, as not enough is currently happening." – Industry expert

"I expect more pre-sorting of commercial plastic waste to happen at economically viable locations, large locations with a lot of household-like waste, such as Schiphol Airport or 'de Efteling' (amusement park)." – Large waste management company

Source: Eurostat; IMF; OECD; CONAI; Interview programme; KPMG analysis.

...accordingly monostream, mixed plastics and mixed films volumes are expected to increase, even though the relative share of mixed plastics is slightly decreasing

Mixed plastics volumes in pre-sorted C&I waste, kt, 2015-2030FC



Percentage point (Δ%)	'20-'30FC
Monostreams	1.0
Mixed films[a]	1.0
Mixed plastics	(2.0)

In general, pre-sorted C&I plastics yields better monostreams than household pre-sorted plastics, as contamination is typically lower[b]. The relative share of mixed plastics is expected to slightly decrease going forward driven by better sorting discipline and technology.

Mixed films are expected to develop from C&I waste as the newly introduced EPR scheme also forces separate plastic collection of lower quality plastics

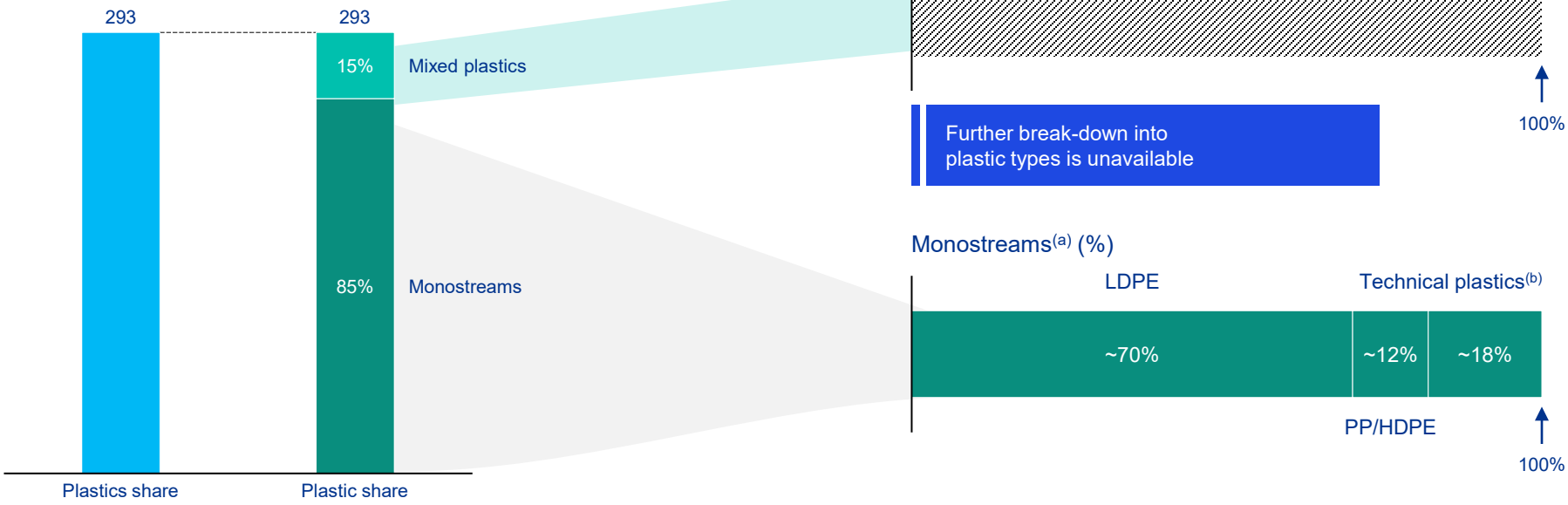
> "Commercial waste if often well-suited for creating monostreams, as it is typically less contaminated than household waste." – Large waste management company

Note: (a) Newly introduced EPR scheme will likely cause a mixed films fraction to develop, as polluted films fractions are sorted together with other plastic fractions;
(b) Contamination is not always lower: Contamination on public places such as railway stations, gas stations, are often worse than with household pre-sorted plastics.

Source: Eurostat; IMF; OECD; Interview programme; KPMG analysis.

Pre-sorted C&I plastics breaks down into approximately 15% of mixed plastics and 85 percent of monostreams with their own specific plastic composition

Overview of commercial pre-sorted waste subdivided into type of plastics, kt, 2020



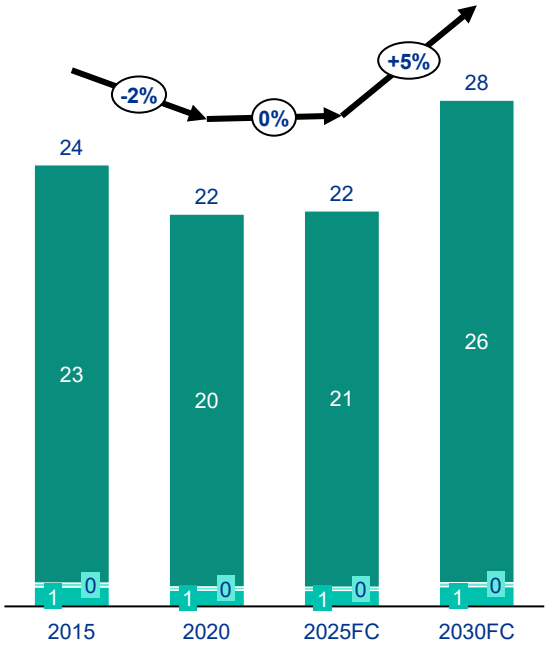
Note: (a) Rounded for data confidentiality purposes.
(b) Technical plastics such as PS, ABS, PVC, etc.
Source: Interview programme; CBS; NTCP; CE Delft; Eurostat; KPMG analysis.

KPMG

C&D pre-sorted

C&D pre-sorted plastics is a small plastic waste stream which is expected to grow as source separation at construction is increasingly becoming the norm

C&D pre-sorted plastics: sorting output, kt, 2015-2030FC

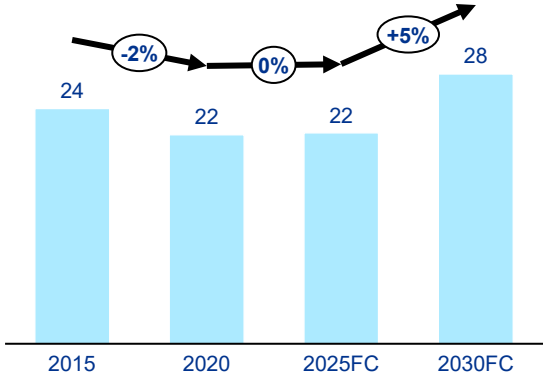


CAGR (%)	'20-'30FC
Monostream	2.6
Mixed films	1.3
Mixed plastics	2.1

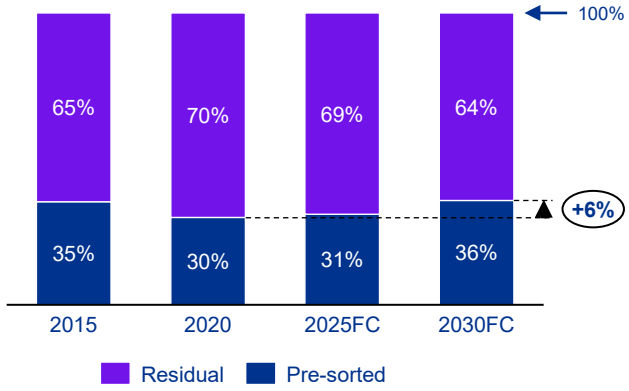
Source: Eurostat; IMF; OECD; Interview programme; KPMG analysis.

C&D pre-sorted plastics volumes are expected to increase towards 2030 due to increasing overall plastic volumes and improved environmental awareness

Plastics from C&D pre-sorted waste[(a)], kt, 2015-2030FC



C&D pre-sorted plastics versus plastics in C&D residual waste, 2015-2030FC



Pre-sorted C&D plastic waste is expected to increase driven by an increase in overall C&D waste volume and environmental awareness at building and construction sites according to interview feedback.

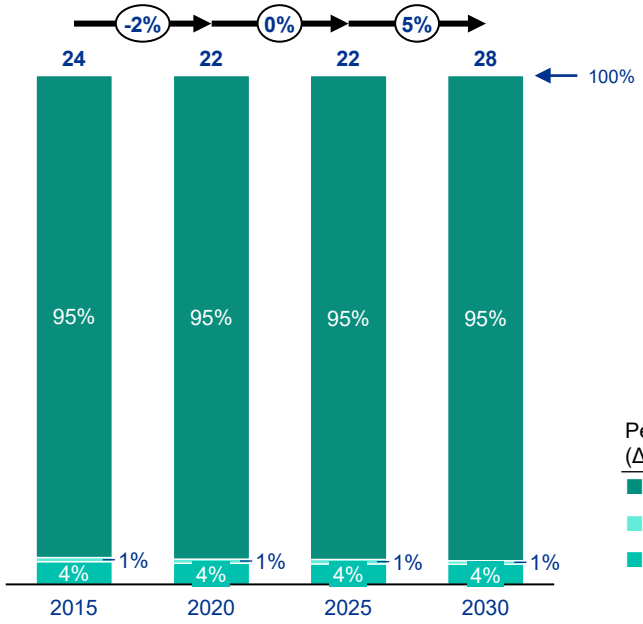
> "Pre-sorted plastics from construction sites are increasing, driven by environmental awareness and sorting regulations." – Industry expert

"I expect that pre-sorting of C&D plastic waste will increase at economically viable locations." – Large waste management company

Note: (a) Potential implementation of EPR for building materials and plastic usage in building and construction might impact this development.
Source: CBS: Eurostat; IMF; OECD; Interview programme; KPMG analysis.

Although increasing source separation increases pre-sorted C&D plastics, no change is expected in the relative shares of monostream, mixed films and mixed plastics

Mixed plastics volumes in pre-sorted C&D waste, kt, 2015-2030FC



Percentage point (Δ%)	'20-'30FC
Monostream	0.3
Mixed films	(0.1)
Mixed plastics	(0.2)

Further break-down into plastic types within monostream, mixed films or mixed plastics is unavailable

C&D pre-sorted plastic volumes are expected to increase, driven by an increase in source separation at construction sites

Interview feedback indicates that source separation (i.e. pre-sorting) at construction sites is expected to increase as waste producers are incentivized to sort plastics due to the high value of good quality plastics.

Share of monostreams within C&D pre-sorted plastics is expected to slightly increase due to improved sorting techniques and expected increasing value of monostreams.

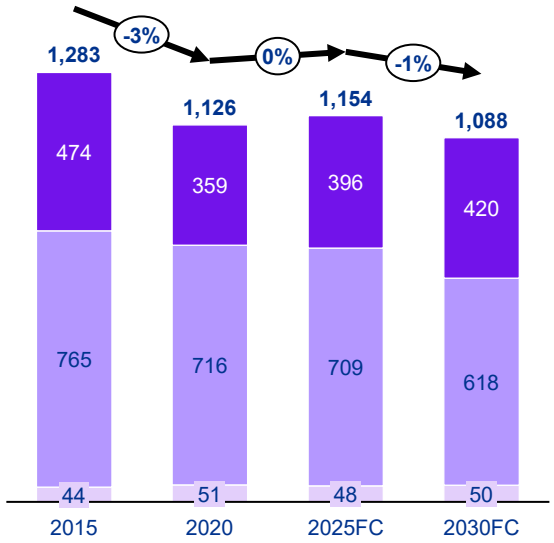
Source: Eurostat; IMF; OECD; Interview programme; KPMG analysis.

Plastic in residual waste

Plastics in residual waste are expected to slightly decrease driven by a strong push towards pre-sorting in C&I while post-sorting will shift volume back from households

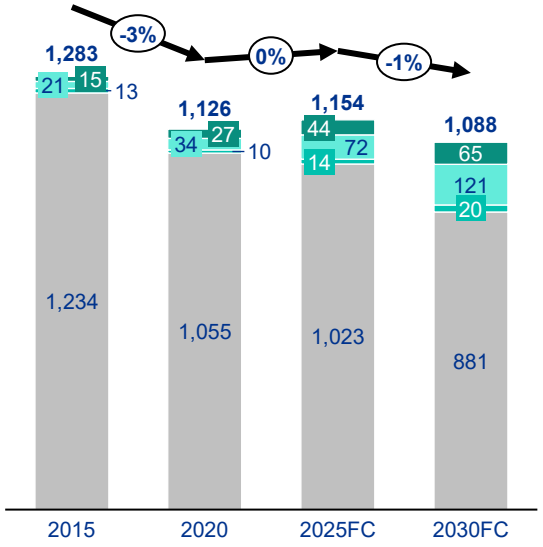
Overview of household, C&I and C&D residual plastics volumes, mixed plastics and mixed films volumes, kt, 2015-2030FC

Residual waste plastics, kt



CAGR (%)	'20-'30FC
HH residual	1.6
C&I residual	(1.5)
C&D residual	(0.1)

Mixed plastics, mixed films and monostream development, kt

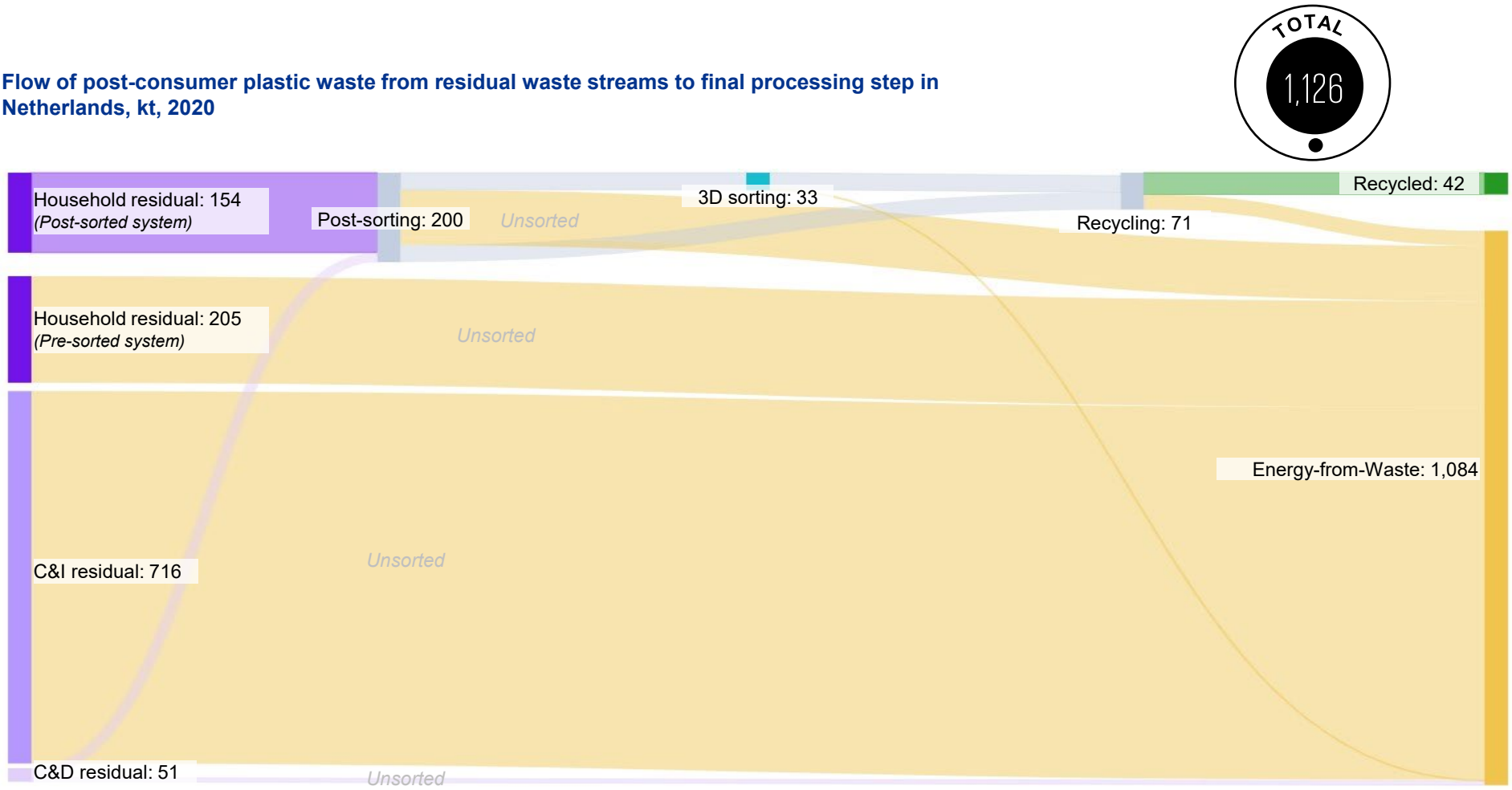


CAGR (%)	'20-'30FC
Monostream	9.2
Mixed films	13.5
Mixed plastics	7.5
Unsorted	(1.8)

Source: CBS; Eurostat; Interview programme; KPMG analysis.

The majority of plastics in residual waste are incinerated – a tremendous potential exists to recover more plastics

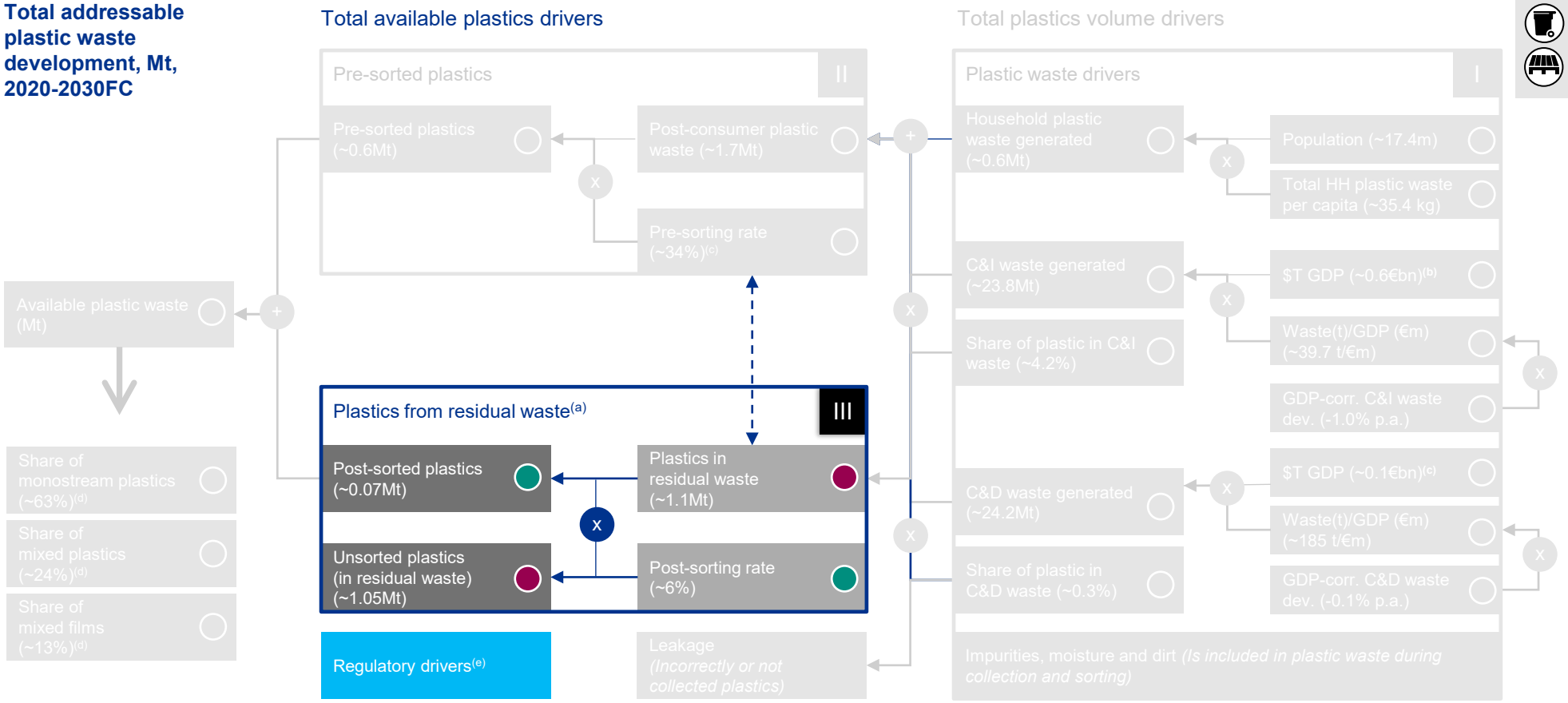
Flow of post-consumer plastic waste from residual waste streams to final processing step in Netherlands, kt, 2020



Source: Interview program; KPMG analysis..

Although there is still much progress to be made, post-sorting rates are expected to increase, resulting in more recovered plastics from residual waste

Total addressable plastic waste development, Mt, 2020-2030FC



Legend: Expected development: ● Increase ● Neutral ● Decrease.

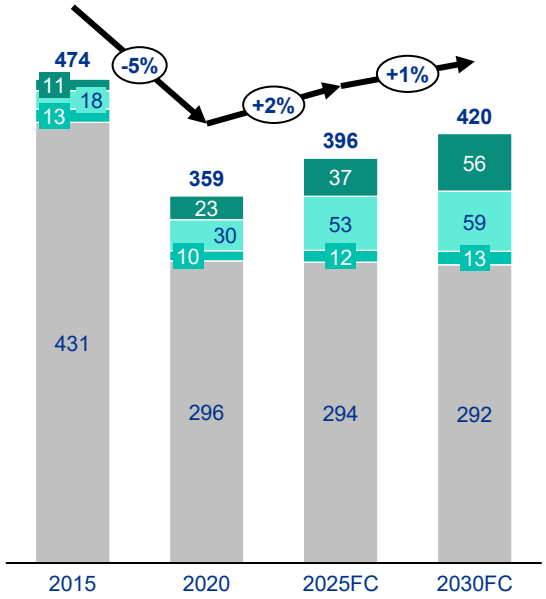
Note: (a) All plastic volumes that are presented are actual plastic volumes after sorting into bales – this means that weight from impurities, moisture and dirt are included; (b) Total GDP for C&I sectors (services, manufacturing and agriculture); (c) Total GDP for C&D sector (construction industry); (d) Concerns the weighted total % for both households, C&I and C&D together (e) Regulatory drivers affect the entire plastic waste value chain.

Source: CBS, Eurostat, Interview programme, KPMG analysis.

Household residual

Plastics in residual waste are expected to increase as more municipalities are expected to shift to post-sorting, leading to higher post-sorted plastic volumes

Household residual plastics: sorting output and unsorted plastics, kt, 2015-2030FC

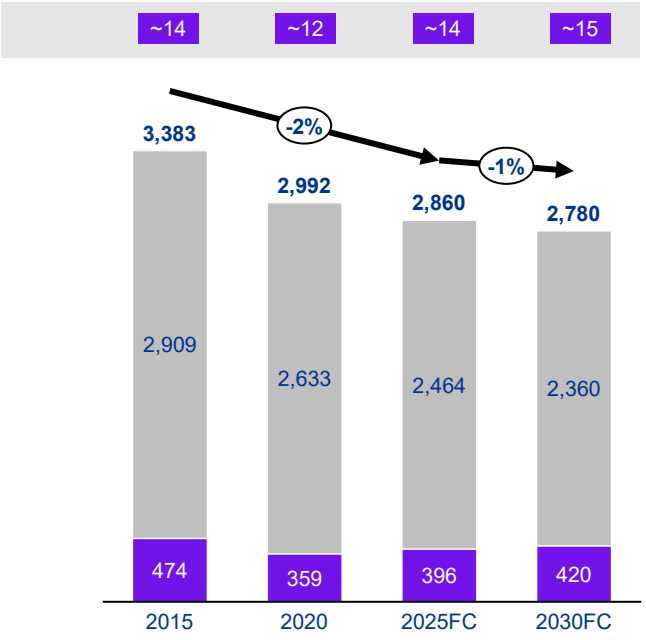


CAGR (%)	'20-'30FC
Monostream	9.4
Mixed films	6.8
Mixed plastics	3.0
Unsorted	(0.1)

Source: Eurostat; IMF; OECD; Interview programme; KPMG analysis.

The share of plastics within residual household waste is expected to increase slightly as share of municipalities opting for post-sorting is increasing...

Residual waste and plastics in household residual waste, kt, 2015-2030



CAGR (%)	'15-'20	'20-'25	'25-'30
Other residual waste	(2.0)	(1.3)	(0.9)
Plastics	(5.4)	2.0	1.2

An increasing number of municipalities opt for full post-sorting of plastic waste leading to an increasing share of plastics in residual waste, which is a contradictory development compared to the historic figures

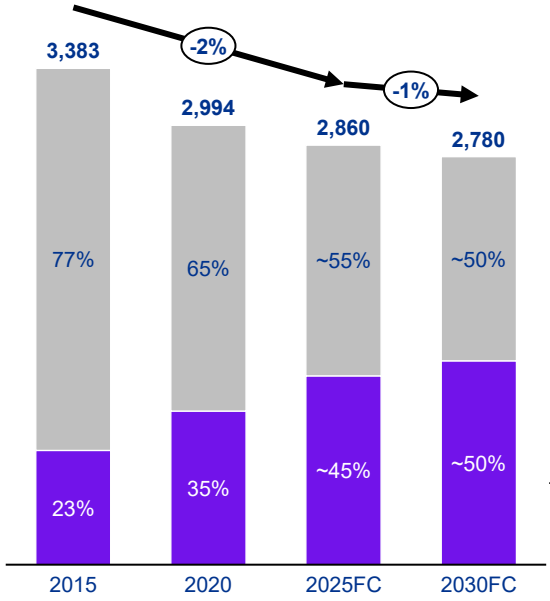
The pre-sorting rate of plastic waste, particularly plastic packaging captured in the PMD waste stream has historically increased as sorting discipline and understanding have improved since the introduction of the waste stream.

However, interview feedback and secondary research indicatives that the share of municipalities opting for plastic post-sorting systems is expected to increase; in those municipalities plastic waste remains fully in residual waste, leading to increasing plastic volumes.

Source: CBS; Eurostat; Interview programme; KPMG analysis.

...leading to a significant increase in residual waste being post-sorted in the Netherlands

Post-sorted household residual waste and household residual waste sent directly to incinerator, kt, 2015-2030



Percentage point (Δ%)	'20-'30FC
Residual waste sent directly to Incineration	(15.0)
Post-sorted residual waste	15.0

> Post-sorting is a good alternative for municipalities with inherently poor pre-sorting rates due to for instance lower literacy or higher non-native populations, often in highly urban areas." – Post-sorting expert

"Post-sorting is the significantly less costly option for municipalities, and also has environmental benefits in terms of fewer transport emissions." – Industry expert

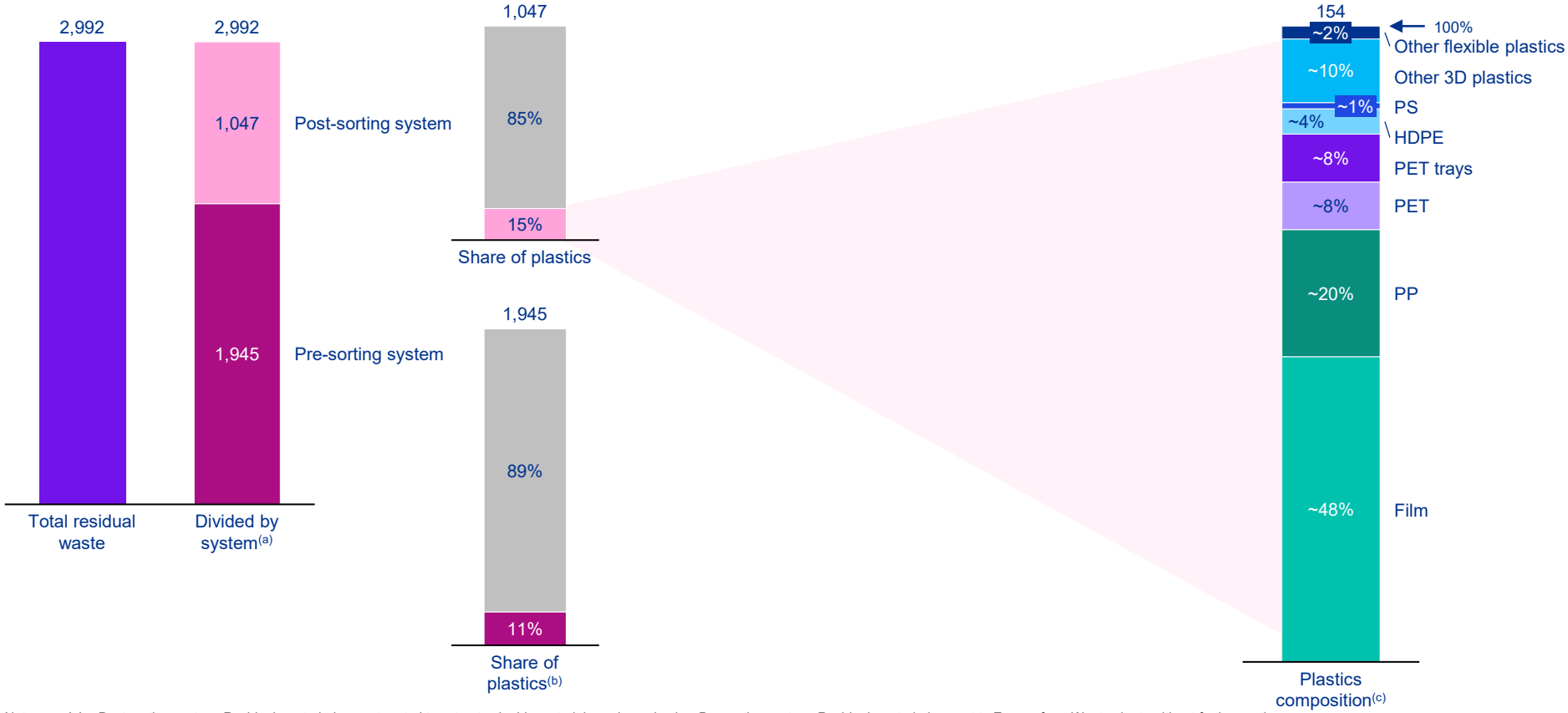
"Currently, some municipalities still apply both pre- and post-sorting for plastics. It is however preferred and expected that municipalities will choose either option." – Industry expert

Increase of post-sorted household residual waste implies that available post-sorting capacity should at least increase from 1,050kt per annum to 1,400kt.

Source: CBS; Eurostat; Interview programme; KPMG analysis.

Residual waste sent to post-sorting contains a higher share of plastics (15%) than residual waste in a pre-sorting system (11%), as no plastics have been pre-sorted

Overview of household residual waste handled in post-sorting system versus pre-sorting system subdivided into type of plastics, kt, 2020

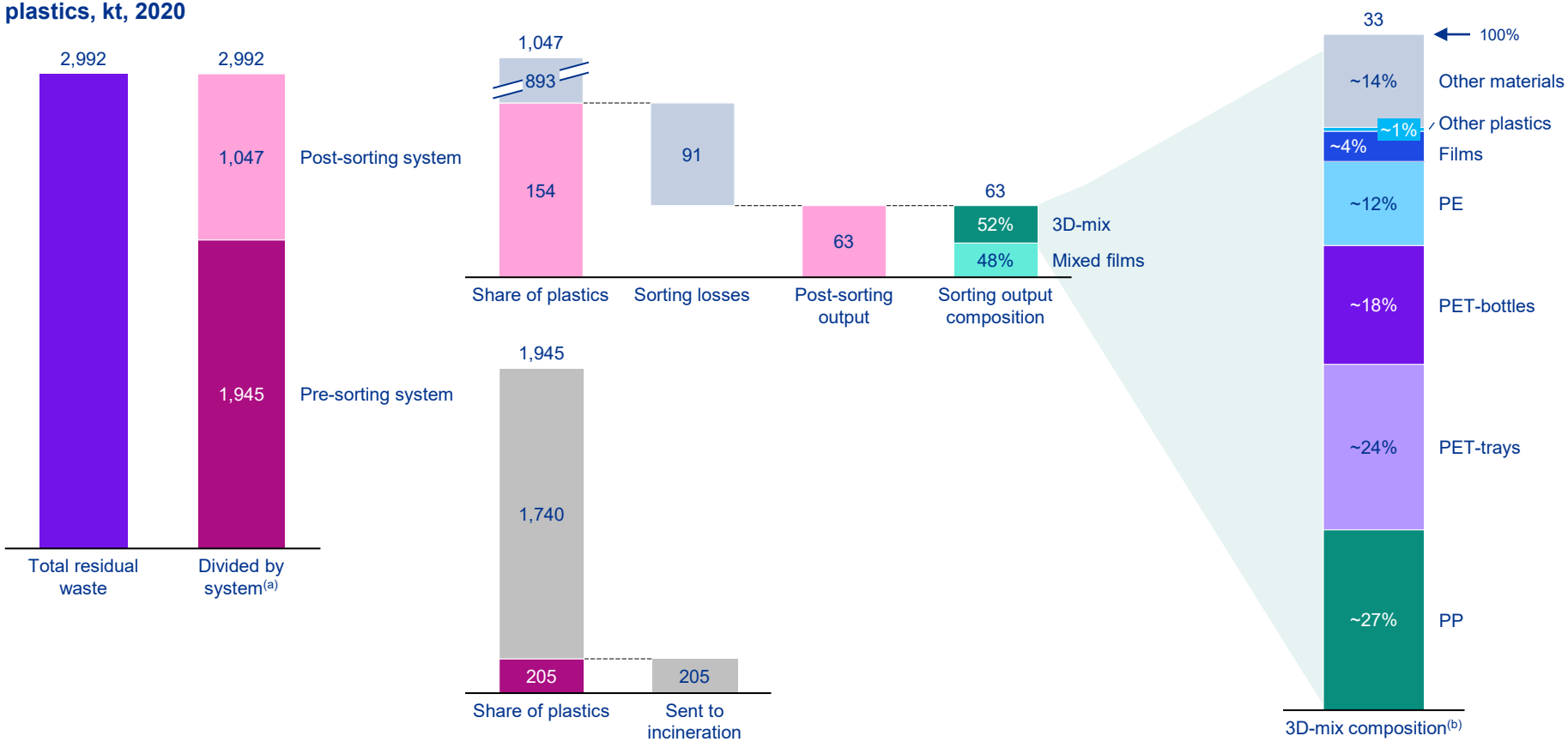


Note: (a) Post-sorting system: Residual waste being post-sorted to extract valuable materials such as plastics; Pre-sorting system: Residual waste being sent to Energy-from-Waste plants without further sorting;
(b) Share of plastic within pre-sorting system might seem high considering the fact that pre-sorted share is already deducted. However, it should be taken into consideration that municipalities handling a pre-sorting system, also pre-sort other (including heavier) waste fractions leading to a shuffled residual waste composition;
(c) Rounded for data confidentiality purposes.

Source: CBS; Eurostat; Interview programme; KPMG analysis.

Post-sorted plastics are nearly always sorted into a 3D-mix and mixed film fraction, the 3D-mix fraction is often further sorted into monostreams and mixed plastics

Overview of household residual waste handled in post-sorting system (incl. sorting losses) versus pre-sorting system subdivided into type of plastics, kt, 2020

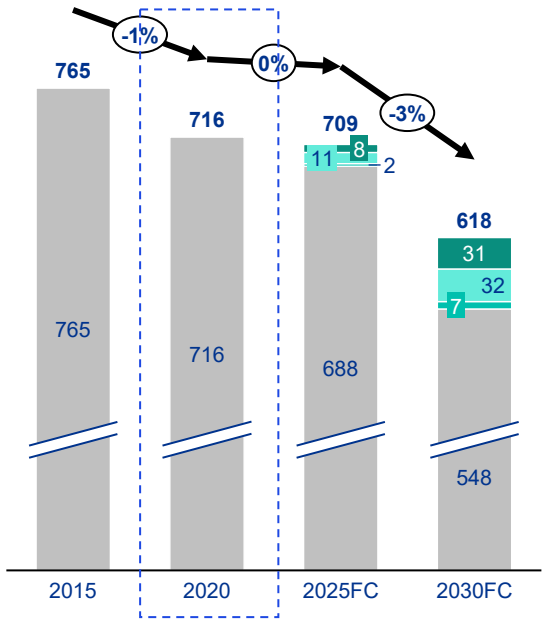


Note: (a) Post-sorting system: Residual waste being post-sorted to extract valuable materials such as plastics; Pre-sorting system: Residual waste being sent to Energy-from-Waste plants without further sorting;
(b) Rounded for data confidentiality purposes.
Source: CBS; Eurostat; Interview programme; KPMG analysis.

C&I residual

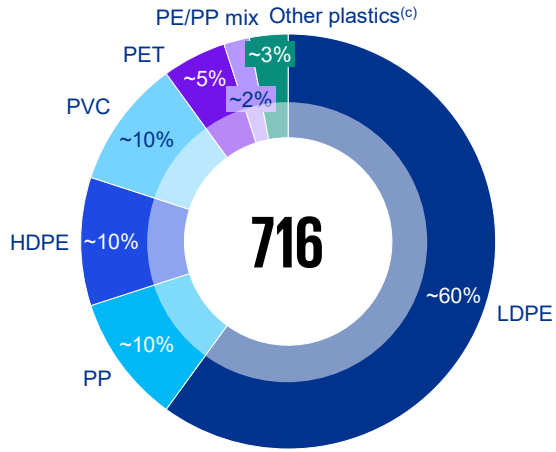
Plastic volumes in C&I residual waste are expected to decrease given the shift to pre-sorting, while post-sorting is expected for some of the remaining plastic volumes

C&I residual plastics: sorting output and unsorted plastics[(a)], kt, 2015-2030FC



CAGR (%)	'25-'30FC
Monostream	31.6
Mixed films	23.7
Mixed plastics	24.2
Unsorted	(4.4)

Composition of C&I residual plastic waste[(b)], kt, 2020

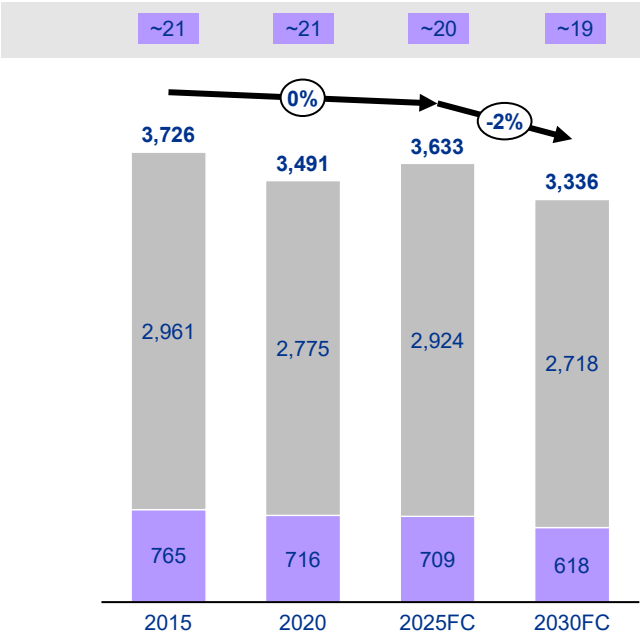


Note: (a) Post-sorting of plastics from C&I residual waste expected to arise, driven by recovery of valuable plastics and for example initiated at places where no pre-sorting is possible;
(b) Rounded for data confidentiality purposes;
(c) Other plastics are PS, ABS, POM, etc.

Source: Eurostat; IMF; OECD; Interview programme; KPMG analysis.

Recently introduced EPR scheme for C&I is expected to increase pre-sorted plastics resulting in a decrease of plastics within C&I residual waste

Residual C&I waste development, kt, 2015-2030FC



Combined estimated share of plastics in residual waste (%)

CAGR (%)	'15-'20	'20-'25FC	'25-'30FC
Other residual waste	(1.3)	1.1	(1.4)
Plastics	(1.3)	(0.2)	(2.7)

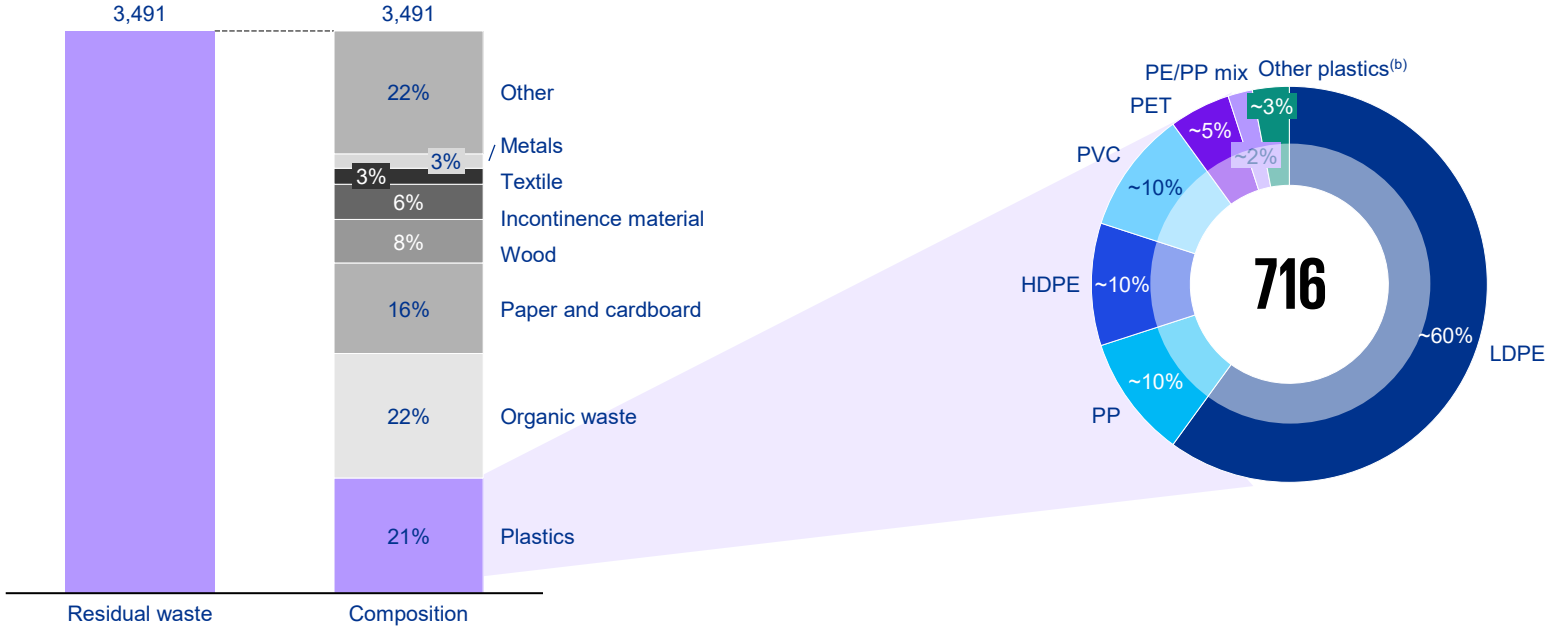
Although details of the introduced EPR scheme remain unclear, the market currently understands that funding will first be provided on pre-sorted plastics waste. Nevertheless it is reasonable to assume that funding will eventually also apply to post-sorting.

First commercial institutions to be incorporated in the EPR scheme are likely to be large locations with household-like waste compositions, such as schools, airports and amusement parks.

Source: CBS; Eurostat; Interview programme; KPMG analysis.

C&I residual waste currently contains approximately 21 percent plastics, these plastics further break down into plastic types of which more than half are films

Overview of C&I residual waste subdivided into type of materials and further divided into type of plastics[(a)], kt, 2020



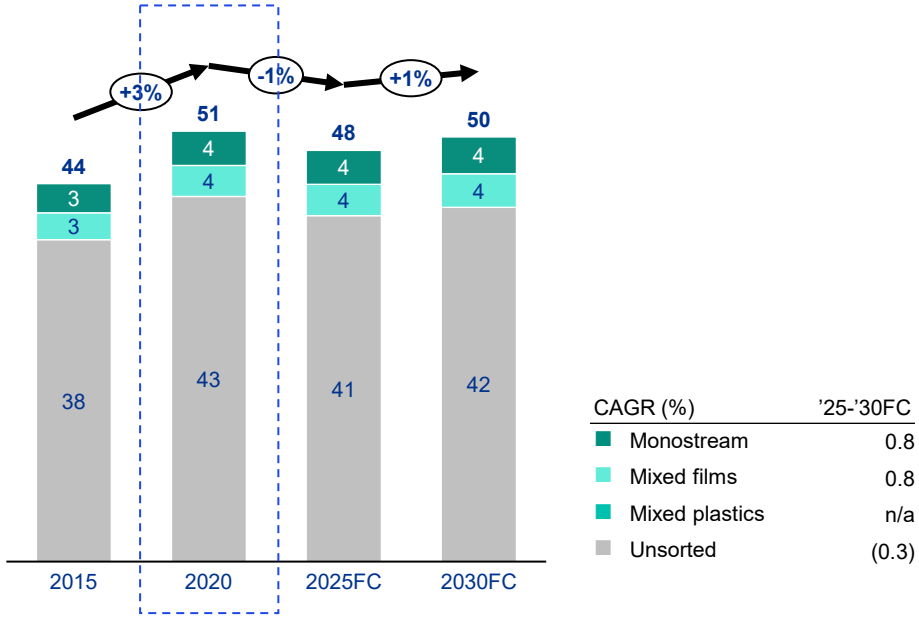
"We observe a range of 15-25% of plastics in residual C&I waste depending on the fraction." – Industry expert

Note: (a) Rounded for data confidentiality purposes.
(b) Other plastics are PS, ABS, POM, etc.
Source: CBS; Eurostat; Rijkswaterstaat; Interview programme; KPMG analysis.

C&D residual

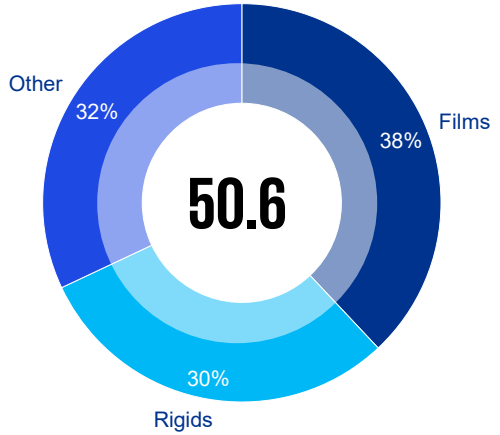
Plastic volume in C&D residual waste is expected to remain stable, while mixed films and monostream volumes are expected to slightly increase due to improved sorting

C&D residual plastics: sorting output and unsorted plastics, kt, 2015-2030FC



CAGR (%)	'25-'30FC
Monostream	0.8
Mixed films	0.8
Mixed plastics	n/a
Unsorted	(0.3)

Composition of C&D residual plastic waste[(a)], kt, 2020

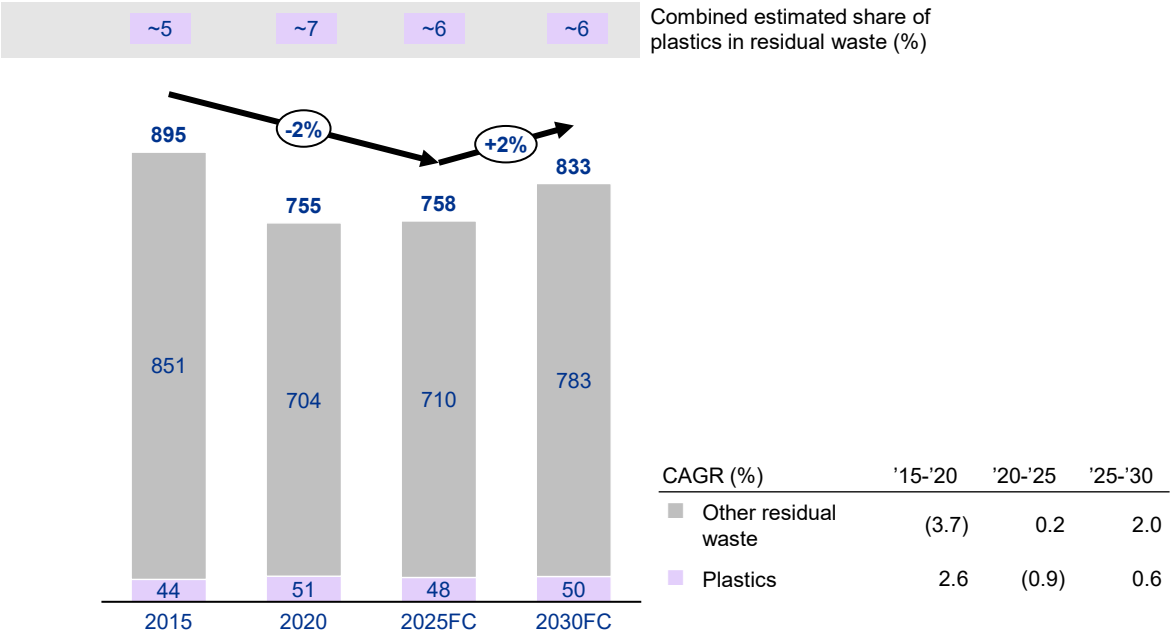


Despite the fact that a large part of the C&D residual waste is post-sorted, plastics are only excreted to a limited extent. Plastic sorting within this waste stream appears to be relatively difficult do to the composition characteristics. Hence, a relative low share of plastics is actually sorted out.

Note: (a) Rounded for data confidentiality purposes.
Source: Eurostat; IMF; OECD; Interview programme; KPMG analysis.

Overall C&D residual waste expected to increase driven by an increase in underlying market – plastic share is expected to slightly decrease

Residual C&D waste development, kt, 2015-2030FC



CAGR (%)	'15-'20	'20-'25	'25-'30
Other residual waste	(3.7)	0.2	2.0
Plastics	2.6	(0.9)	0.6

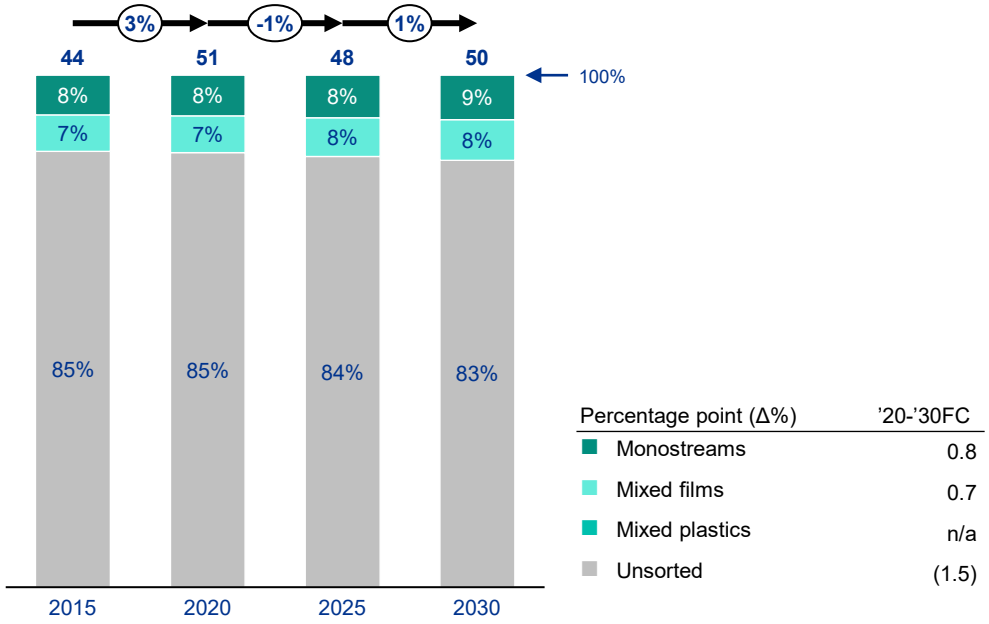
Overall residual C&D waste expected to increase due to expected increase in building and construction activity towards 2030.

The share of plastics within residual waste is expected to slightly decrease due to an expected increase of pre-sorting of plastics at building and construction sites.

Source: CBS; Eurostat; Interview programme; KPMG analysis.

Share of monostreams and mixed films from residual C&D plastics are expected to slightly increase due to expected improved sorting techniques

Mixed plastics, volumes in residual C&D waste, kt, 2015-2030FC



Total plastics from C&D residual waste is expected to remain stable, while mixed films and monostream plastics are expected to slightly increase over time at the expense of the unsorted stream

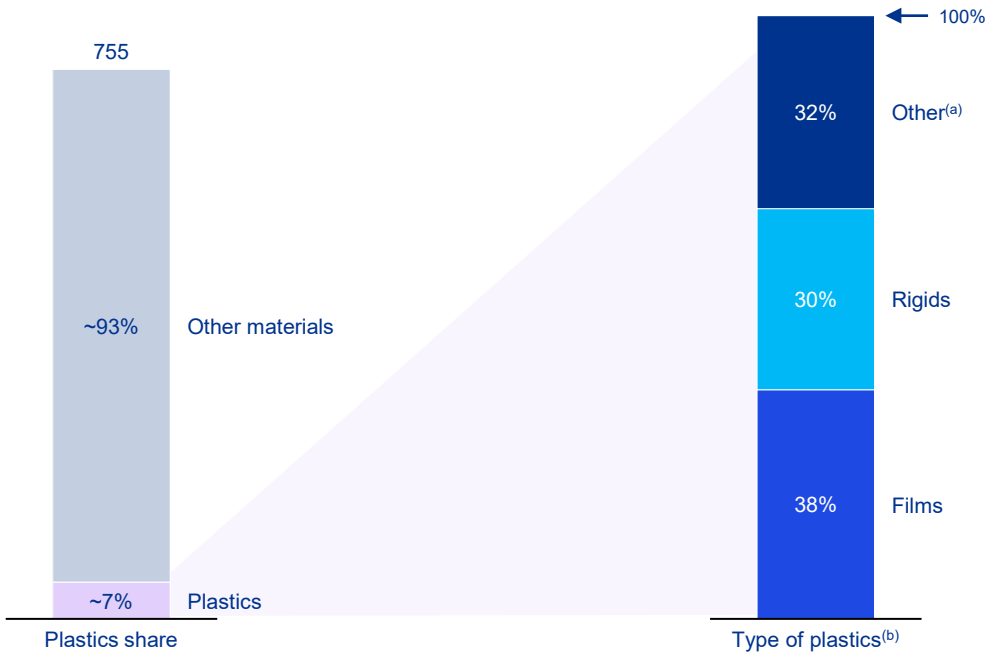
Overall C&D residual waste is expected to grow, while plastic volumes from C&D residual waste are expected to slightly decrease, resulting in a stable development of plastics in C&D residual waste. Share of sorted monostreams and mixed films however are expected to increase at the expense of the share of unsorted plastics in C&D residual waste.

Expected slight increase in share of monostreams and mixed films is driven by improved sorting techniques and the expected increasing value of these monostream plastics.

Source: Eurostat; IMF; OECD; Interview programme; KPMG analysis.

C&D waste contains ~7% of plastics, which breaks further down into 38 percent of films and 30 percent of rigids

Overview of C&D residual waste subdivided into type of plastics, kt, 2020



"The share of plastics in Construction and Demolition is below 10%." – Industry expert

"Plastic construction waste contains high levels of PVC plastic" – Industry expert

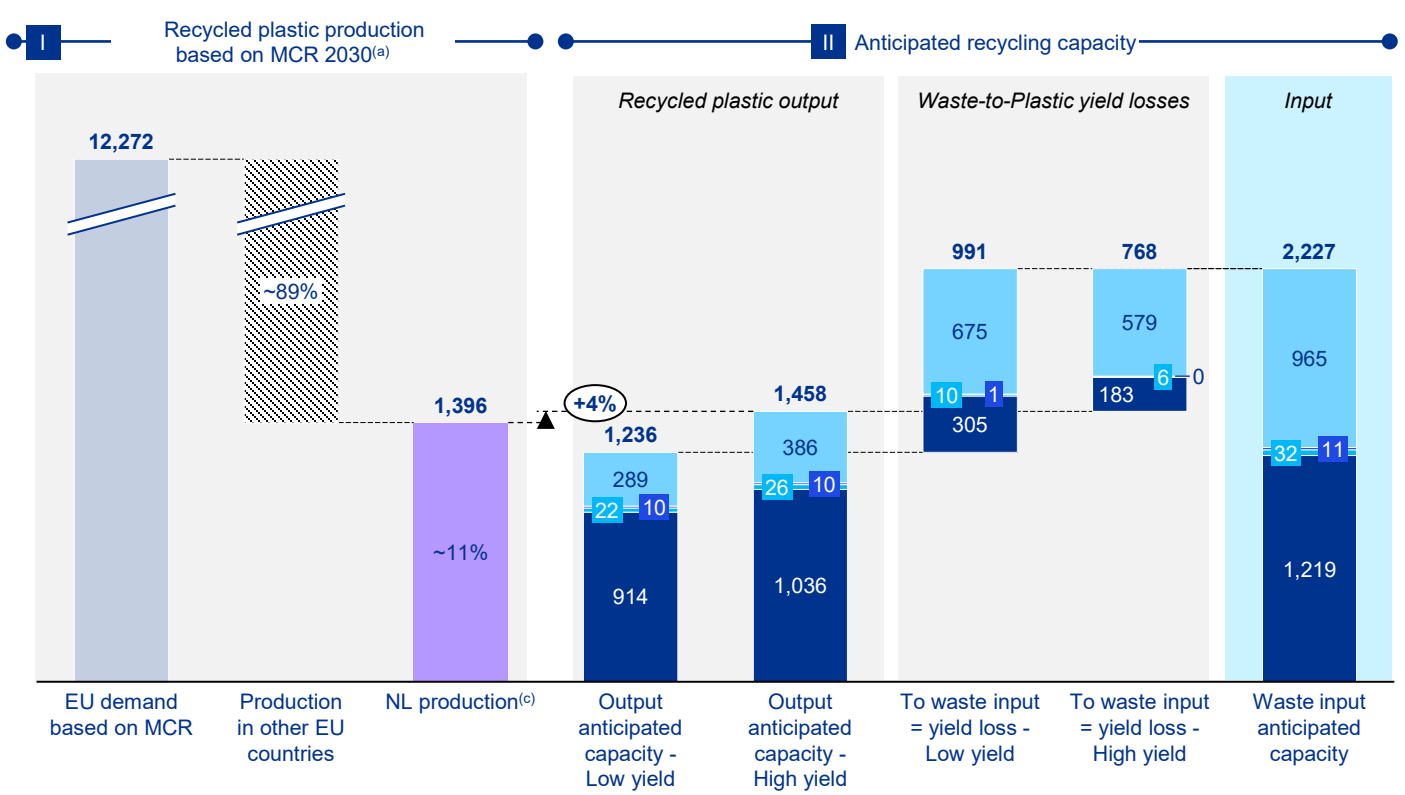
Note: (a) Other plastics contain plastics that are interwoven with other materials such as mattrasses, metal compositions, textiles, etc.;
(b) Rounded for data confidentiality purposes.
Source: CBS; Eurostat; Interview programme; KPMG analysis.

5.

Feedstock demand

In 2030 the anticipated recycling capacity in NL is approximately sufficient to fulfil local demand *and* support NL's position in the EU plastic market, resulting in 2.2Mt of feedstock demand

Estimated recycled plastic demand based on the European minimum content requirement (MCR) versus recycled plastic demand from announced recycling projects based on required plastic waste input, 2030FC, kt



P2P (including pre-treatment) yield per technology

Technology	Low	High
Pyrolysis	30%	40%
Depolymerisation	90%	97%
Dissolution	70%	80%
Mechanical recycling	75%	85%

Recycled plastic production EU
Recycled plastic production non-NL
Recycled plastic production NL

Range indicates the waste-to-plastic yield based (if applicable) on a fuel exempt model, which includes loss of residue, contamination, operational losses and fuel

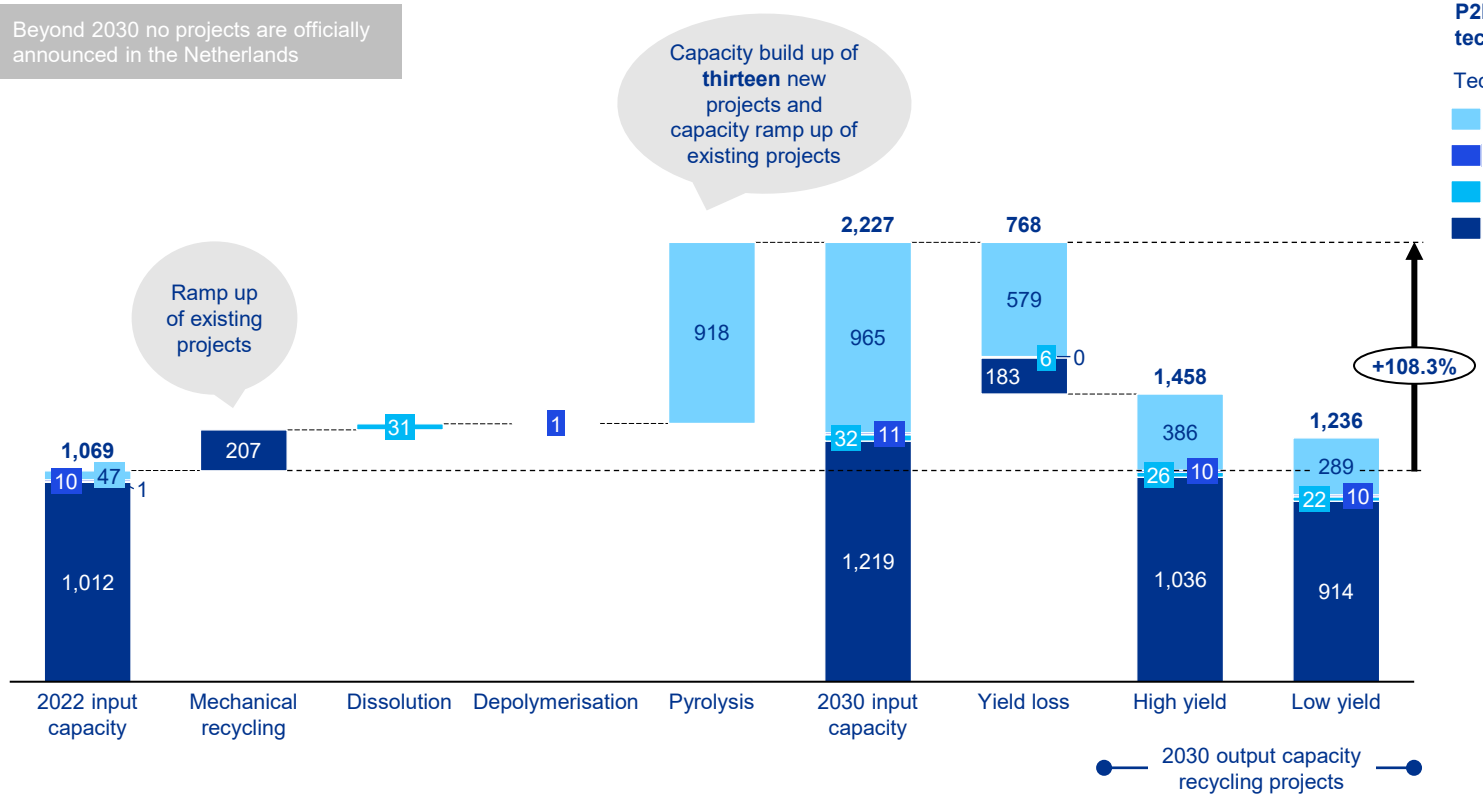
Note: (a) Besides packaging and automotive, no other MCR targets are currently announced. However, it is likely realistic that these will be announced in the near future. Therefore an illustrative MCR target of 20% in 2030 for all other industries has been taken into account;
(b) Based on a 95% capacity utilisation for all recycling projects and 80% likelihood of construction for planned recycling projects;
(c) NL production estimate based on Dutch chemical industry sales, cracking capacity and other production estimates.

Source: Interview programme; Eurostat; European Union; Dutch Government; KPMG analysis.

Total announced feedstock input capacity for all recycling technologies is expected to equal 2.2 Mt in 2030

Overview of expected development of mechanical and chemical recycling input capacity[(a)], 2022-2030FC, kt

Beyond 2030 no projects are officially announced in the Netherlands



P2P (including pre-treatment) yield per technology

Technology	Low	High
Pyrolysis	30%	40%
Depolymerisation	90%	97%
Dissolution	70%	80%
Mechanical recycling	75%	85%

> We aim to build multiple recycling sites in Europe, where exactly will depend on feedstock availability and local regulations. For example, Dutch nitrogen restrictions make the Netherlands an unfavourable location."

Note: (a) Based on a 95% capacity utilization for all recycling projects and 80% likelihood of construction for planned recycling projects;
(b) Realisation of recycling capacity is dependent on the acceptance of policies and legislation which would recognise the recycling methods as recycling and make the investments economically viable.

Source: Interview programme; KPMG analysis.

Many industries will or are expected to be subject to mandatory content requirements (MCR) for recycled plastics, driving demand for recyclates across the EU

Plastic applying industries and their implementation strategy for recycled plastic content

Sector	Main type of plastic	Minimum recycled content %	
Packaging (Food)	PET, PP, LDPE	10% 50%	The revision of the EU packaging and packaging waste directive state that non-PET contact sensitive packaging must contain a minimum of 10% recycled plastic, while PET food plastic must contain at least 30% recycled plastic.
Packaging (Non-Food)	LDPE, HDPE PP	35% 65%	The new mandatory content requirement for non-contact sensitive packaging now calls for a minimum of 35% recycled plastic.
Automotive	PP, PUR	25% 30%	EU proposed regulation of minimum recycled content percentage of 25% by 2030.
Building & Construction	PVC, HDPE	20% 30%	"Many companies are relatively small and flexible, helping the adoption of recycled plastic." – Plastic converter
Electrical & Electronics	PP, PUR	20% 30%	"At this moment it is unrealistic to introduce a 30% recycled plastic content throughout the electrical industry. Therefore, it is currently being discussed whether a goal of 15% should be set." – Plastic converter
Houseware, leisure, sports	PP	20% 30%	Currently around 2.6% of the plastics in houseware, leisure and sport is recycled in Europe.
Agriculture	LDPE/ PP film	20% 30%	Recycled plastic has a lower price than virgin plastic leading to adoption of recycled plastic in industries that are price sensitive and do not necessarily require high-quality plastics, like agriculture and building & construction.
Other	PUR, PP, LDPE	20% 30%	Other industries such as textiles and hygiene products. An EPR scheme for textiles is expected to be implemented in 2025. MCR's are yet to be formulated by the Ecodesign for sustainable products regulation. Current discussions regarding the application of biodegradable plastics might form new revised requirements.
Dutch MCR[a]	All plastics	30%	The intention has been announced to implement a minimum recycled content requirement 'Circular plastic norm' target of 30% by 2030 for all plastics in the Netherlands. No further details are known yet.

Illustrative MCR target[b]

Incorporated minimum content requirement

Explicitly mentioned in Circular Economy Action Plan

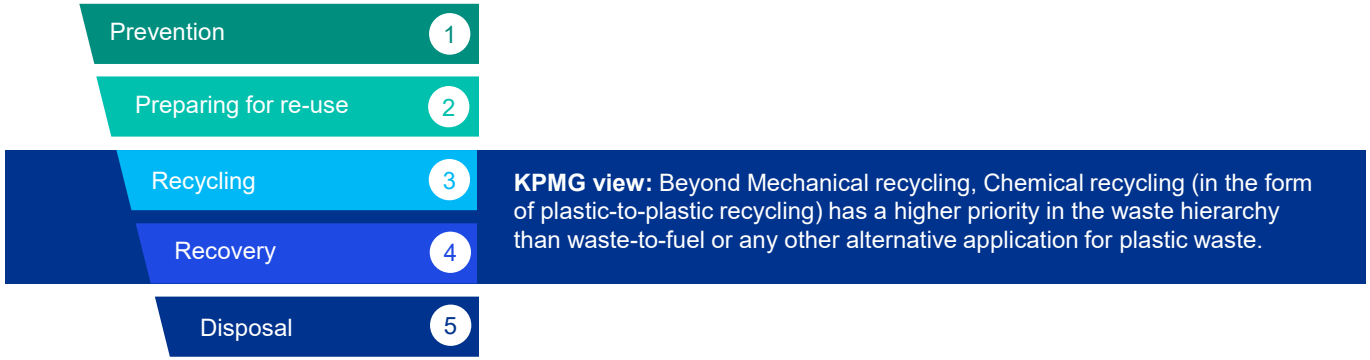
2030 2040

Note: (a) Dutch MCR named 'circulaire plastic norm' is applicable to all industries;
(b) Besides the packaging and proposed automotive (for 2030) MCRs, no other MCR targets have currently been announced. However, it is to be expected that these will be introduced in the near future. For illustrative purposes an MCR target of 20% in 2030 and 30% in 2040 for all other industries has been assumed.

Source: Plastics Europe; Euractiv; Plastic recyclers; Interview programme; KPMG analysis.

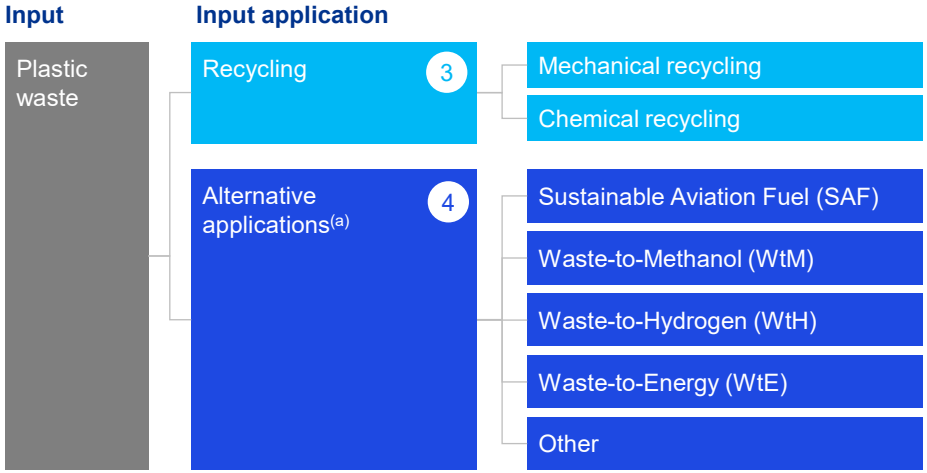
Waste-to-fuel applications have a very low chance of competing with chemical recycling given the waste hierarchy priority and pressure to reach recycling targets

Waste hierarchy as proposed through the Waste Framework Directive



Waste-to-fuel applications primarily target feedstocks such as residues which cannot be treated by other technologies (or at very high costs)

Waste-to-fuel applications include gasification which can produce jet-fuel and methanol as an end product



Legend: Likelihood of adoption: ● High likelihood ○ Low likelihood

Note: (a) Concerns competing input applications. Please refer to 'Alternative applications' subsection for further explanation.

Source: Interview programme; European Commission; KPMG analysis.

Likelihood of feedstock adoption of alternative applications(a)

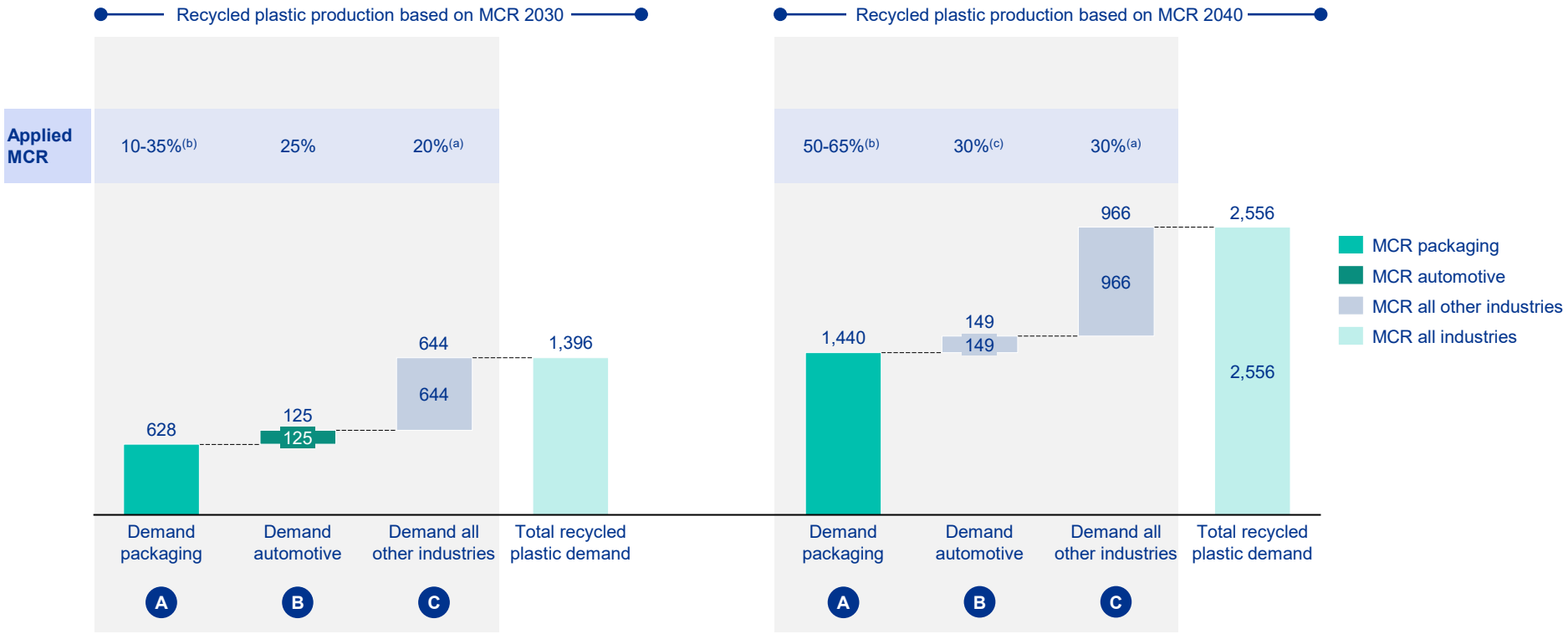
	SAF	WtM	WtH	WtE
Plastic monostreams	○	○	○	○
Mixed plastics	◔	◔	◔	○
Residues	◕	◑	◑	◔

> "The longer you can prevent a product from being converted into CO2, the better. Therefore, plastic-to-plastic will take precedence over waste-to-fuel applications." – Industry expert

Macro perspective: Mandatory content requirement (MCR)

Expected recycled plastics production to sustain Dutch position in EU recycling market increases from 1.4 Mt in 2030 to 2.6 Mt in 2040 due to strong increase of MCR

Recycled plastic demand based on the European minimum content requirement (MCR)[a], 2030 – 2040FC, kt



Note:
(a) Besides packaging and (proposed) automotive, no other MCR targets are currently announced. However, it is likely that these will be announced in the near future. Therefore an illustrative MCR target of 20% in 2030 and 30% in 2040 for all other industries has been taken into account;
(b) Dependent on type of plastic packaging: in 2030 10% for contact sensitive packaging, 30% for plastic bottle packaging and 35% for non-contact sensitive packaging and in 2040 50% for contact sensitive packaging and 65% for both plastic bottle as non-contact sensitive packaging;
(c) Automotive MCR target is 25% in 2030. No official target has been set for 2040 so an illustrative share of 30% in 2040 has been applied;
(d) ~10% of European cracker capacity is located in the Netherlands which drives virgin-like quality recycled plastics. These are assumed to be primarily used for contact sensitive packaging, whereas other industries mainly use mechanically recycled plastics which is not tied to cracker capacity. Dutch plastic contact sensitive packaging demand is deducted from this volume to prevent double counting.

Source: Interview programme; Plastics Europe; European commission; KPMG analysis.

When putting Dutch plastic production into a European perspective, the Netherlands accounts for approximately 11% of total European plastic production...

EU plastic packaging demand per packaging type, 2020-2040FC, kt

Assumed constant: Forecasting EU end-user plastic packaging demand outside the scope of this study

Dutch share of plastic production in total EU plastic demand, 2020-2040FC, %

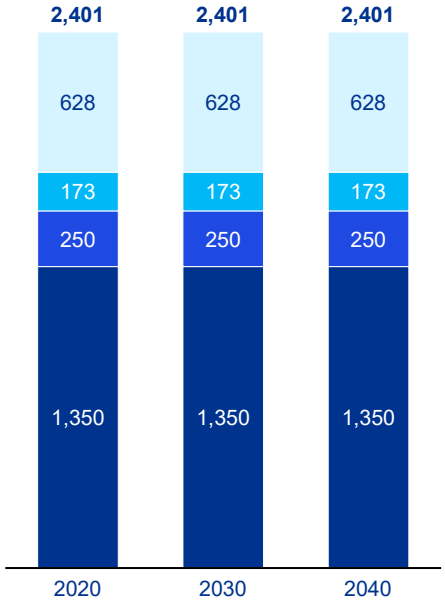
Dutch plastic packaging production, 2020-2040FC, kt

Note: (a) Plastic production assumed to be constant.
Source: Interview programme; Plastics Europe; ING; European commission; KPMG analysis.

...which would result 1.4 Mt of recycled plastic required in 2040 to adhere to the European plastic packaging MCR...

Dutch plastic packaging production, 2020-2040FC, kt

Assumed constant: Forecasting plastic packaging production outside the scope of this study



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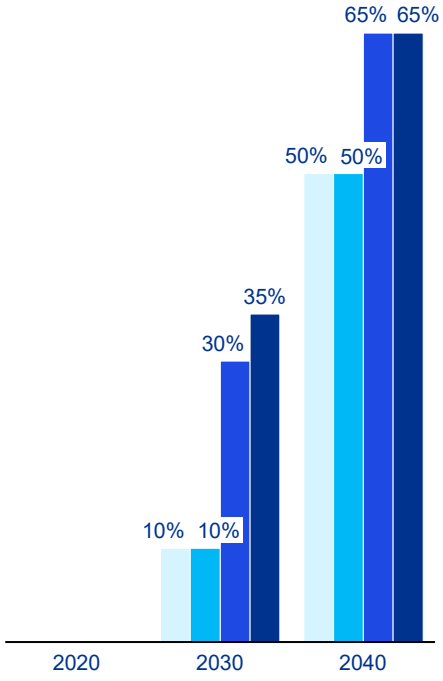
MCR targets per plastic packaging product group, 2020-2040FC, %



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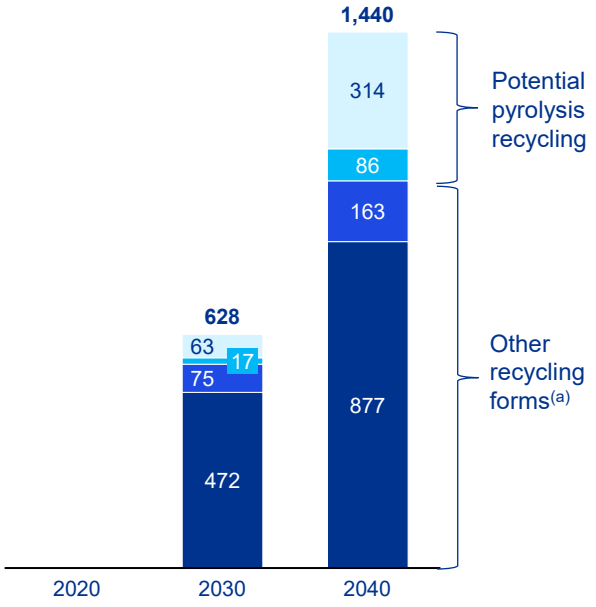
Recycled plastic packaging production based on MCR, 2020-2040FC, kt

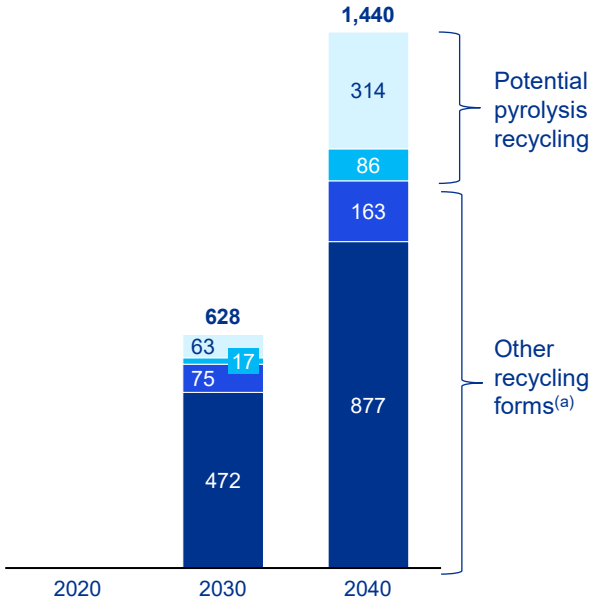


Non-contact sensitive packaging | Plastic bottle packaging | Other contact sensitive packaging | PO contact sensitive packaging

Note: (a) Other recycling includes mechanical recycling, dissolution (physical recycling), depolymerisation (chemical recycling).
Source: Interview programme; Plastics Europe; ING; European commission; KPMG analysis.

...resulting in an estimated feedstock required between 2.2 Mt and 2.8 Mt in 2040

Recycled plastic packaging production based on MCR, 2020-2040FC, kt



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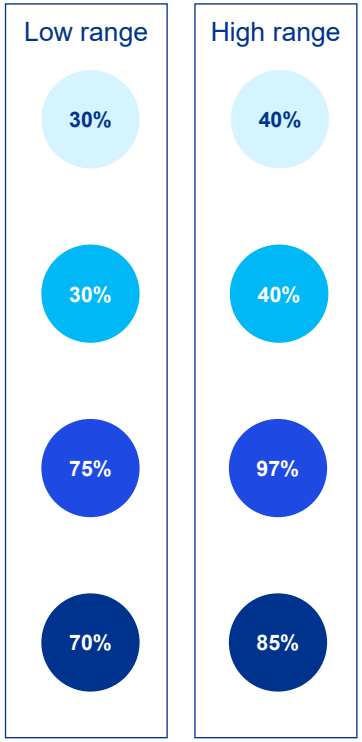
Estimated average yield range(b)



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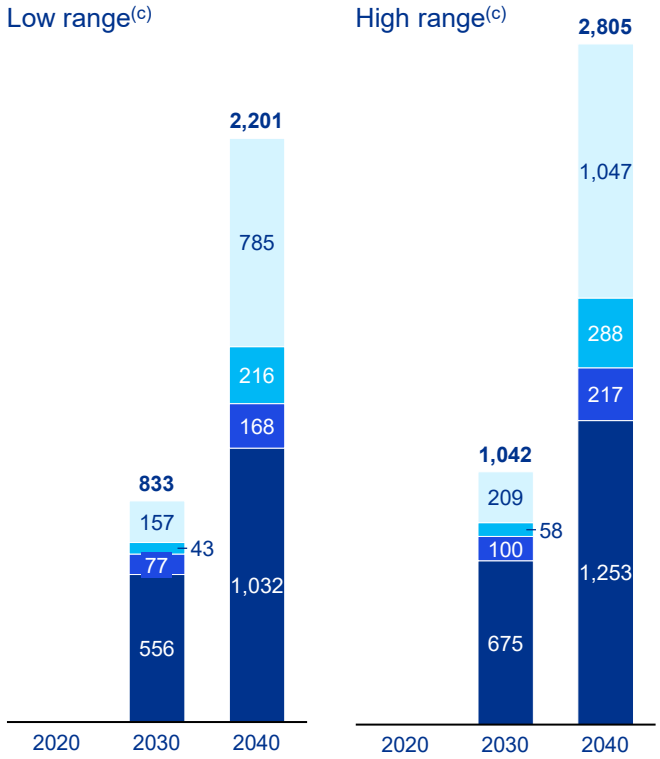
Feedstock required to meet recycled plastic packaging production, 2020-2040FC, kt



Non-contact sensitive packaging | Plastic bottle packaging | Other contact sensitive packaging | PO contact sensitive packaging

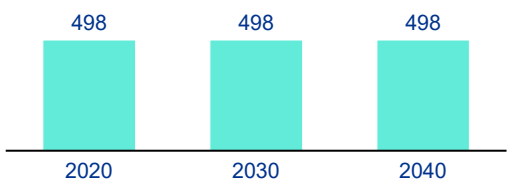
Note: (a) Other recycling includes mechanical recycling, dissolution (physical recycling), depolymerisation (chemical recycling);
(b) Refer to the last page of this subsection for more details on P2P yields per plastic packaging category; Non-contact sensitive packaging also includes medicine packaging, which has not been accounted for, hence could lead to a underestimation, as yields for MR is mostly higher than other forms of recycling;
(c) Low yield range leads to high required feedstock and vice versa.

Source: Interview programme; Plastics Europe; ING; European commission; KPMG analysis.

The proposed automotive MCR of 25% will result in a plastic feedstock demand of 147–166 kt in 2030 and 176 – 199 kt in 2040 based on a illustrative MCR target of 30%

Dutch automotive plastic production[(a)], 2020-2040FC, kt

Assumed constant: Forecasting Dutch automotive plastic production outside the scope of this study



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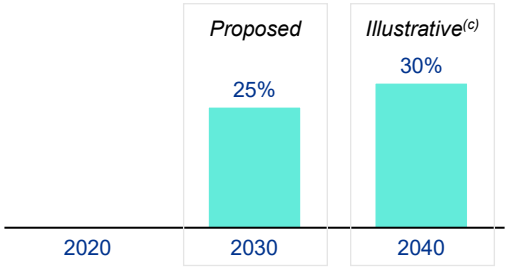
MCR targets for automotive as currently proposed[(b)], 2020-2040FC, %



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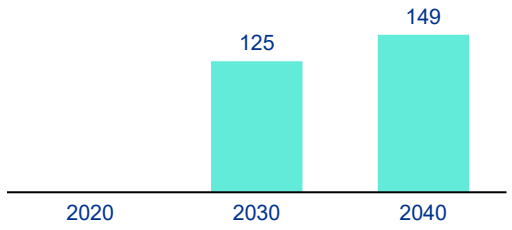
Dutch automotive recycled plastic production based on proposed automotive MCR, 2020-2040FC, kt



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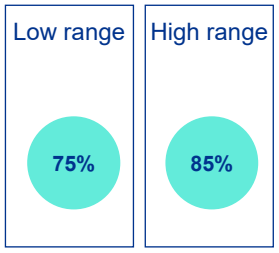
Mechanical recycling yield range[(d)], %



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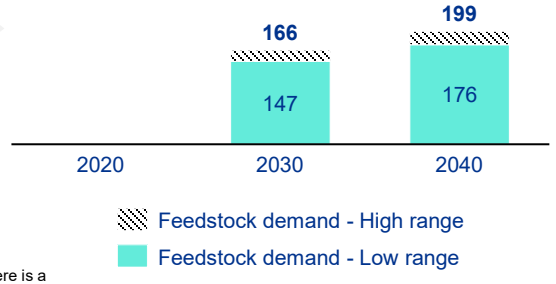
Feedstock required to meet recycled plastic automotive production, 2020-2040FC, kt



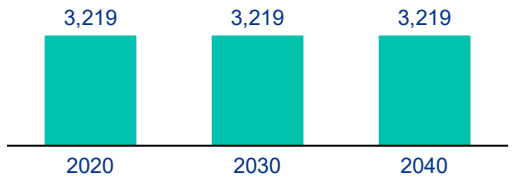
Note: (a) Plastic production assumed to be constant and based on ~11% plastic production in Netherlands;
(b) Besides the 25% MCR target for 2030, the European Commission has also stated that 25% of this 25% MCR has to originate from automotive waste, meaning there is a 6.25% closed-loop recycling requirement;
(c) Automotive MCR target is 25% in 2030. No official target has been set for 2040 so an illustrative percentage of 30% in 2040 has been applied;
(d) Recycling of automotive plastics assumed to be primarily done by mechanical recycling.

Source: Interview programme; Plastics Europe; ING; European commission; KPMG analysis.

Applying an illustrative MCR to plastic production for all other industries result in plastic feedstock demand of 1.1 – 1.2 Mt in 2040

Dutch plastic production for all other industries[(a)], 2020-2040FC, kt

Assumed constant: Forecasting Dutch plastic production from other Dutch industries outside the scope of this study



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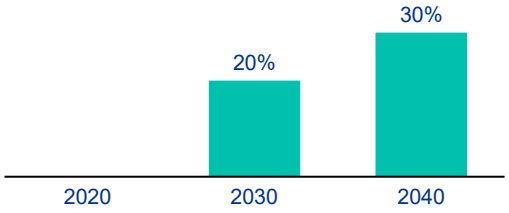
Illustrative MCR targets for all other industries[(b)], 2020-2040FC, %



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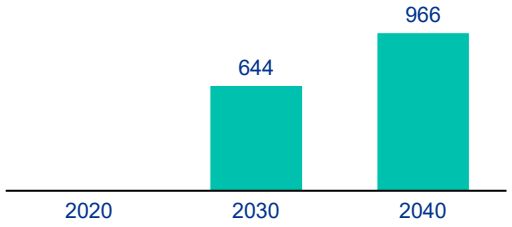
Dutch automotive recycled plastic production based on illustrative MCR targets, 2020-2040FC, kt



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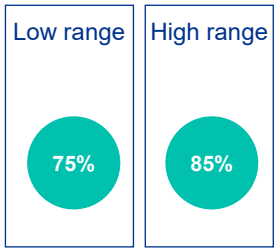
Mechanical recycling yield range[(c)], %



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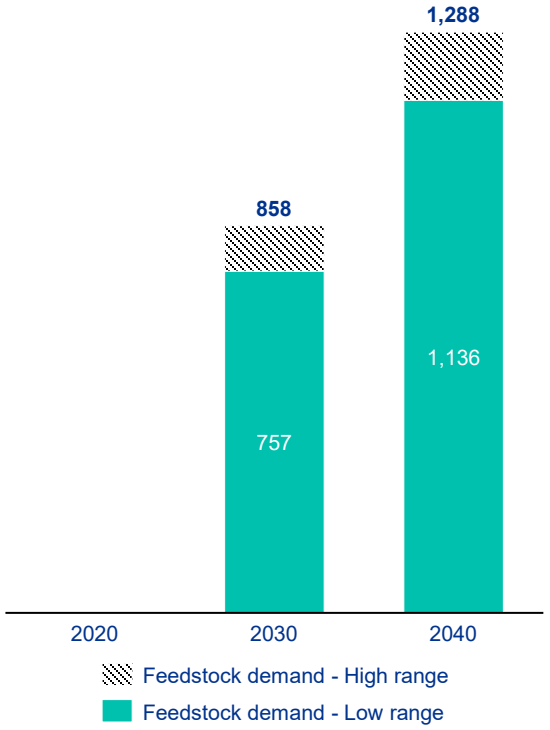
Feedstock required to meet recycled plastic production for all other industries, 2020-2040FC, kt



Note: (a) Plastic production assumed to be constant and based on ~11% plastic production in Netherlands;
(b) Besides the packaging and proposed automotive MCRs, no other MCR targets have currently been announced. However, it is to be expected that these will be introduced in the near future. For illustrative purposes an MCR target of 20% in 2030 and 30% in 2040 for all other industries has been assumed;
(c) Recycling of plastics for all other industries assumed to be primarily done by mechanical recycling.

Source: Interview programme; Plastics Europe; ING; European commission; KPMG analysis.

Each applied recycling technology has a different output yield, which is also heavily influenced by the input

Recycling technology	Input	Recycling technology process yields*		Product focus
		Low range	High range	
Mechanical recycling	Monostream	75%	85%	Non-contact sensitive packaging, Automotive industry, other industries
Dissolution	Monostream	70%	80%	Non-contact sensitive packaging, *Future potential for contact sensitive packaging*
	Mixed films	55%	70%	
	Mixed plastics	30%	60%	
Depolymerisation	Monostream[(a)]	90%	97%	Plastic bottle packaging (PET)
Pyrolysis	Mixed films	40%	50%	Contact sensitive packaging and other contact sensitive applications
	Mixed plastics	20%	30%	

Range indicates the waste-to-plastic yield based (if applicable) on a fuel exempt model, which includes loss of residue, contamination, operational losses and fuel

KPMG view

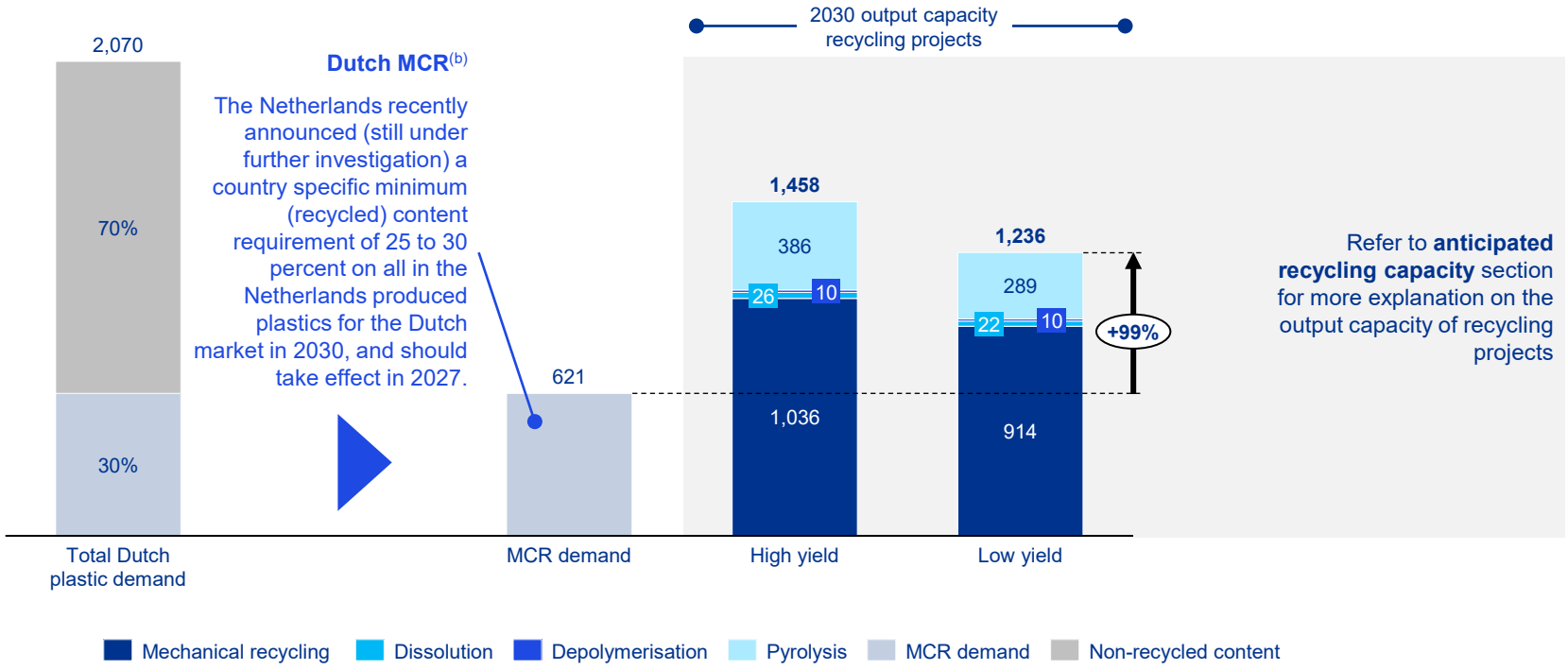
	Rationale	Low	High
Non-contact sensitive packaging[(b)]	Non-contact sensitive packaging material likely to be produced through **mechanical recycling** or **dissolution** of monostream input materials	70%	85%
Plastic bottle packaging (PET)	Plastic bottle packaging material likely to be produced through **mechanical recycling** or **depolymerisation** of monostream input material	75%	97%
Other contact sensitive packaging	Other contact sensitive packaging material (besides PO) assumed to be produced through **pyrolysis** of both mixed films (50%) and mixed plastics (50%) input material	30%	40%
		Weighted average estimate	
PO contact sensitive packaging	PO contact sensitive packaging material assumed to be produced through **pyrolysis** of both mixed films (50%) and mixed plastics (50%) input material	30%	40%
		Weighted average estimate	
Automotive industry	Automotive monostream plastics are expected to be predominantly processed through **mechanical recycling**	75%	85%
Other industries	Other products and industries such as plastics in textiles and hygiene products are assumed to be predominantly processed through **mechanical recycling**	75%	85%

Note: (a) DKR 328-1 input material: PET;
(b) Non-contact sensitive packaging also includes medicine packaging, which has not been accounted for, hence could lead to a underestimation, as yields for MR is mostly higher than other forms of recycling.

Source: Interview programme; Plastics Europe; CE Delft; European commission; KPMG analysis.

Recently announced MCR of 30% on all plastics produced in the Netherlands for the Dutch market, leads to a plastic demand that is half of the plastic produced by projects

Demand for recycled plastics resulting from the Dutch MCR in comparison to recycled plastic output of current and announced recycling projects[a], 2030FC, kt – Indicative



Note: (a) Plastic demand assumed to be constant from 2020 – 2030;

(b) Dutch MCR ('Circulaire plastic norm') is expected to be enforced through a trading systems where rebalancing to different product categories will be possible to reach the 30% target. However, it is unclear how each product category will be effected.

Source: Interview programme; Plastics Europe; European commission; KPMG analysis.

Anticipated recycling capacity

Methodology: Feedstock requirements are based on four key elements

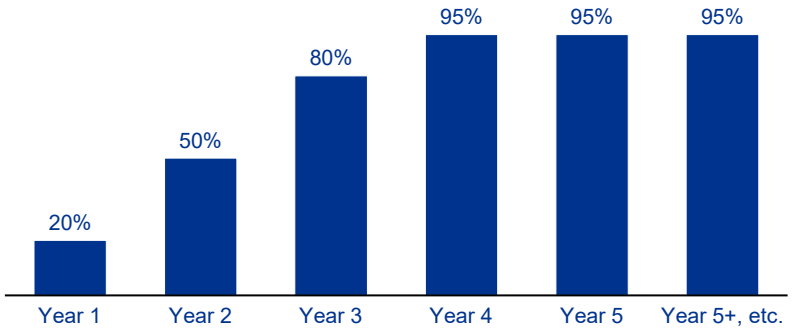
Input capacity	Yield (higher & lower bounder) per technology	Ramp-up period adjustment	Likelihood of construction
Input capacity from current and anticipated recycling projects consists of required inputs without incorporating sorting- and pre-treatment losses. All inputs are aggregated into a total plastic waste/feedstock to calculate the plastic-to-plastic outputs.	End-to-end recycling yield differs between different recycling technologies, recycling facility efficiency and type of input material. Hence, a higher and lower bounder yield is taken into account.	When a recycling facility comes into operation it does not directly operate at full-scale capacity. For this a ramp-up period is included for the first few years. Implied full-scale capacity is in most cases a theoretical number, without considering any downtime.	Announced recycling capacity does not necessarily mean that the recycling facility will be actually constructed. Actual construction still depends on a number of factors (e.g. investment decision). Hence, a likelihood of construction is included to all announced recycling capacity.

See next page for details

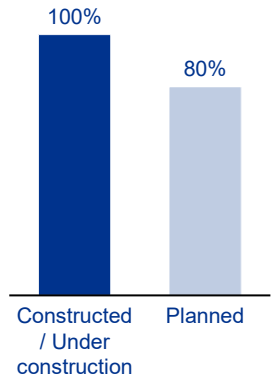
Source: Interview programme; KPMG analysis.

Methodology: Announcements are adjusted to account for ramp-up period and negative investment decisions in future estimation of recycling capacities

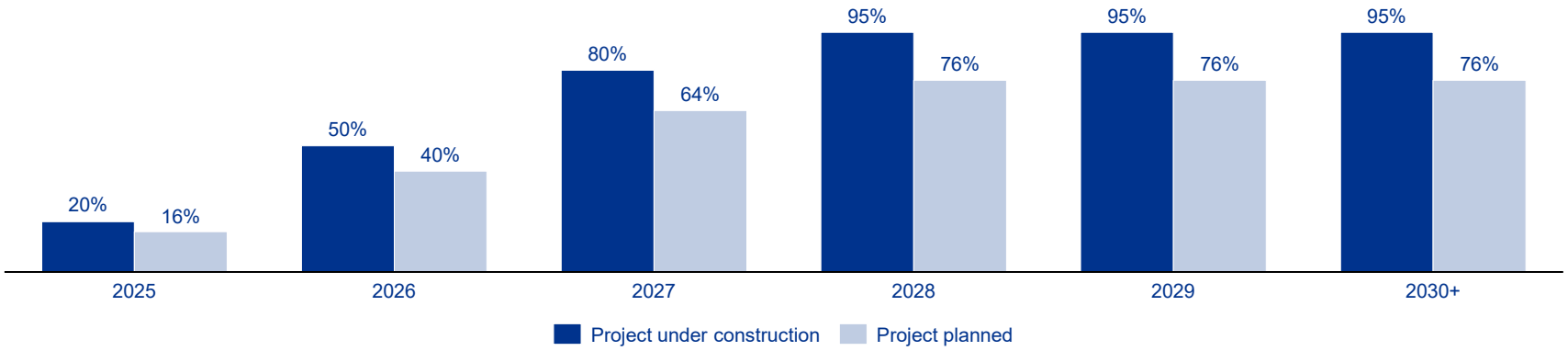
Assumed capacity used after construction year



Assumed construction likelihood



Example assumed utilized capacity for announced project planned in 2025

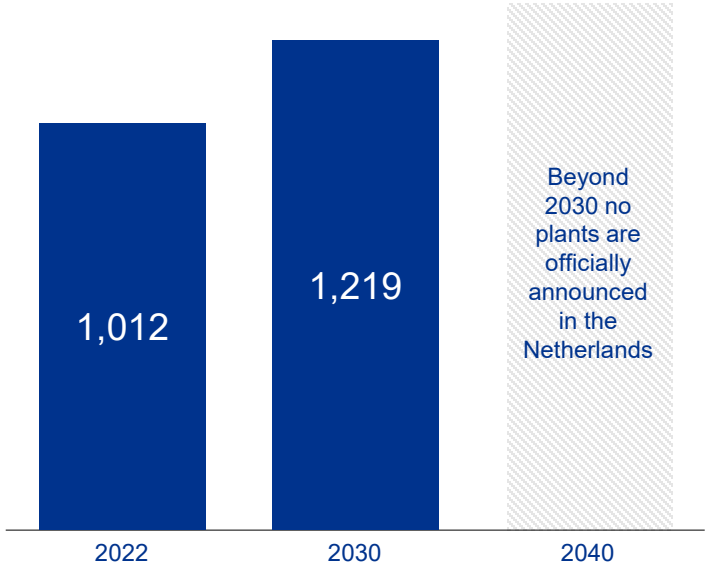


Source: Interview programme; KPMG analysis.

Mechanical recycling

Mechanical recycling is the most mature form of recycling and is expected to have a feedstock demand of 1.2 Mt in 2030

MECHANICAL RECYCLING: Plastic waste input capacity[a], 2022-2040FC, kt



26 **+0** Plants

Note: Mechanical recycling of mixed plastics is currently being done in Germany, no known capacity for this in the Dutch market.
Source: Plastics Europe; Interview programme; EcoProg; Company websites; KPMG analysis.

Main characteristics

Maturity

- Most mature and common type of recycling
- Other applications include: collection and grinding of PP crates and regrinding to mould new crates, collection of LDPE films used in agriculture and industrial packaging and processing it into refuse bags
- A significant hurdle within mechanical plastic recycling when it comes to capacity development is the degradation and quality loss that occurs after every time a plastic is mechanically recycled. There is therefore only a limited amount of times that a plastic can get mechanically recycled before the quality becomes too poor to physically use for its intended purpose. There are however some advanced mechanical recycling techniques that do have food-grade approval for PET

Capacity development

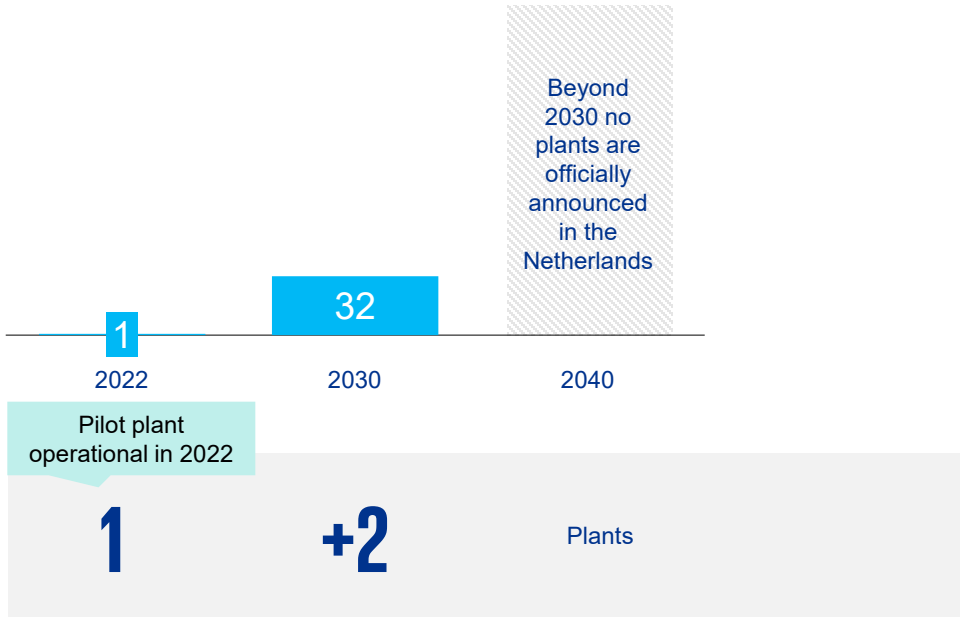
- Significant increase is expected due to ramp up of two installations that started production in 2022 and two installations that started in 2021 as well as an overall increase of demand for mechanical recycling capacity based on mandatory content requirements

Feedstock availability

- Plastic monostreams such as DKR 328, DKR 329, DKR 324, DKR 340. Or more low quality plastic streams such as mixed films (DKR 310).
- Mechanical recycling requires a significantly purified monostream of waste. The waste used is sorted and filtered out until the required purity is reached often by the mechanical recycler or waste management company.

Dissolution is a relatively immature technology with very limited announced capacity, however it has the potential to deliver relatively high quality recycled plastics

DISSOLUTION: Plastic waste input capacity[(a)], 2022-2040FC, kt



Main characteristics

Maturity

- Relatively immature form of recycling with only pilot plants operational in the Netherlands and abroad
- Has the potential to produce food grade plastic packaging for which it is currently running for approval at the EU

Capacity development

- No significant increase expected in the short-term – one plant expected to ramp up in capacity starting production from 2022 and one plant announced to start production in 2023, both plants use polystyrene foam as input
- In the long-term dissolution holds the potential to play a significant role and ramp-up in capacity

Feedstock availability

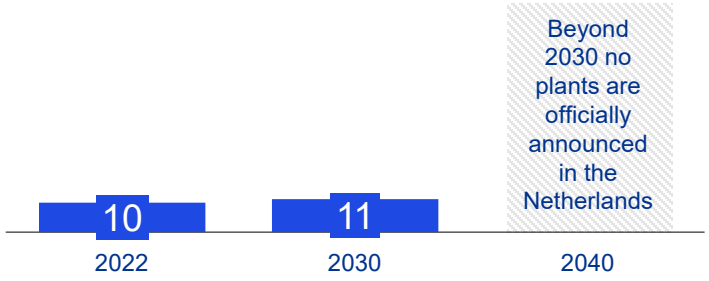
- Plastic monostreams/ thermoplastics, mixed plastics, and mixed films
- Dissolution is able to treat an extensive range of plastic resins and can virtually treat any of the thermoplastics. Most of the projects however focus on PS, PVC and polyolefins
- The feedstock used for dissolution can contain significant amounts of contaminants
- E.g. PS, PET, PVC, PA, PP, PMMA etc.

Note: (a) Publicly announced dissolution projects by Trinseo and Obbotec, however for these projects no capacity figures have been announced.
Source: Interview programme; EcoProg; Company websites; KPMG analysis.

Chemical recycling

Expansion of depolymerisation technology is expected to be constrained due to limited feedstock availability and suitability

DEPOLYMERISATION: Plastic waste input capacity, 2022-2040FC, kt



1	+0	Plants

Main characteristics

Maturity.

- Depolymerisation technology is relatively mature and can be categorised into: hydrolysis, methanolysis and glycolysis.
- Depolymerisation recycles the plastic back to virgin-grade and has a yield of an estimated 90-97% unlike mechanical recycling.
- The technology requires high volumes to be cost-effective and requires a waste-stream with low amounts of contaminants which makes it highly dependent on sorting quality.

Capacity development

- Only one known plant is currently operational, that utilises glycolysis, in the Netherlands that started production in 2019. The plant is to slightly ramp-up from 2022 onwards.

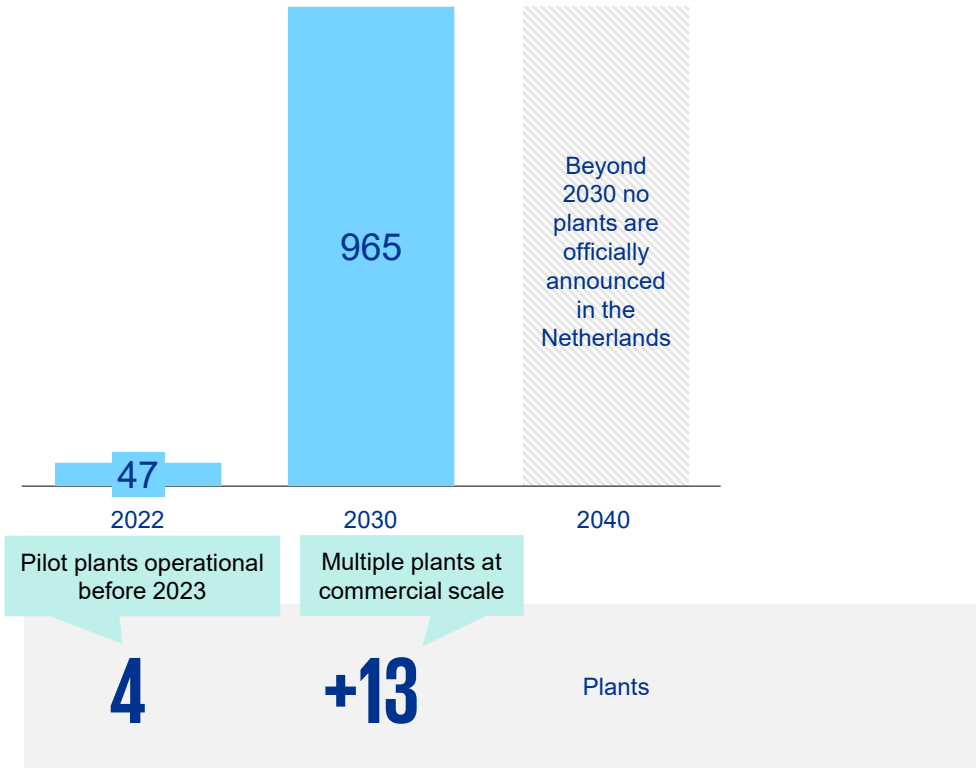
Feedstock availability

- Plastics used in depolymerisation technology mostly include monostream plastics such as PET.
- E.g. DKR 328-1.

Source: Interview programme; EcoProg; Company websites; PBL; KPMG analysis.

There is a massive ambition to scale up pyrolysis capacity in the Netherlands which will require a total feedstock of 0.1 Mt in 2030

PYROLYSIS: Plastic waste input capacity, 2022-2040FC, kt



Source: Interview programme; Eunomia; EcoProg; PBL; Company websites; KPMG analysis.

Main characteristics

Maturity

- Maturity of pyrolysis has progressed rapidly over the past few years and is currently ready for commercial scale deployment.
- Output quality can differ which will play a crucial role in the recycling factor as heavy fractions are likely not counted as recycling.

Capacity development

- Pyrolysis projects are expected to build up significant capacity in the future as the petro-chemical industry is starting to look for sources of pyrolysis oil to be used in their crackers.
- Thirteen new installations are expected to start production after 2022, while three plants ramped up their capacity since they started in 2022. One plant will gradually ramp up capacity, what they started doing since 2020.

Feedstock availability

- Feedstock restrictions for pyrolysis are stringent as it can only process polyolefins with very limited contaminations.
- In the short-term mixed film feedstock will be the most desirable feedstock which is likely to shift to mixed plastics as mixed films can achieve higher recycling rates through other technologies.
- Both mixed films and mixed plastics need to undergo intensive pre-treatment to make it suitable for pyrolysis with result in significant yield losses.
- In terms of contaminants, pyrolysis feedstock is also not able to exceed the following thresholds: PVC/ PVDC: 1%, PET/ EVOH/ Nylon: 5%, PS: 7%, Rigid metal/glass/dirt/ fines: 7%, Paper/ organics: 10%.

Alternative applications

Alternative applications *(mainly gasification)* are not likely to use the same plastics waste feedstock as MR and CR and therefore do not compete

Overview of the type of feedstock needed for competing applications and announced capacities within the Netherlands

Quality of stream ↑

Waste input	Sustainable Aviation Fuel (SAF)	LOA[a]	Waste-to-Methanol (WtM)	LOA[a]	Waste-to-Hydrogen (WtH)	LOA[a]	Waste-to-Energy (WtE)	LOA[a]
Monostream plastics	✗ Such streams are required to be treated through mechanical recycling	○	✗ Such streams are required to be treated through mechanical recycling	○	✗ Such streams are required to be treated through mechanical recycling	○	✗ Such streams are required to be treated through mechanical recycling	○
Mixed plastics	~ Theoretically SAF can use the same feedstock as pyrolysis and can thus also process DKR 350 streams, however would make more sense for plastic-to-plastic recycling	◔	~ According to CE Delft most of the feedstock used for gasification, one of the processes within waste-to-methanol, is mixed plastic waste. Such a stream would be better for plastic-to-plastic recycling	◔	~ According to CE Delft most of the feedstock used for gasification, one of the processes within waste-to-methanol, is mixed plastic waste. Such a stream would be better for plastic-to-plastic recycling	◔	~ Currently used in cement kilns as SRF/RDF. However better treatment exists and is emerging which can create more value	○
Residues and residual waste (containing plastics)	✓ Some SAF methods use waste such as oils, sugars, agricultural and forest wastes, energy crops, cellulosic biomass and others to produce SAF Also waste residues containing plastics	◔	✓ Any material with carbon such as coal, lignite, wood-waste and agricultural residue can be utilized for methanol production Also waste residues containing plastics	◑	✓ The Waste to hydrogen process has been achieved with food waste, wood chips, sewage sludge, forestry waste, SRF and RDF Also waste residues containing plastics	◑	~ Only sorting out plastic is very costly can it go to a waste to energy facility	◔

Announced capacities in the Netherlands

Three known expected SAF projects

- 500 kt (expected completion 2nd half of 2023)
- 820 kt (expected start of production: 2025)
- 100 kt (expected start of production: 2025/26)

Three known expected WtM projects

- 87.5 kt (expected start of production: 2025)
- 90 kt (expected start of production: 2025)
- 120 kt (expected start of production: 2024 and plans to expand to 500 kt by 2030)

One known expected WtH project

- 375 kt waste to hydrogen facility with a 700kt sorting installation (recently announced, no known expected start of production)

Note: (a) Likelihood of adoption.

Source: Interview programme; Company websites; KPMG analysis.

Sustainable aviation fuel is expected to be the most scalable application compared to the other applications due to its high potential to directly decrease emissions

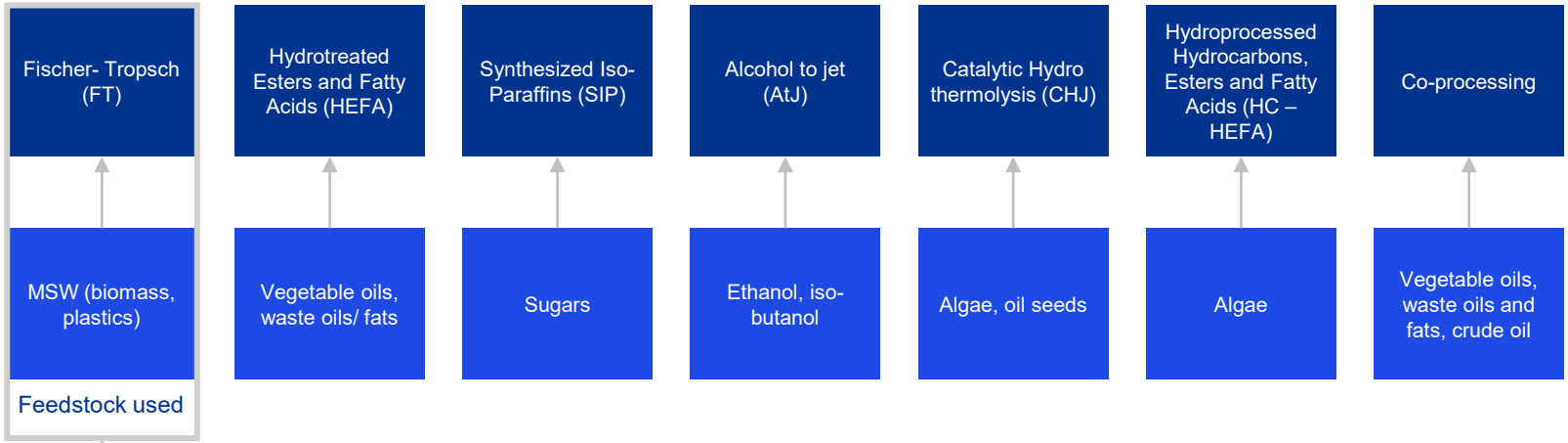
Overview of the business case potential of alternative fuels/ technologies

	Technology	Description	Business case potential	Reasoning
I	Sustainable Aviation Fuel (SAF)	• Sustainable aviation fuels has recently been assessed by the European Commission and evaluated to "have the potential to significantly reduce aircraft emissions. However, this potential is largely untapped as such fuels only represent only 0.05% of total jet fuel consumption." SAF can also be produced with a large variety of feedstocks (not necessarily municipal waste/ plastics). Furthermore there are obligations originating from the ReFuelEU Aviation regarding the application of e-fuels. • A commitment made by more than 100 companies at the Sustainable Development Impact Summit 2021 includes powering global aviation with 10% SAF by 2030. • A number of large projects have been announced in the Netherland with a known capacity of over a million tonnes • At present, the most common, simplest and cheapest type of SAF technology, namely synthesized paraffinic kerosene from Hydroprocessed esters and fatty acids (HEFA), utilizes monocrops/algae as feedstock		• As aviation remains one of the most polluting industries, significant effort is being put in finding alternative fuel sources that would limit the emissions caused by global aviation • While SAF is estimated to be double the price of conventional jet fuel, the greener alternative causes 80% less CO2 emissions • Scalability issues however present as the fuel is barely being utilized and no sustainable and consistent feedstock is available to make SAF economically viable at this moment
II	Waste to Methanol (WtM)	• An economic assessment on waste-to-methanol estimated the return on investment to be 29% with a payback period of four years for a bio methanol production process derived from (the organic fractions from) refuse-derived fuels (RDF) • Waste-to-methanol can also use a large variety of feedstock, as long as the feedstock includes a high quantity of carbon. Feedstock sources could include municipal solid waste, coal, lignite, wood waste and agricultural residue • Maersk has assessed methanol as having "high scalability potential" and has already ordered 8 vessels that will be run on dual fuel engines with a vision to use 95% green methanol and 5% bio diesel • Only several waste-to-Methanol plants have been announced in the Netherlands	 	• Similarly to SAF, waste-to-methanol also requires a reliable and consistent supply of feedstock • While gasification technology (especially of oil and coal) is already operating at a commercial level, the application of gasification technologies to various feedstock sources such as biomass and MSW is still at an early stage of commercialization and requires further development
III	Waste to Hydrogen (WtH)	• Waste-to-hydrogen is still at an early stage of technology and is only applicable for a handful of sustainable end-uses. One of such end-uses includes hydrogen powered cars through fuel cells, a technology that is still being developed • High-end waste management technologies are required to pre-treat the waste for waste-to-hydrogen technology • Only one waste-to-hydrogen plant has been announced in the Netherlands		• Waste to hydrogen is not expected to be have a high likelihood of adoption and business case potential given its large yield losses and inefficiency

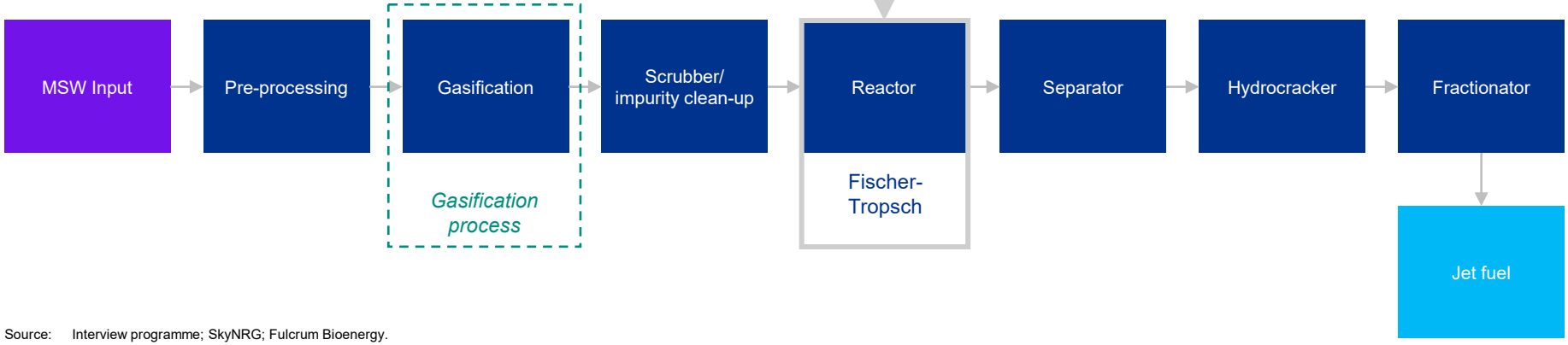
Source: Interview programme; European Commission; KPMG analysis.

Sustainable Aviation Fuel (SAF) can be generated through several technology types, of which the Fischer-Tropsch (FT) technology uses MSW as feedstock

Overview of sustainable aviation fuel technology types – Indicative



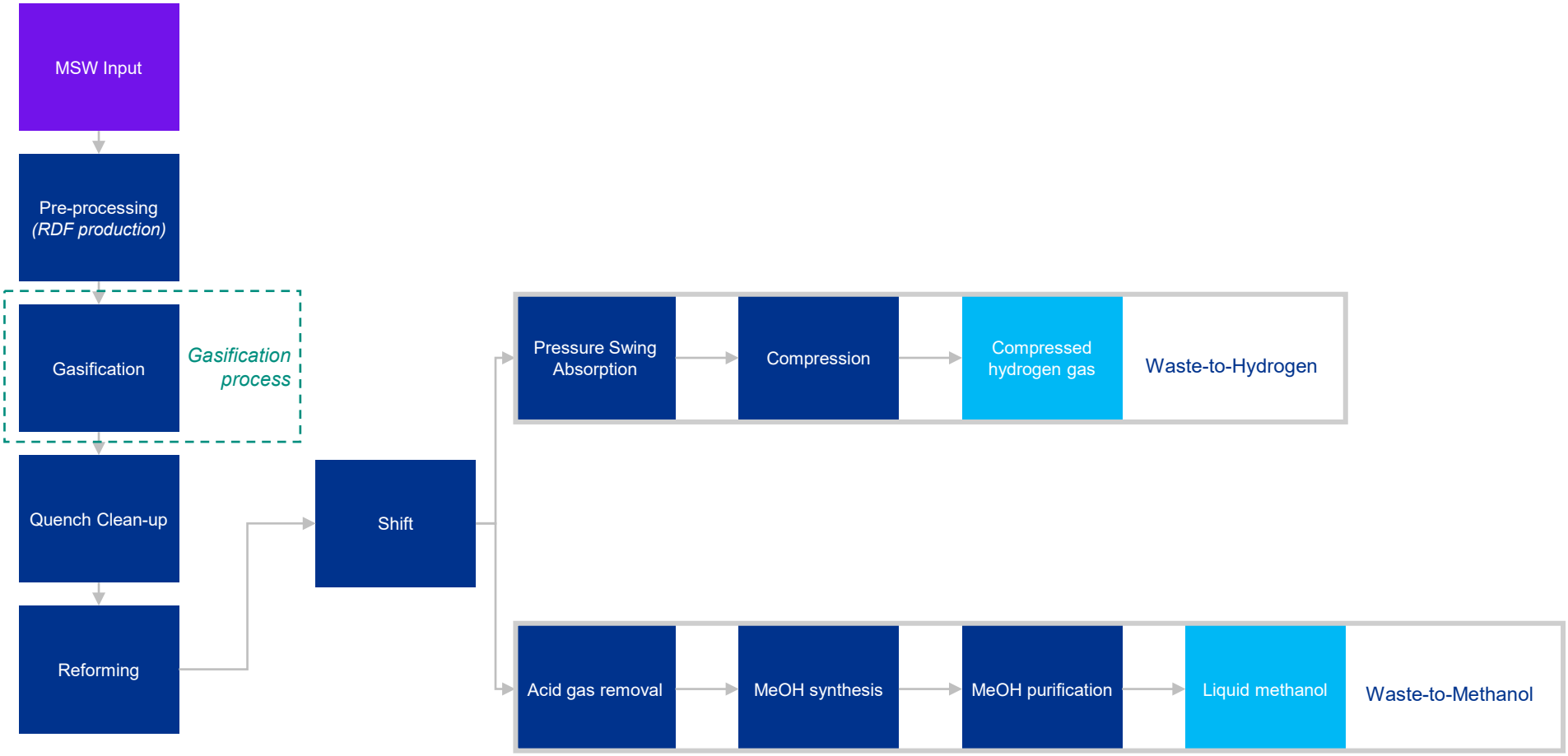
Sustainable aviation fuel diagram of the Fischer-Tropsch method



Source: Interview programme; SkyNRG; Fulcrum Bioenergy.

Waste-to-Methanol (WtM) and Waste-to-Hydrogen (WtH) process diagram

Waste-to-Methanol and Waste-to-Hydrogen process diagram[a] – Indicative



Note: (a) CO2 capture at Energy-from-Waste facilities in combination with methanol synthesis (with H2) is out-of-scope for this study.

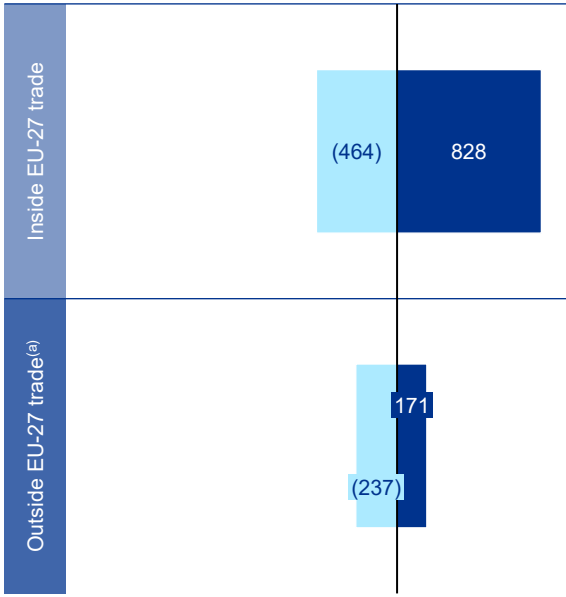
Source: Interview programme; Princeton University..

6.

Import & Export dynamics

A significant share of current plastic waste exports could be retained in the Netherlands as future feedstock for Dutch mechanical recycling plants

Overview of 2022 import and export volumes, incentives and retention possibilities for plastic waste in the Netherlands



Reason for trade	Retention possibilities of export volumes
Import and export volumes within the EU-27 are mainly the result of specialisation in processing methods (e.g. high quality recycling, incineration) and infrastructural facilities (e.g. re-export through the port of Rotterdam) leading to economic incentives for imports and exports	Retention of volumes currently exported towards countries inside the EU-27 can mainly obtained by increasing local plastic waste demand and treatment capacity (soft measures)
Import volumes from outside the EU-27 are mainly coming from European countries such as the UK, Switzerland, Iceland, etc. with similar cost-levels as the Netherlands and follow the same trade incentives as the inside EU-27 category **Export** volumes are predominantly going towards lower-cost processing countries such as Indonesia, Turkey, Vietnam and Malaysia as processing and transport costs are less expensive than in Europe	Retention of export volumes is possible due to (future) regulation making it harder or impossible to export plastic waste towards countries outside of the EU-27 (hard measure) Other retention incentives could come from additional local demand for plastic waste as a result of increased recycling standards (following regulations) resulting in higher willingness to pay for feedstock than in countries now exported to (soft measures)

Note: (a) Beware that UK is outside EU-27;
(b) Retaining currently exported plastic waste might potentially lead to undesirable consequences when plastics that is exported for mechanical recycling is used for chemical recycling in the Netherlands.

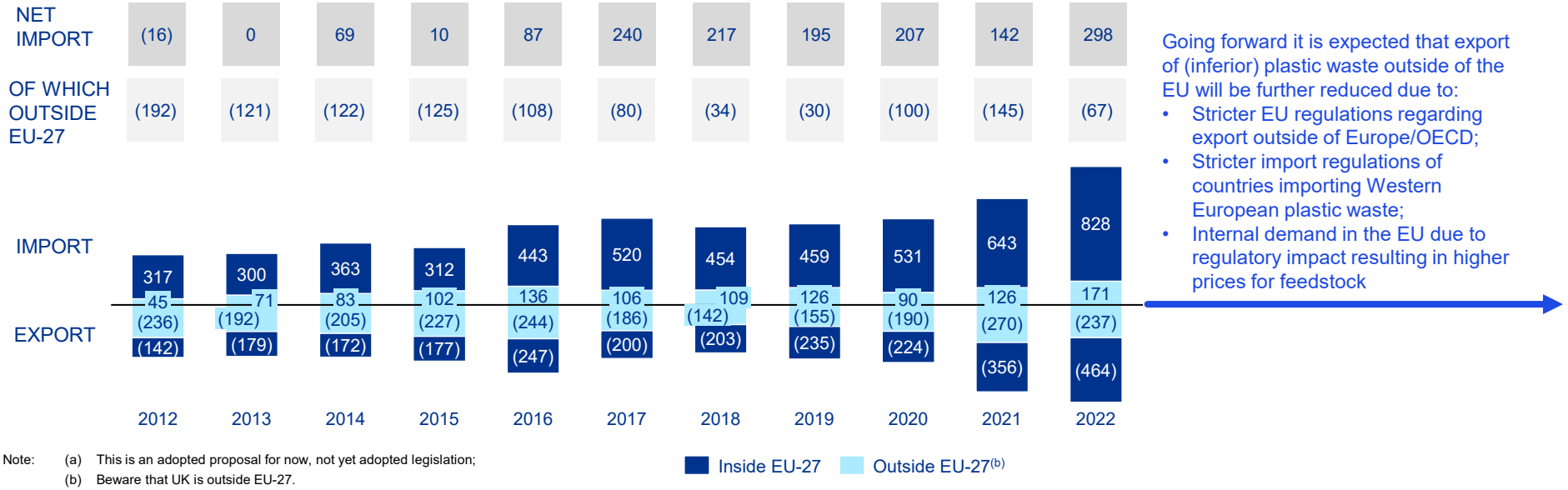
Source: Interview programme; Eurostat; European Union; Dutch Government; KPMG analysis.

Since 2012 the Netherlands has consistently been a net importer of plastic waste with a large surge in intra-EU trade in recent years

Timeline on import- and export of plastic waste

2012-2017	2017-2018	2020-2021	2021	2021	2023-2025 (expected)	2022 – 2028 (proposed)
Substantial share of exports outside of the EU by Netherlands was to China	**Ban on import of plastic waste by China**	**(Partial) ban on import of plastic waste by Malaysia and Vietnam**	**Ban on export of unsorted plastic waste (>2% contamination rate) to developing countries by EU becomes effective**	**Ban on trade of unsorted plastic waste within the EU with a contamination rate of >6%, The Netherlands chose to adhere to a stricter >2% limit**	**Ban on import of plastic waste by Thailand** Others likely to follow	**European Environmental committee adopted proposal to ban all exports of plastic waste to non-OECD countries followed by an export ban towards non-EU OECD countries within 4 years[a]**

Imports and exports of plastic recyclable materials to and from the Netherlands, 2012-2022, kt



Going forward it is expected that export of (inferior) plastic waste outside of the EU will be further reduced due to:

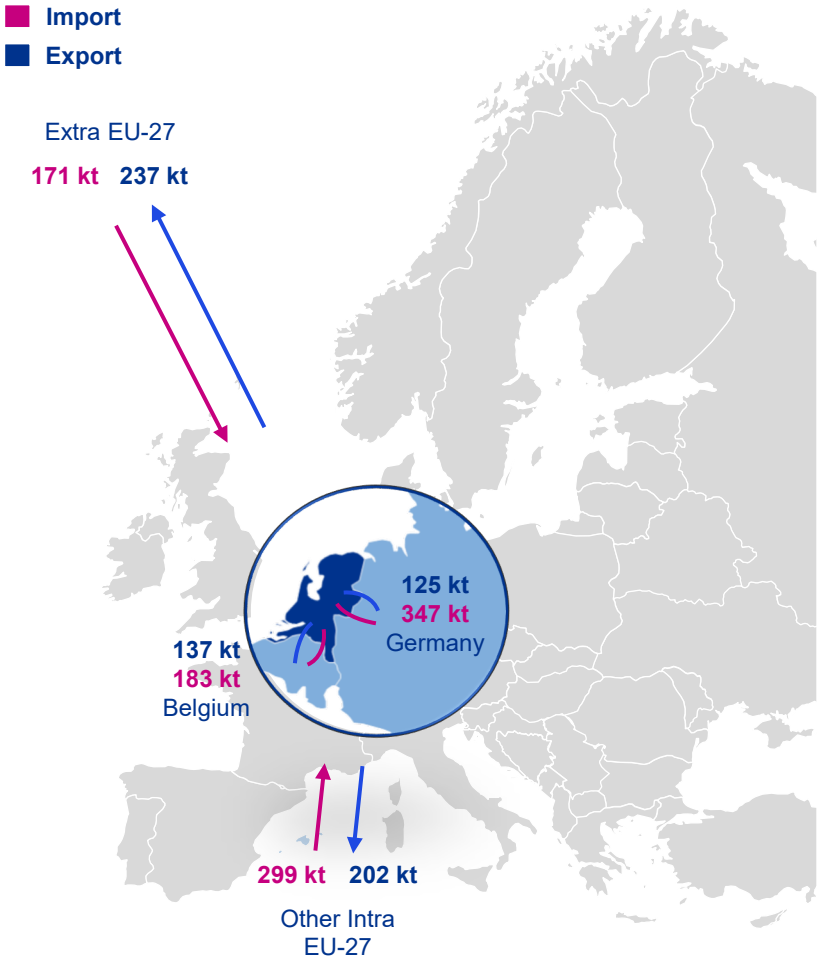
- Stricter EU regulations regarding export outside of Europe/OECD;
- Stricter import regulations of countries importing Western European plastic waste;
- Internal demand in the EU due to regulatory impact resulting in higher prices for feedstock

Note: (a) This is an adopted proposal for now, not yet adopted legislation;
(b) Beware that UK is outside EU-27.

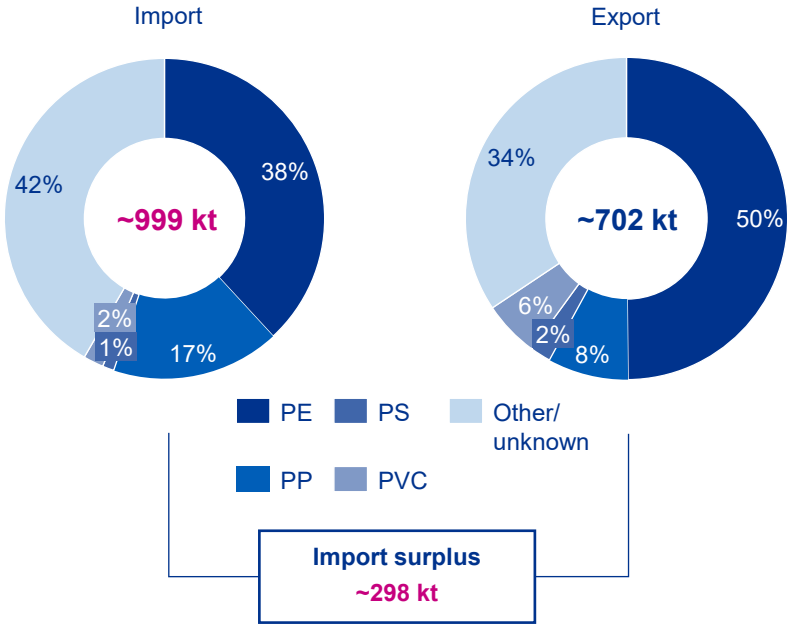
Source: Interview programme; Eurostat; European Union; Dutch Government; KPMG analysis.

The majority of plastic waste being imported from neighbouring countries Belgium and Germany

Import/export volumes of plastic waste in the Netherlands, kt, 2022



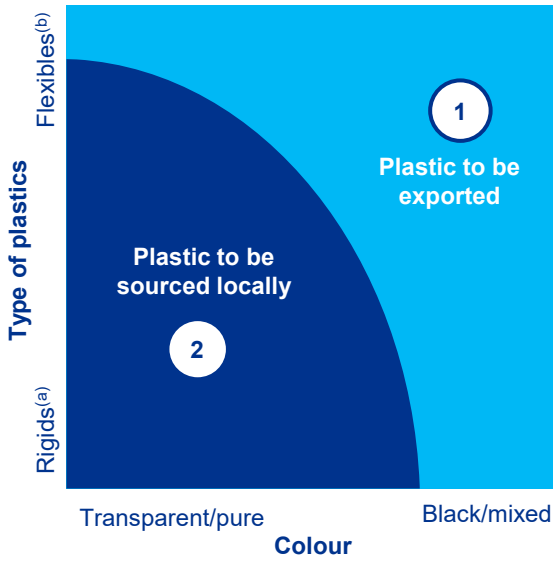
Import/export of plastics waste per material type, %, 2022



Source: Eurostat; KPMG analysis.

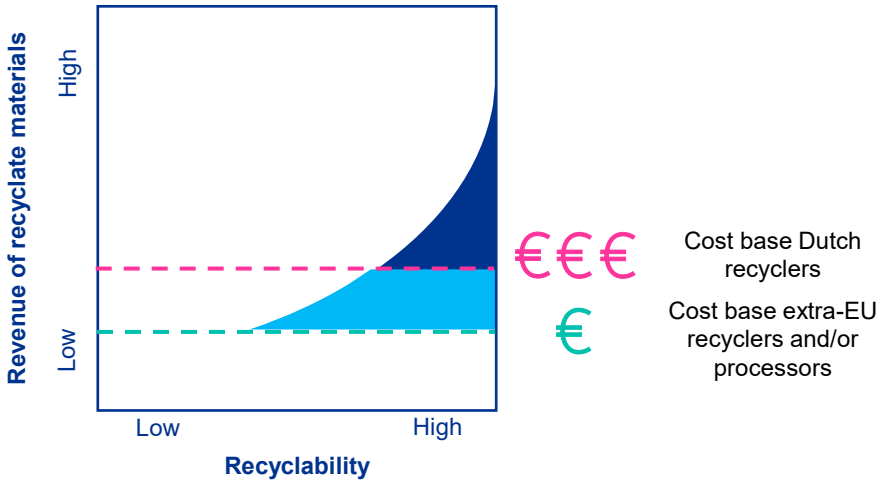
Lower value flexible plastics are mainly exported outside the EU as these plastics are associated with high sorting and recycling costs

Indicative overview of recyclability of different plastic types



> "In low cost countries they further increase the value by sorting on colour through handpicking." – *Waste manager*

1 Hard to recycle plastics are often too expensive to recycle in Western Europe due to the high cost base of the recycling plants there. Therefore, these plastics are often treated at other locations where cost bases are lower and where handpicking is required to increase the value

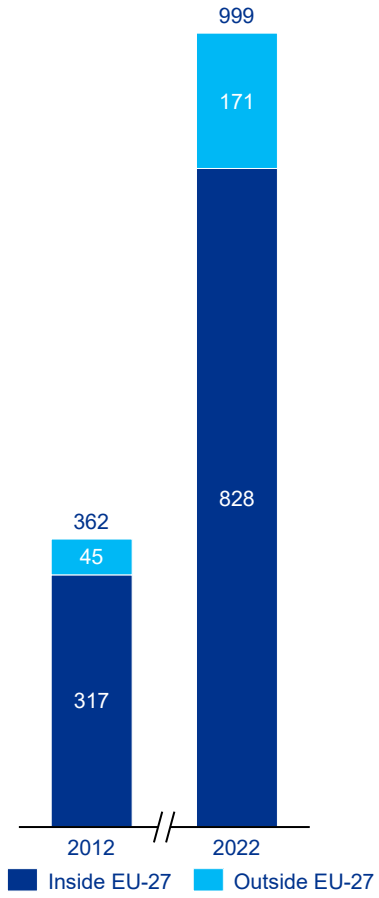


2 Easy to recycle plastics are often traded through long-term contracts leading to local players with better connections obtaining these contracts

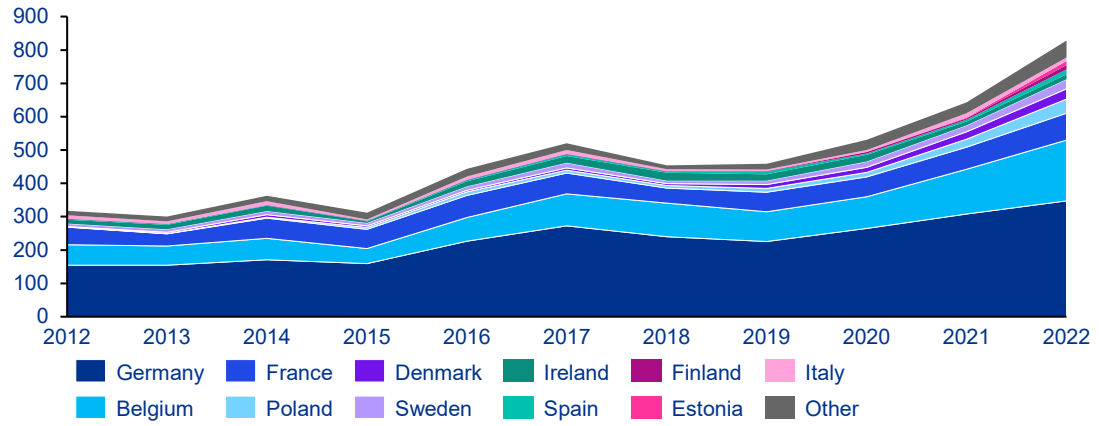
Note: (a) Rigid plastics consist of HDPE, PP and PET;
(b) Flexible plastics consist of LDPE and PP;
Source: Interview programme; KPMG analysis.

Imports are mainly originating from neighbouring countries – Germany and Belgium have many sorting facilities near the borders

Imports of plastic recyclable materials from the Netherlands, 2012-2022, kt



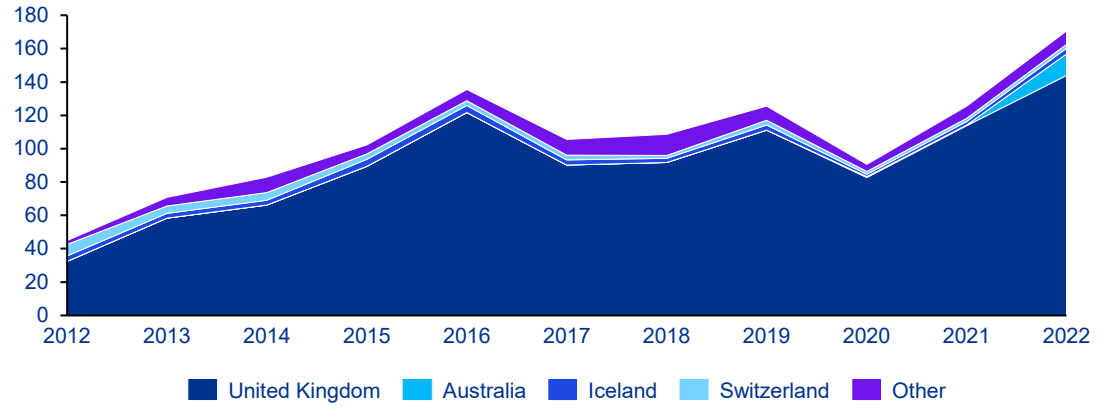
Imports of plastic recyclable materials to the Netherlands from inside EU-27 countries, 2012-2022, kt



Imports from EU countries are partly re-exported, incinerated or used for recycling

The increase in recent years is most likely the result in plastic waste markets becoming more mature leading to increased economic activity and specialisation of recyclers which require certain types of plastic not sufficiently available on the domestic market

Imports of plastic recyclable materials to the Netherlands from outside EU-27 countries, 2012-2022, kt

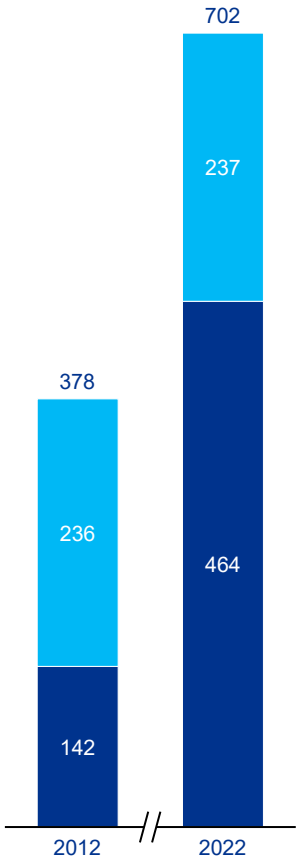


Non-EU countries are a relatively small part of total plastic imports towards the Netherlands where the UK takes the most dominant position

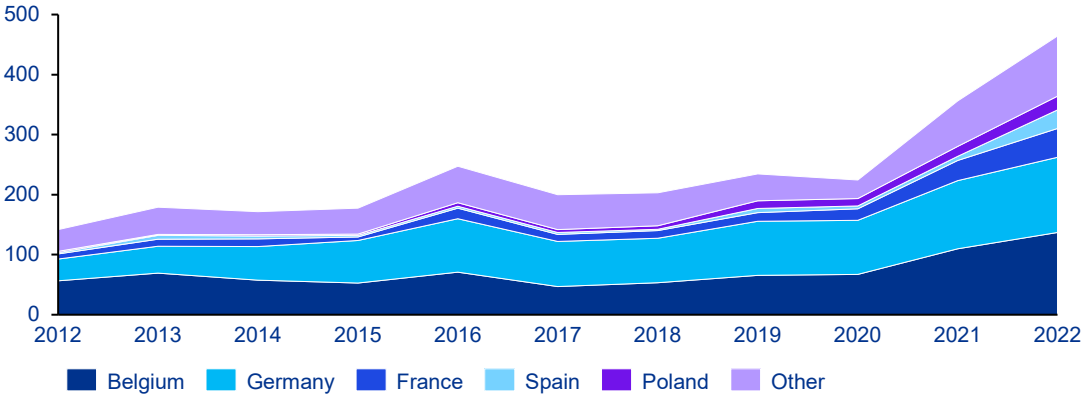
Source: Interview programme; Eurostat; KPMG analysis.

Plastic waste exports to other EU countries have increased significantly in the past decade, Belgium and Germany developed a mature waste infrastructure

Exports of plastic recyclable materials from the Netherlands, 2012-2022, kt



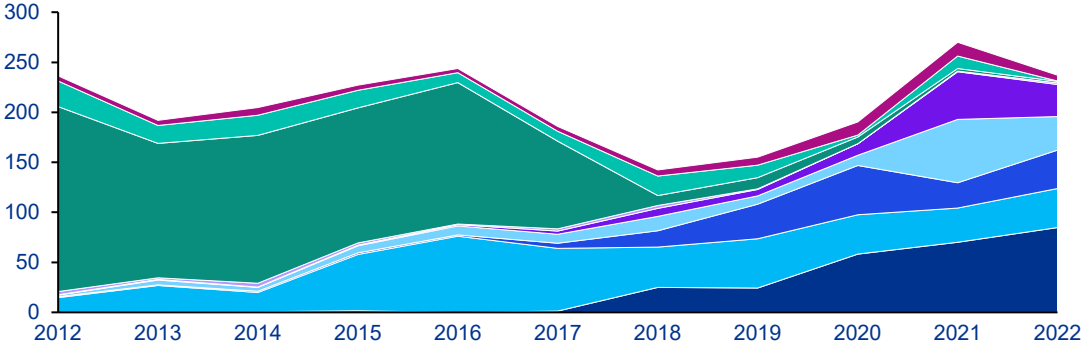
Exports of plastic recyclable materials from the Netherlands to inside EU-27 countries, 2012-2022, kt



Belgium and Germany have a very mature plastic recycling industry where low grade plastics are exported to

The increase in exports in recent years is also most likely the result in plastic waste markets becoming more mature leading to increased economic activity

Exports of plastic recyclable materials from the Netherlands to outside EU-27 countries, 2012-2022, kt



China introduced a plastic waste import ban in 2017-2018 which led to a large shift of export volume towards other non-EU countries. (Partial) import bans in Vietnam and Malaysia could explain reduced exports to these countries in 2022

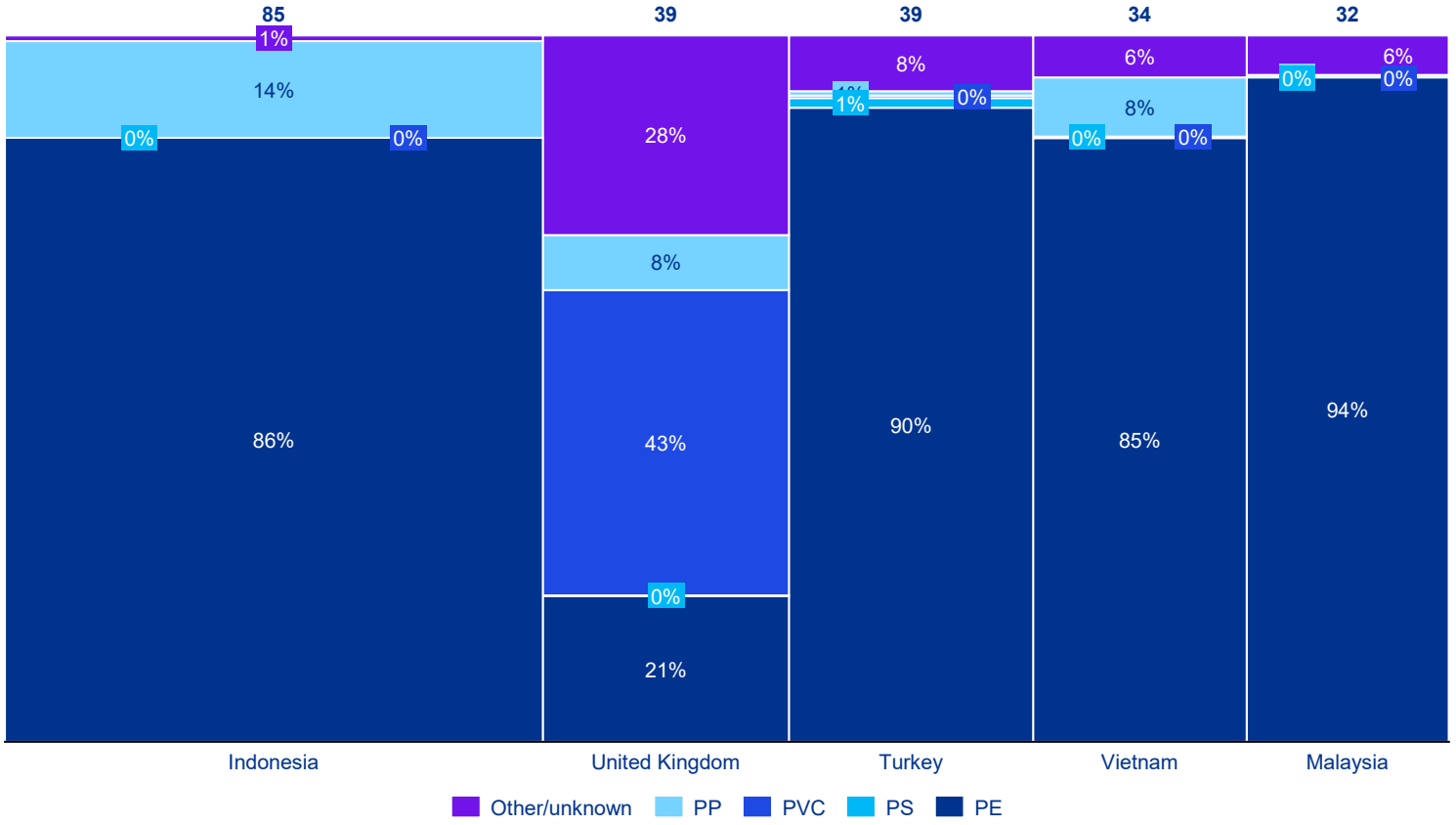
Drivers for these export streams is the availability of cheap hand-recycling capabilities in these countries which is too expansive in the Netherlands and Europe

Inside EU-27 | Outside EU-27

Source: Interview programme; Eurostat; KPMG analysis.

Most of exported volume towards low income non-EU countries consists of mixed/coloured PE which requires handpicking to increase the value

Exports of plastic recyclable materials from the Netherlands to top outside EU-27 countries per type, 2022, kt



The plastics going to other countries are mainly films which have a relatively high quality with less than 2% contamination (by law) and consist of mixed colours

Mixed films can significantly increase in value through handpicking as machine sorting tends to result in a lower quality

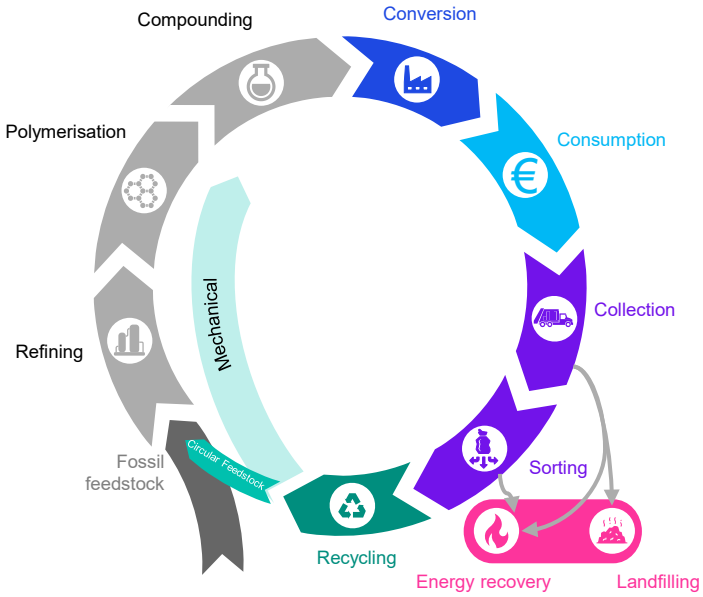
Processing and transport costs for exporting are generally very low compared to domestic treatment

Source: Interview programme; Eurostat; KPMG analysis.

7.
Policies

The plastic waste recycling value chain faces a number of (proposed) policies that will fundamentally change industry dynamics (1/2)

Simplified overview of the plastic recycling value chain for plastic waste



Categorization of impacting policies

1	*European-wide or Dutch-specific policies*
2	*Policy is currently active or proposed/communicated*
3	*Policy is a directive or regulation[d]*

Relevant (proposed) policies

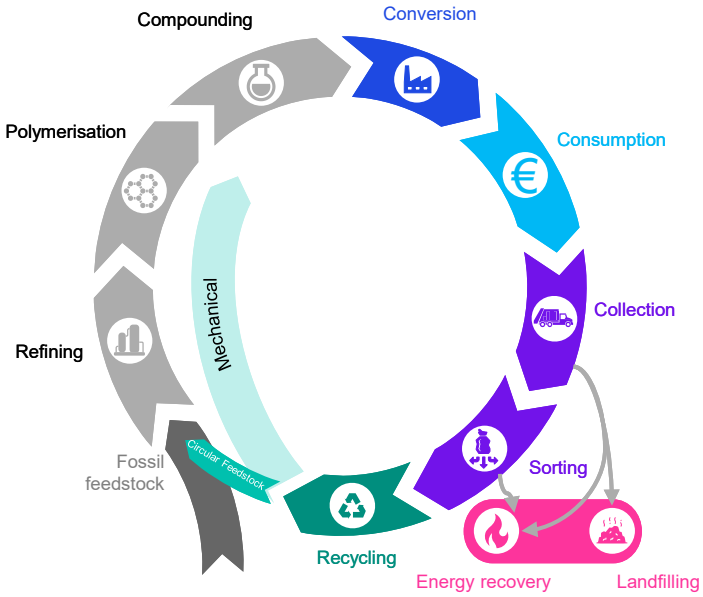
	Relevant (proposed) policies	Category
I	ESPR [a] – Product design regulations Harmonized design requirements for plastic and polymers	R
II	PPWR[b] – Minimum recycled content Minimum share of recycled material quote of 10-35%	R
III	PPWR[b] – Levy for unrecycled plastic Countries must contribute 800 EUR/t for unrecycled plastics	R
IV	Sustainable carbon cycles – sustainable carbon quota Minimum share of sustainable non-fossil carbon quote of 20%	D
V	ELV proposal for Regulation[c] – Recycled content requirement Recycled plastic content share in cars to be 25% (2030)	R
VI	Extended Producer Responsibility (EPR) Converter pays €1,050 excl. VAT per kg of plastic	R
VII	Single-use plastics Directive – Ban Ban of the ten most frequently littered single-use plastic items	D
VIII	Waste shipment regulation – Plastic export bans Inhibition of plastic waste to non-OECD countries	R
IX	Waste framework Directive – Municipal recycling rate Municipal waste recycling rate 55% (2025) / 60% (2030)	D
X	Single-use plastics Directive – Collection target Separate collection of plastic bottles 77% (2025) / 90% (2029)	D

Note: (a) Ecodesign for sustainable products regulation (b) Packaging & Packaging Waste Regulation; (c) End-of-life Vehicle; (d) Regulations have binding legal force throughout every Member State and enter into force on a set date in all the Member States. Directives lay down certain results that must be achieved but each Member State is free to decide how to transpose directives into national laws.

Source: European Commission; KPMG analysis.

The plastic waste recycling value chain faces a number of (proposed) policies that will fundamentally change industry dynamics (2/2)

Simplified overview of the plastic recycling value chain for plastic waste



Categorization of impacting policies

1	*European-wide or Dutch-specific policies*	
2	*Policy is currently active or proposed/communicated*	
3	*Policy is a directive or regulation[d]*	D R

Relevant (proposed) policies

	Policy	Category
XI	Waste Framework Directive - End-of-waste status rec. plastic Rules for transportation of collected plastic waste vs products	D
XII	EU ETS[a] directive – Inclusion of incinerators Incineration inclusion in ETS, raising costs (2028-2030)	D
XIII	Landfill directive – Landfill limit Landfill limit of 10% (2035)	D
XIV	Waste disposal levy Higher levy paid for NL waste sent to incinerator and abroad	R
XV	PPWR[b] – Plastic packaging recycling rate Plastic packaging recycling rate 50% (2025) / 55% (2030)	R
XVI	Chemical recycling acceptance Acceptance of chemical recycling and calculation method	R
XVII	Climate goals – minimum recycled content All plastics to be comprised of 25%-30% reused/ bio material	R
XVIII	CO2 levy Yearly increasing levy to 125 euro per tonne CO2 in 2030	R
XIX	Other regulations taken into account	

Note: (a) Emission Trading System; (b) Packaging & Packaging Waste Regulation; (c) Regulations have binding legal force throughout every Member State and enter into force on a set date in all the Member States. Directives lay down certain results that must be achieved but each Member State is free to decide how to transpose directives into national laws.

Source: European Commission; KPMG analysis.

The overall impact of European policies on the business case for both mechanical and chemical recycling of plastics is expected to be positive (1)

Key regulations affecting the European plastics recycling market

	Policy	Chemical recycling supply impact	Chemical recycling demand impact	Mechanical recycling supply impact	Mechanical recycling demand impact
I	Ecodesign for Sustainable Products Regulation	Ability to disassemble plastic from products would ultimately generate a larger pool of potentially recyclable plastic for chemical recycling,	Increased in demand for (mostly very high quality or contact sensitive) recycled plastics, if a minimum recycled content is introduced, which (some not-all) chemical recycling can produce.	Ability to disassemble plastic from products would ultimately generate a larger pool of potentially recyclable plastic for mechanical recycling.	Ecodesign is expected to lead to more demand for single-material plastic products, which can more easily be made from mechanical recycling than multi-material products.
II	Minimum recycled content	No impact expected.	Strong increased demand for (mostly very high quality or contact sensitive) recycled plastics, which (some not-all) chemical recycling can produce.	No impact expected.	Strong increase in demand for recycled non-contact sensitive packaging and single-use beverage plastics bottles.
III	Levy for unrecycled plastic	Plastics becomes less desirable for packaging as costs will pass on to brand owners. Expected to be limited however since most countries already have a tax system in place.	Increase of recycling demand, if levy is charged to producers/ consumers, as virgin plastics become more expensive and thereby recycled material more competitive	Plastics becomes less desirable for packaging as costs will pass on to brand owners. Expected to be limited however since most countries already have a tax system in place.	Increase of recycling demand, if levy is charged to producers/ consumers, as virgin plastics become more expensive and thereby recycled material more competitive
IV	Sustainable carbon quota	No significant effect expected.	In case it gets affirmed effect will be substantial. However, no regulation expected in the short-term and hence no effect.	No impact expected.	No regulation expected in the short-term and hence no effect. In case it gets affirmed effect will be substantial.
V	ELV proposal for Regulation	No significant effect expected.	Increased demand, for high quality or recycled plastics.	No impact expected.	Strong increase as it will be easiest way to meet the recycling target.
VI	Extended Producer Responsibility	More funding made available for sorting and collection through the new C&I EPR scheme and other schemes.	No significant effect expected.	More funding made available for sorting and collection through the new C&I EPR scheme and other schemes.	No impact expected.
VII	Single used plastic - Ban	Supply of single-use plastic waste may decrease. However, the total impact will be limited due to the relatively low volumes addressed.	No significant effect expected.	Supply of single-use plastic waste may decrease. However, the total impact will be limited due to the relatively low volumes addressed.	No significant effect expected.

Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.

Source: European Commission; Plastics Europe; KPMG analysis.

The overall impact of European regulations on the business case for both mechanical and chemical recycling of plastics is expected to be positive (2)

Key regulations affecting the European plastics recycling market

Policy	Chemical recycling supply impact	Chemical recycling demand impact	Mechanical recycling supply impact	Mechanical recycling demand impact
VIII Export restrictions	Supply of mixed plastics/films feedstock waste in Europe increases due to export ban, especially for low quality mixed plastics.	No significant effect expected.	Supply of monostream feedstock waste in Europe expected to increase due to export ban.	No significant effect expected.
IX Municipal recycling rate	Municipalities are incentivised to increase recycling rates, which can be achieved through post-sorting and better source separation. This results in higher accessibility of mixed plastic/films waste.	No significant effect expected.	Municipalities are incentivised to increase recycling rates, which can be achieved through post-sorting and better source separation. This results in more monostreams being available.	No significant effect expected.
X Single used plastics - Collection	No significant effect expected.	No significant effect expected.	No significant effect expected.	No significant effect expected.
XI End-of-waste status	Supply might increase as EU harmonised standards facilitates more trade between EU countries, making the waste more accessible.	No significant effect expected. Dependent on where EoW waste will be applied (after or before repolymerization)	Supply might increase as EU harmonised standards facilitates more trade between EU countries, making the waste more accessible.	No significant effect expected.
XII ETS regulation for incineration	ETS inclusion increases WtE incineration costs, strengthening the case for post-sorting to reduce waste incineration which improves the supply of sorted mixed plastics/films.	No significant effect expected.	ETS inclusion increases WtE incineration costs, strengthening the case for post-sorting to reduce waste incineration which improves the supply of sorted monostreams	No significant effect expected.
XIII Landfill directive	Large volumes of waste feedstock that were previously landfilled will be accessible to obtain for chemical recycling in the long-term (2035).	No significant effect expected.	Large volumes of waste feedstock that were previously landfilled will be accessible to obtain for mechanical recycling in the long-term (2035).	No significant effect expected.

Key: Expected impact: Very positive; Slightly positive; Limited or no effect; Slightly negative; Negative.

Source: European Commission; Plastics Europe; KPMG analysis.

The overall impact of European regulations on the business case for both mechanical and chemical recycling of plastics is expected to be positive (3)

Key regulations affecting the European plastics recycling market

	Policy	Chemical recycling supply impact	Chemical recycling demand impact	Mechanical recycling supply impact	Mechanical recycling demand impact
XIV	Waste disposal levy	Higher incineration and landfilling costs strengthen the case for post-sorting improving accessibility of sorted mixed plastics/films and low quality recycling.	No significant effect expected.	Higher incineration and landfilling costs strengthen the case for post-sorting improving accessibility of monostreams.	No significant effect expected.
XV	Plastics recycling rate targets	Sorting companies to sort (relatively) more mono-streams (also dependent on chemical recycling acceptance), reducing the supply of mixed plastics/films waste.	No significant effect expected.	The recycling targets incentivises sorting companies to sort more monostreams and thus more feedstock will become available for mechanical recycling	No significant impact expected
XVI	Acceptance of chemical recycling	No significant effect expected.	When chemical recycling will count towards reaching recycling rates, the demand for chemically recycled plastics is expected to increase, of which the extent is depending on the chosen measuring point and improvement in yield.	No significant effect expected.	No significant effect expected.
XVII	Minimum recycled content	No significant effect expected.	Depending on how the regulations take shape, chemical recycling demand will be driven for use in high quality and contact sensitive products.	No significant effect expected.	Although the exact scope of the regulations are still uncertain, it is expected that a significant share of the recycled material will be processed through low-grade/ easily recyclable plastic groups through mechanical recycling.
XVIII	CO2 levy	Due to higher incineration cost, post-sorting is encouraged, ultimately unlocking more usable feedstock for recycling	No significant effect expected.	Due to higher incineration cost, post-sorting is encouraged, ultimately unlocking more usable feedstock for recycling	No significant effect expected.

Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.

Source: European Commission; Plastics Europe; KPMG analysis.

The ESPR is expected to unlock more recycling demand and supply when specific regulations are passed through for each product category until 2030

I ESPR – Product design regulations
Harmonized design requirements for plastic and polymers

Description

The Ecodesign for Sustainable Products Regulation, one of the regulations originating from the EU Green deal, offers a harmonized framework regarding the product requirements of specific end-use and intermediary products including plastic and polymers.

A proposal for the ESPR has recently been published, where 31 product categories still need to be assessed. Regulations are expected to arrive by 2030.

CR impact

Supply:

Harmonized design requirements would improve the ability to disassemble plastic from products and ultimately generate a larger pool of potentially recyclable plastic.

Demand:

Share of recycled material, from the minimum rec. content requirement, will partly be translated through chemical recycling for (high quality) recycled contact sensitive plastics.

MR impact

Supply:

Harmonized design requirements would improve the ability to disassemble plastic from products and ultimately generate a larger pool of potentially recyclable plastic.

Demand:

Ecodesign is expected to lead to more demand for single-material plastic products, which can more easily be made from mechanical recycling than multi-material products.

Range of products considered under eco-design

End-use products (non-exhaustive[a])

Textiles and footwear | Furniture[b] | ICT products | Tyres | Detergents

Intermediary products*

Iron and steel | Aluminium | Chemicals

**Based on the market consultation request, it was expected that plastics and polymers would also fall under the ESPR as an intermediary product. However, the European Parliament has currently taken a position where plastics and polymers are not mentioned. It is therefore expected that plastics and polymers will mainly be tackled through product-specific legislation.*

Ecodesign criteria

Framework on range of product requirements:

- Product durability, reusability, upgradability and reparability
- Presence of substances that inhibit circularity
- Energy and resource efficiency
- Recycled content
- Remanufacturing and recycling
- Carbon and environmental footprints
- Information requirements (digital passport)

Potential measures for plastics and polymers under ESPR

Performance requirement on:
- Minimum recycled content in product
- Plastic production to ease disassembly of products made of plastic
- Maximum limit of emission of microplastic per ton of product
- Minimum recycled content per unit/tonne of product
- Plastic production to facilitate recyclability
- Plastic production to ease re-use

Information requirement on how to recycle plastic or polymer

Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Note: (a) Other products include: lubricants and paints.
(b) Including bed mattresses
Source: European Commission; JRC; KPMG analysis.

Introduction of recycled material quota in plastic products is expected to drastically increase demand, for all types of recycling, including chemical recycling

II PPWR[(a)] – Minimum recycled content
Minimum share of recycled material quote of 10-35%

Description

The EU proposed to implement a minimum recycled content quota for different types of packaging material in 2030, ranging from 10% to 35%, depending on the use case.

In 2040, the minimum content quota is proposed to increase to between 50% and 65%.

The current Packaging and Packaging Waste Directive is expected to be revised into a regulation and enacted by the end of 2024.

CR impact

Supply:
No impact expected.

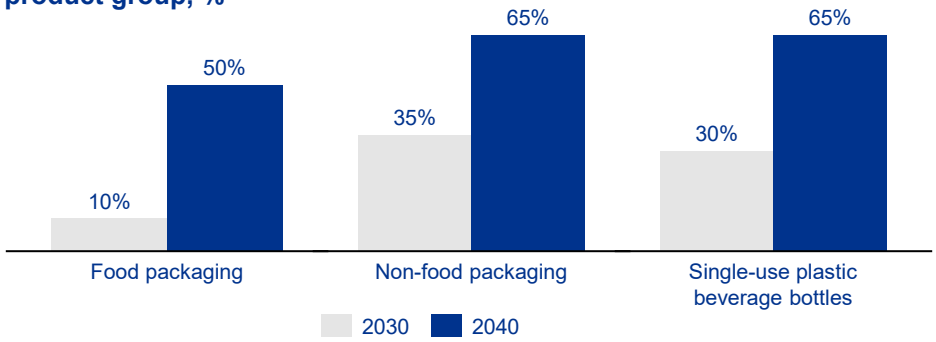
Demand:
Strong increase in demand for (high quality) recycled contact sensitive plastics, which (some not-all) chemical recycling can produce.

MR impact

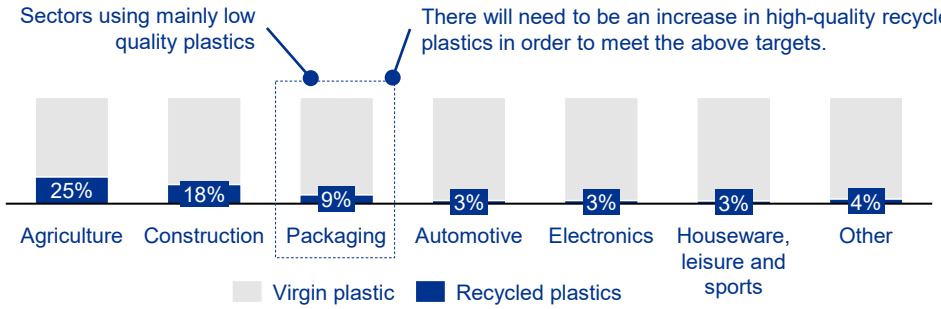
Supply:
No impact expected.

Demand:
Strong increase in demand for recycled non-contact sensitive packaging and single-use beverage bottle plastics.

Proposed minimum recycled content requirement targets per packaging product group, %



Recycled content in EU plastic products per sector, 2021, %, Plastics Europe



> "Cosmetic brands use food grade packaging while this is not mandatory." – Industry expert

Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Source: European Commission; Plastics Europe; KPMG analysis.

An EU plastic tax on unrecycled plastics will boost demand for recycled plastics, enhancing their economic competitiveness against virgin plastics

III PPWR – Levy for unrecycled plastic
Countries must contribute 800 EUR/t for unrecycled plastics

Description

As of 2021, all EU states must contribute EUR 800/tonne for plastic packaging waste that is not recycled at end of life.

Most European countries have some form of plastic levy in place or are planning to introduce the new levy, either by directly passing through the plastic tax levy to producers or by some other form of existing plastic tax. The current Packaging and Packaging Waste Directive is expected to be revised into a regulation and enacted by the end of 2024.

CR impact

Supply:

Plastics becomes less desirable for packaging as costs will pass on to brand owners. The impact is expected to be limited as many states already have some form of plastic tax in place or don't pass through the tax.

Demand:

Increase of recycling demand, if levy is charged to producers/ consumers, as virgin plastics become more expensive and thereby recycled material more competitive

MR impact

Supply:

Plastics becomes less desirable for packaging as costs will pass on to brand owners. The impact is expected to be limited as many states already have some form of plastic tax in place or don't pass through the tax.

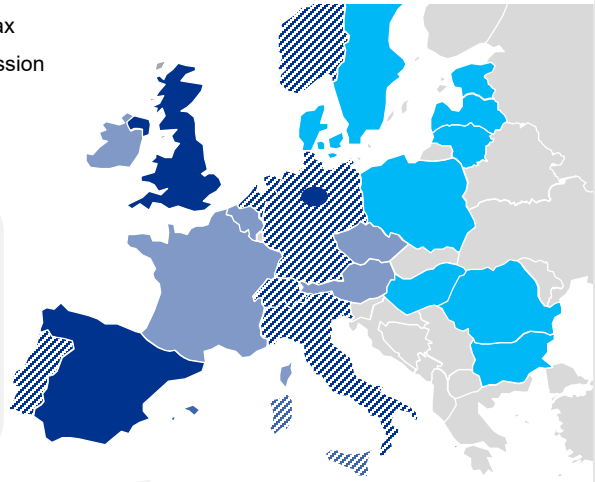
Demand:

Increase of recycling demand, if levy is charged to producers/ consumers, as virgin plastics become more expensive and thereby recycled material more competitive

Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Source: European Commission; Plastics Europe; KPMG analysis.

Implementation status plastic packaging tax

- Implemented new plastic packaging tax
- Introduction announced / under discussion
- Government covers levy
- Other plastic taxation in place



The design of a state's plastic tax varies across countries in terms of e.g.:
- Pass through: state vs producers;
- Scope: packaging vs plastics;
- Source: foreign vs domestically; Rate: tax rate applied;
- Exemption lists.

The impact is expected to be limited as many states already have some form of plastic tax in place.

Many member states have however since the implementation of the directive not setup any tax schemes that are passed to producers, instead such states pay the tax in the form of a contribution paid from their own state budgets. Members are however expected to pass a law by the end of 2023.

The Netherlands also has not passed a plastic tax and pays an annual contribution estimated to be around €180-220m annually. The Netherlands have published a study exploring the possibilities of introducing a national tax on virgin plastics, most likely taxed when plastic powders and granules are sold to producers of plastic products. A concrete tax proposal/plan however has not materialized from the study.

The minimum required content of sustainable carbon may increase demand for chemically recycled plastics if the target gets affirmed in EU law

IV Sustainable carbon cycles – sustainable carbon quota
Minimum share of sustainable non-fossil carbon quote of 20%

Description

The communication on sustainable carbon cycles currently states that at least 20% of the carbon used in chemical and plastic products should be from sustainable non-fossil sources by 2030. This is currently only an aspirational target.

The communication did not provide a definition of sustainable non-fossil sources but it is expected[(a)] to include:

- Carbon from recycled waste
- CO_2 captured from industrial processes
- Sustainable biomass

CR impact

Supply:

The sustainable carbon quota are not expected to significantly affect the supply of mixed plastics/films waste feedstock.

Demand:

In case it gets affirmed effect will be substantial. However, no regulation expected in the short-term and hence no effect.

MR impact

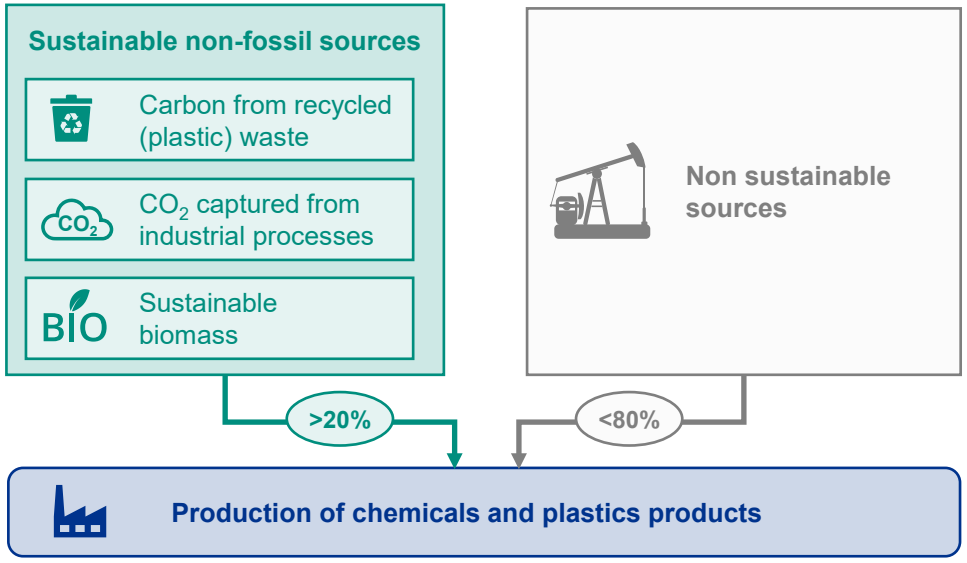
Supply:

No impact expected

Demand:

No regulation expected in short-term and hence no effect. In case it gets affirmed effect will be substantial

Sustainable carbon cycles framework as proposed by Cefic



"At the moment, it is not clear how the communication will evolve. It will likely become more binding, but it is not possible to say whether this will be in 2030 or later" – Industry expert

"The impact of the introduction of sustainable carbon quota on demand for recycled plastics will also depend on what is considered a sustainable non-fossil source and how the mix will develop" – Industry expert

Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Note: (a) As stated in the Cefic position paper: "Restoring sustainable carbon cycles"
Source: European Commission; Plastics Europe; KPMG analysis.

Demand for chemical recycling is expected to increase if the revision of the ELV Regulation is passed, namely due to higher demand for high-quality recycled plastics

V ELV proposal for Regulation[b] – Recycled content requirement
Recycled plastic content share in cars to be 25% (2030)

Description

A new proposal for the revision of the End-of-life Vehicle (ELV) directive (change to Regulation) regarding the reuse, recovery and recycling of end-of-life vehicles has recently been published in 2023.

The following mandatory recycled thermoplastic content target has been proposed (per weight of plastic used in vehicles):

- 25% in 2030

Besides, 25% of this 25% MCR has to come from automotive, leading to a closed-loop recycling requirement of 6.25%

CR impact

Supply:

No expected impact on the supply of mixed plastics/films waste feedstock.

Demand:

Chemical recycling demand is expected to slightly increase as most of the plastics will be processed through mechanical recycling and only the high-grade portion will be supplied through chemical recycling.

MR impact

Supply:

No expected impact on supply of monostream feedstock

Demand:

Mechanical recycling demand is expected to strongly increase to meet the proposed recycled content targets

Recycled content target from post-consumer plastic waste

Target is based on the weight of plastic used in vehicles

25%

2030

Most frequently used plastics in the automotive industry[a]

- PUR /PU — Polyurethane
- ABS — Acrylonitrile, butadiene, styrene
- PC — Poly-carbonates
- PP — Poly-propylene
- PBT — Poly-butylene terephthalate

~28%-74% of all plastics used in the automotive industry can be chemically recycled (for pyrolysis only its estimated to be 23.5%) according to a study by the RIVM "*Chemische recycling van kunststoffen van voertuigen*"

The Netherlands already implemented a revision of the ELV regulation through the "Autowrakken richtlijn", where a 20% minimum recycled content is applied in the automotive industry

Note: (a) Most of the plastics are processed through mechanical recycling in the Netherlands, however could also be recycled chemically
Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Source: European Commission; EuRIC; RIVM; Interview programme; Plastics Europe; KPMG analysis.

The Dutch EPR scheme is expected to positively impact the waste supply for chemical and mechanical recycling

VI Extended Producer Responsibility (EPR) - Plastic packaging
Producer pays €1.050 excl. VAT per kg of plastic

Description

The collection, sorting and treatment of PMD waste in the Netherlands is funded by the producers and importers of PMD products. However, the parties who collectively are responsible to orchestrate the EPR scheme are Afvalfonds Verpakkingen and Nedvang. Their primary task is to realise the recycling targets for packaging waste. The PPWD requires Member States to set up “systems” for the return and/or collection and reuse or recovery, including recycling, of used packaging from the consumer or other final user

CR impact

Supply:
Expected to further grow the mixed plastic/film feedstock given the implementation of the C&I waste EPR scheme in 2023 and of other still to be implemented EPR schemes. Besides, tariffs based on the recyclability of plastics may also lead to more supply

Demand:
No direct impact expected. The Afvalfonds may start contracting chemical recyclers in the future

MR impact

Supply:
Expected to further grow the monostream feedstock given the implementation of the C&I waste EPR scheme in 2023 and of other still to be implemented EPR schemes. Besides, tariffs based on the recyclability of plastics may also lead to more supply

Demand:
Through monopolisation Nedvang has control over where plastic waste goes.

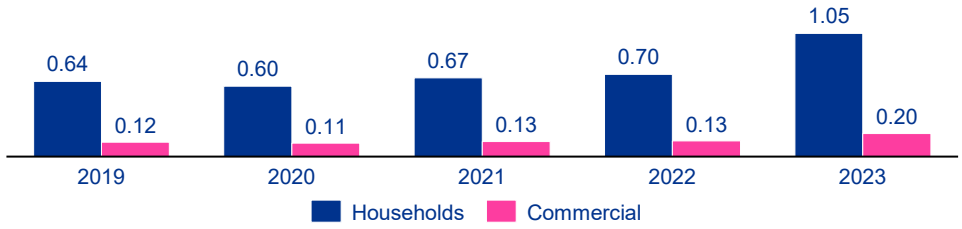
EPR scheme implementation and type recognition timeline in the Netherlands

	Pre-sorting	Post-sorting
Household waste	1978	~2018: First facilities get reimbursements for post-sorting of plastic packaging
C&I waste	2023: The Afvalfonds will start collecting pre-sorted plastics and beverage cartons and glass bottles from businesses	?: No system in place yet

Products expected to have an EPR scheme introduced in the near future

Single-use plastics | Textiles | Agriculture plastic | C&D plastic | Furniture | Diapers

EPR regular tariff development for plastics €/kg excl. VAT, 2019 - 2023



Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Source: Afvalfonds Verpakkingen; Nedvang; Wikipedia; Interview programme; KPMG analysis.

The single-use plastic directive is expected to have limited impact on supply (for both CR as MR), mainly due to low volumes addressed by the ban

VII Single-use plastics directive – Ban
Ban of the ten most frequently littered single-use plastic items

Description

In July 2021, the EU introduced the single-use plastics directive.

The directive aims to reduce the volume and impact of a selection of single-use plastic products.

This selection often becomes litter through either a ban from the European markets or by obliging member states to reduce consumption through raising awareness, and design and labelling requirements.

CR impact

Supply:

Supply of single-use plastic waste will decrease. However, the total impact will be limited due to the relatively low volumes addressed.

Demand:

No direct impact expected

MR impact

Supply:

Supply of single-use plastic waste will decrease. However, the total impact will be limited due to the relatively low volumes addressed.

Demand:

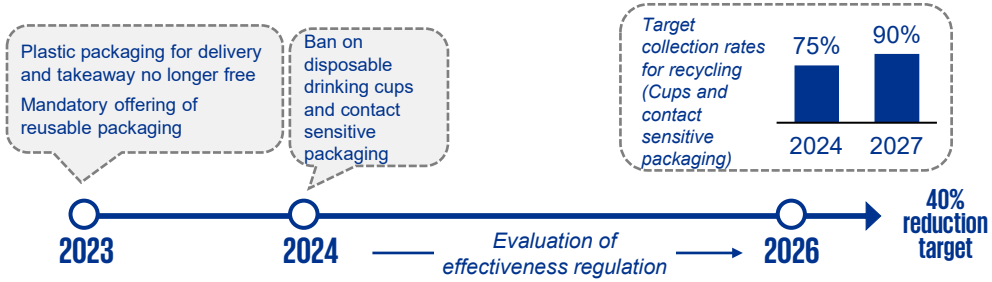
No direct impact expected

Types of plastics within the scope of the single-use plastic directive

Products that can not be placed on the markets of EU member states (banned)

Products of which member states are obligated to reduce consumption

Dutch governments directive implementation timeline for 2023 and onwards



Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Source: European Commission; KPMG analysis.

The plastic waste export ban to non-OECD countries and phasing out of export to OECD countries will increase the addressability of mixed plastics/film and monostream waste in Europe

VIII Waste shipment regulation – Plastic export bans
Inhibition of plastic waste tot non-OECD countries

Description

In January 2021 the EU parliament announced it would consider banning export of plastic waste to non-OECD countries, except for clean, non-hazardous waste destined for recycling.

Additionally, in January 2023 it was proposed that plastic waste export to OECD countries would be phased out in the next four years. A recent revision has been adopted by the EU council, with negotiations expected to begin with the EU Parliament shortly.

See import & export section for more details

CR impact

Supply:

Supply of mixed plastic/film feedstock waste in Europe increases due to the export ban, especially for lower quality mixed plastics. In the Netherlands however the import impact is expected to be less due to more stringent contamination maximum requirements in plastic in the Netherlands.

Demand:

No direct impact

MR impact

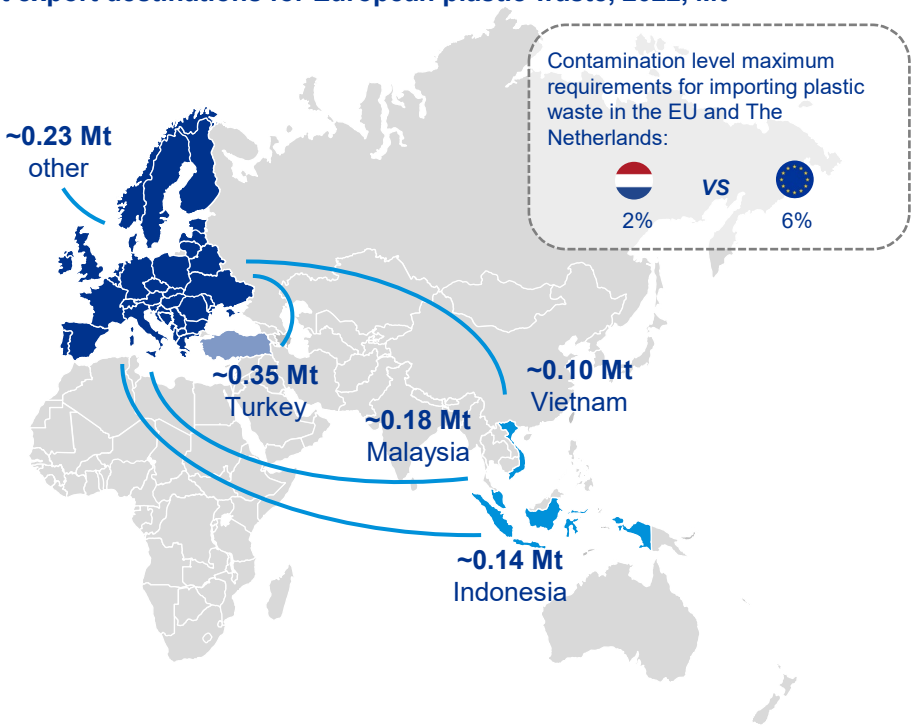
Supply:

Supply of monostream feedstock waste in Europe increases due to the export ban. In the Netherlands however the import impact is expected to be less due to more stringent contamination rules in plastics (for NL a 2% polluted plastic maximum is enforced while EU wide its 6%).

Demand:

No direct impact

Largest export destinations for European plastic waste, 2022, Mt



The EU council has adopted a revision of the Waste Shipment Regulation as of the 25th of May, 2023 and is ready to start negotiation with the EU Parliament regarding updating the legislation

The update of the legislation is regarding Intra-EU shipments, digitalised procedures, exports of waste and illegal shipments. For intra-EU shipments the council is recommending a PIC procedure where exporters need to notify and receive a written confirmation from the countries of dispatch, destination and transit prior to export. For "Green-listed" waste, a less stringent procedure is expected to be applied. For exporting waste outside the EU member states, the council agreed to waste management facilities at the country of destination to be audited every three years by an independent body. The council also clarified which types of waste are allowed to be exported.

Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Source: European Commission; Eurostat; Plastics Europe; KPMG analysis.

The municipal waste recycling targets are expected to positively impact the supply of mechanical and chemical recycling due to better source separation

IX Waste framework directive – Municipal recycling rate

Municipal waste recycling rate 55% (2025) / 60% (2030)

Description

The Waste Framework Directive states that the recycling and the preparing for re-use of municipal waste shall be increased to a minimum of:

50% in 2020;

55% in 2025;

60% in 2030;

65% in 2035.

CR impact

Supply:

Plastic in particular is a material which can help to increase overall recycling as recycling compared to other materials is relatively low. The recycling target also incentivizes post-sorting and better source separation.

Demand:

No direct impact

MR impact

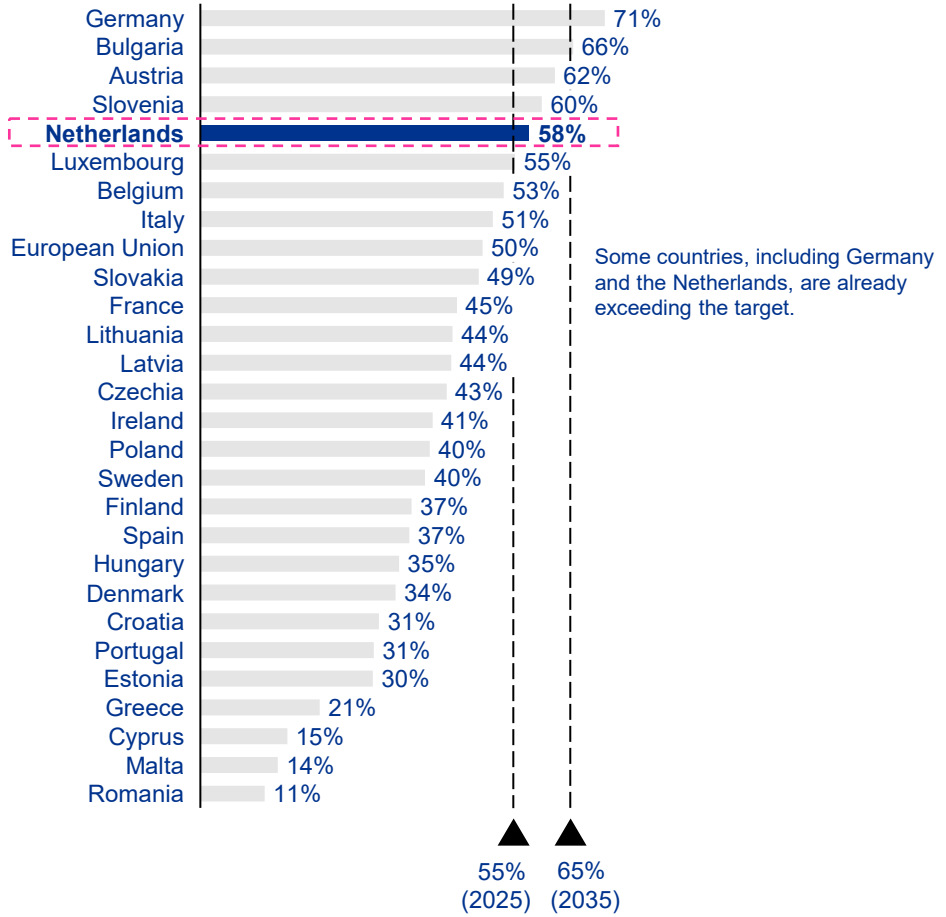
Supply:

The recycling target incentivizes post-sorting and better source separation. Therefore more plastic are available for the recycler

Demand:

No direct impact

Municipal waste recycling rates by country, 2021, %



Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.

Source: European Commission; Eurostat; VANG; KPMG analysis.

The collection targets for plastic bottles will have limited impact on mixed plastics/films and monostreams as plastic bottles mainly consist of PET and DRS schemes are already in place

X Single-use plastics directive – Collection target
Separate collection of plastic bottles 77% (2025) / 90% (2029)

Description

The single-use plastic directive aims to improve the collection of single-use plastics through the introduction of DRS schemes, and design and labelling requirements for producers.

The EU has set a 77% collection target for plastic bottles by 2025 and 90% by 2029.

CR impact

Supply:

No impact on the supply of mixed plastics due to already long existing DRS scheme in the Netherlands

Demand:

No direct impact is expected on chemical recycling demand.

MR impact

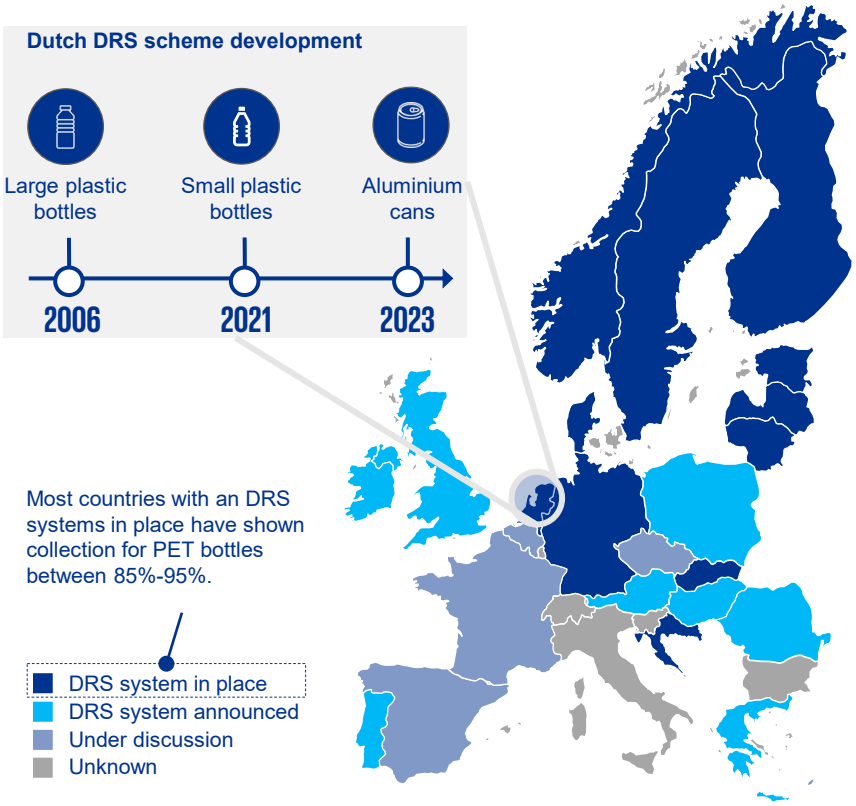
Supply:

No impact on the supply of monostream plastics due to already long existing DRS scheme in the Netherlands

Demand:

No direct impact is expected on mechanical recycling demand.

Overview of DRS schemes within Europe and collection rates (for PET)



Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Source: European Commission Adelphi; NVC; Company websites; KPMG analysis.

Harmonised EU end-of-waste criteria for plastics are discussed and would help to solve many of the current difficulties such as trading barriers and administrative slack

XI Waste Framework Directive - End-of-waste status
Rules for transportation of collected plastic waste vs products

Description

The WFD includes end-of-waste criteria to decide when a substance or object ceases to be waste. General criteria have been established but currently there are no end-of-waste criteria for plastics.

As a result, individual member states or even counties may use their own interpretation of the general EoW criteria. The EU is currently setting up EoW criteria for five types of plastics, including PE, PP and mixed plastics, expected to be finalised Q1 2024. Discussions are currently also taking place on how to include chemical recycling.

CR impact

Supply:

Supply might increase as harmonized standards facilitate trade between EU countries

Demand:

No direct impact is expected on chem. recycling demand. This is however dependent on where the EoW status will be applied, after or before repolymerization could have an impact on traceability and create an uneven playing field compared to mech. rec.(a)

MR impact

Supply:

Supply might increase as harmonized standards facilitate trade between EU countries

Demand:

No direct impact is expected

Current situation (EU-level)

End-of-waste criteria *General*	End-of-waste criteria *Plastics*
✓	✗

Individual member states may apply their own interpretation of the general end-of-waste criteria on plastics.
This may be an appropriate authority or the waste owner itself.

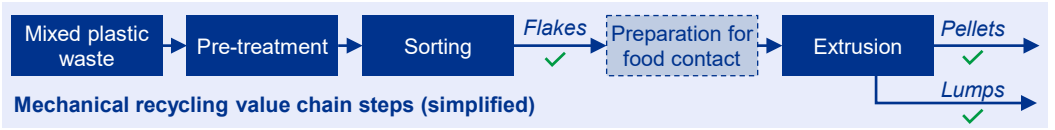
Current general EoW criteria

Waste ceases to be waste when it has undergone a recovery operation and complies with specific criteria:

- The substance or object is commonly used
- There is and existing market or demand for the recycled product
- The use is lawful
- The usage will not lead to an adverse environmental or human health impact

In the Netherlands it may take a minimum of 2 months to receive authorisation to export recycled waste (while importing from outside of NL is an even longer and more complex process)

EoW status authorisation point as proposed by the JRC in mechanical and chemical recycling (pyrolysis is used as an example for chemical recycling)



✓ *Point at which End-of-waste status is given*

Setting the EoW status point before repolymerisation could significantly impact traceability and transparency. However, it is highly uncertain whether the EoW status point will be set before repolymerisation.

Note: (a) The JRC is currently recommending to place the EoW after repolymerisation for chemical recycling
Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Source: European Commission; JRC; KPMG analysis.

By 2028 WtE incineration is expected to be subject to EU ETS, increasing incineration prices and potentially incentivising waste prevention and recycling

XII EU ETS[(a)] directive – Inclusion of incinerators
Incineration inclusion in ETS, raising costs (2028)

Description

Incineration is expected to be subjected to the EU Emission Trading System. This will increase the gate fee for mixed plastics/films, which are currently predominantly sent to incineration.

The European Commission stated in Dec 2022 that waste-to-energy incinerators are to be reviewed in 2026 and are expected to be included in EU ETS between 2028 and 2030. This will drive the costs of acquisition and incineration in plastic waste.

CR impact

Supply:

ETS inclusion increases WtE incineration costs, strengthening the case for post-sorting to reduce waste incineration which improves the supply of sorted mixed plastics/films

Demand:

Effect is expected to be limited

MR impact

Supply:

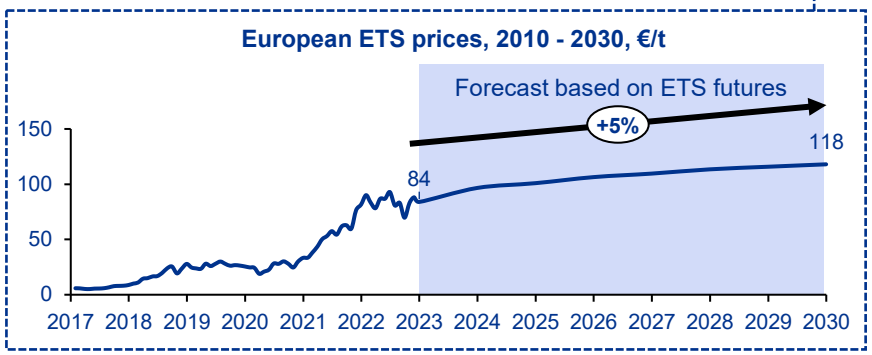
ETS inclusion increases WtE incineration costs, strengthening the case for post-sorting to reduce waste incineration which improves the supply of sorted monostream plastics

Demand:

Effect is expected to be limited

Timeline regulation EU ETS inclusion for maritime shipping and incineration industry

Overview of EU ETS impact on incineration gate fee



Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Source: European Commission; Plastics Europe; Refinitiv KPMG analysis.

The revision of the EU Landfill Directive is expected to increase the addressability of mixed plastics and monostream waste feedstock and lead to lower feedstock prices

XIII Landfill directive – Landfill limit
Landfill limit of 10% (2035) on MSW

Description

The revision of the EU Landfill Directive will mostly affect countries without prior landfill bans in place and will increase the available plastic waste feedstock and as a result reduce feedstock prices. The revised Landfill Directive mandates EU Member States to reduce landfilling of recyclable or energy-recoverable waste by 2030 and limit municipal waste landfilling to 10% by 2035.

Towards 2035, Member states will gradually increase landfill taxes if they did not yet ban landfilling.

CR impact

Supply:
Large volumes of waste feedstock that were previously landfilled will be accessible to obtain for chemical recycling in the long term (2035)

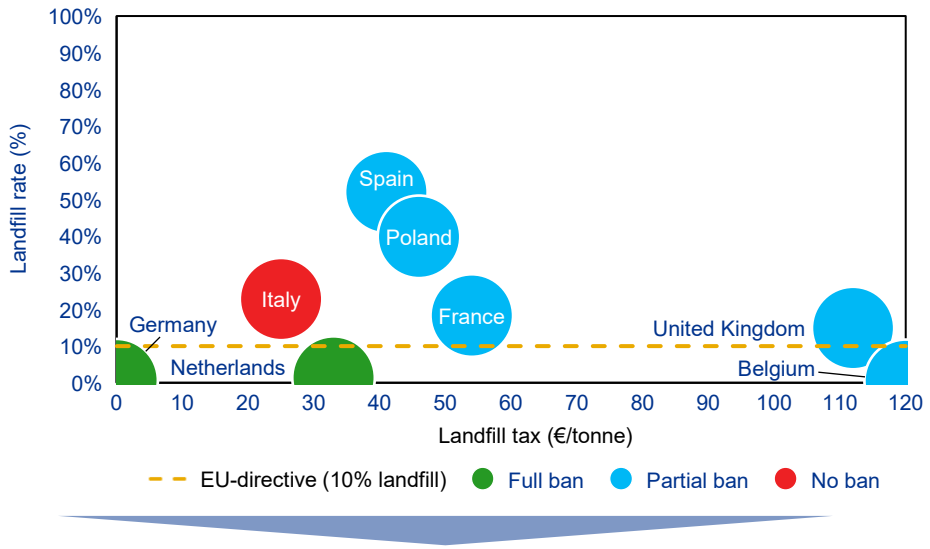
Demand:
No direct impact expected

MR impact

Supply:
Large volumes of waste feedstock that were previously landfilled will be accessible to obtain for mechanical recycling in the long term (2035)

Demand:
No direct impact expected

Municipal waste landfill rates and landfill taxes in selected EU countries, 2020



Timeline EU Landfill directive

Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Source: European Commission; Plastics Europe; KPMG analysis.

The "Afvalstoffenbelasting" is expected to slightly increase the overall supply of plastic waste driven by the higher cost for incineration and storage

XIV Waste disposal levy
Higher levy paid for NL waste sent to incinerator and abroad

Description

The afvalstoffenbelasting is a tax imposed on waste disposal, which specifically applies to businesses that process waste in the Netherlands. The tax aims to encourage waste reduction and recycling. The tax is applied to waste that is incinerated, stored and waste that is transported abroad. The waste disposal tax is indexed yearly with inflation.

CR impact

Supply:
The disposal levy increases incineration and landfilling costs, strengthening the case for post and pre-sorting which improves accessibility of sorted mixed plastics and low quality recycling

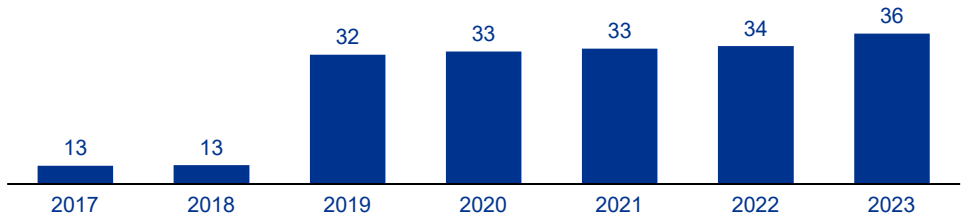
Demand:
No significant effect expected.

MR impact

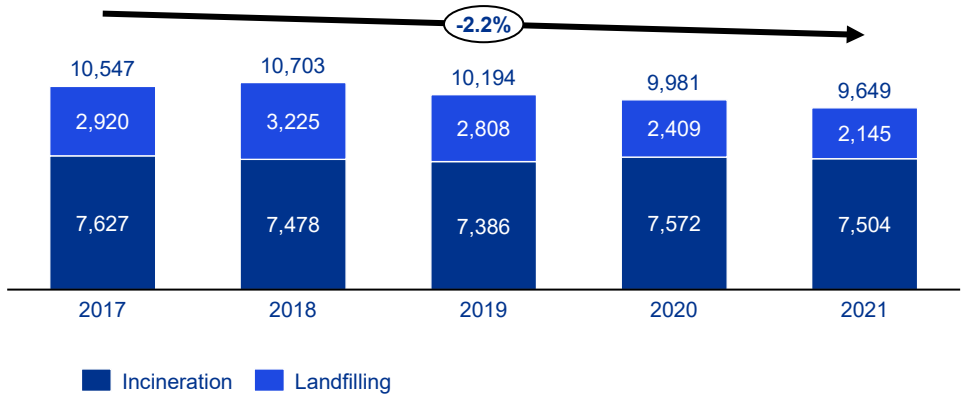
Supply:
The disposal levy increases incineration and landfilling costs, strengthening the case for post and pre-sorting which improves accessibility of monostream plastics

Demand:
No significant effect expected.

Waste disposal tariff development €/000 tonne



Processed waste in kilotons in the Netherlands, 2017 - 2021



Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Source: European Commission; Plastics Europe; Afval Circulair; KPMG analysis.

The new calculation method for plastics recycling rate is expected to shift supply in favour of mechanical recycling as the targets incentivise sorting out monostreams

XV PPWR – Plastic packaging recycling rate
Plastic packaging recycling rate 50% (2025) / 55% (2030)

Description

The packaging and packaging waste regulation states that by 2025, 50% of all plastic packaging waste must be recycled (55% by 2030).

In 2020, the recycling rates of countries dropped as a result of a new calculation method that considers post-recycling plastics volumes as opposed to volumes sent-to-recycling.

CR impact

Supply:

The recycling targets incentivises sorting companies to sort (relatively) more mono-streams (also dependent on chemical recycling acceptance), thus reducing the overall supply of mixed plastics/films waste for chemical recycling due to sorting effects.

Demand[a]:

No direct impact expected on chemical recycling demand.

MR impact

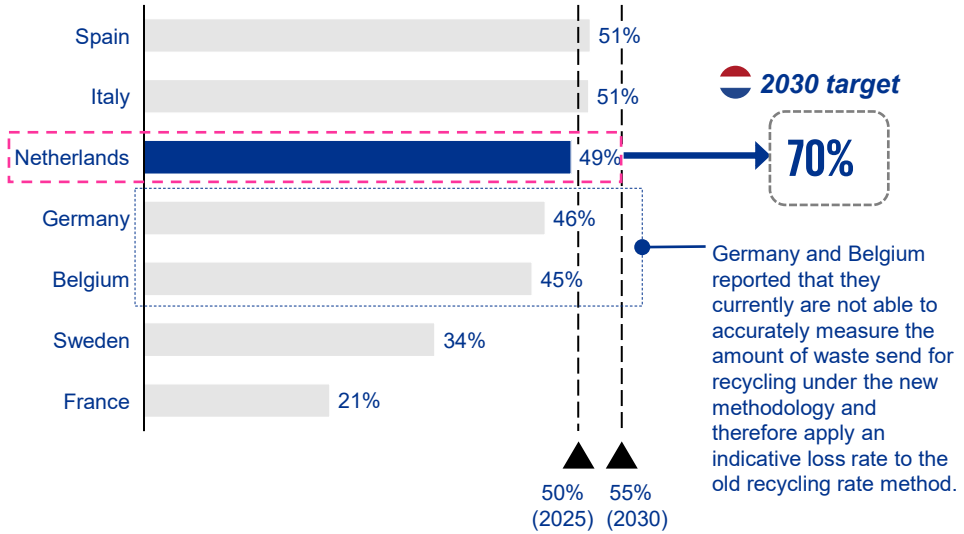
Supply:

The recycling targets incentivises sorting companies to sort more mono-streams and thus more feedstock will become available for mechanical recycling

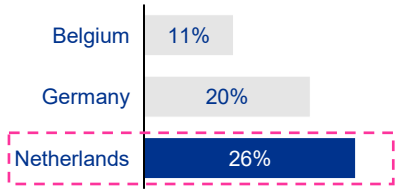
Demand:

No direct impact expected on mechanical recycling demand.

Plastic packaging recycling rate (%), new methodology, 2020



Loss rates applied by member states (%)



The loss rates, i.e. difference in % between old and new calculation method, vary significantly between member states, indicating potential flaws in the estimates.

Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Note: a) Due to plastic quality loss in mechanical recycling, the plastic would at some point need to end up at chemical recycling due to too much degradation, thereby increasing the demand for CR. Only direct effects are however explored in this section.
Source: European Commission; Plastics Europe; KPMG analysis.

Inclusion of chemical recycling in recycling rate targets is expected to increase the demand for chemically recycled plastics

XVI Chemical recycling acceptance
Acceptance of chemical recycling and calculation method

Description

Currently, chemical recycling is recognized as "recycling" by the EU (within the WFD), with many member stats promoting its acceptance (in the Netherlands CR is included in the LAP3[(a)]). The debate centres on how to calculate chemical recycling output and determine what qualifies as "recycled".

It is expected that by 2030 chemical recycling will count towards recycling rate targets. A recent letter by the industry to the EU commission advocated a mass balance fuel exempt model with discussions taking place to include the calculation method in the SUPD. CEWEP in the meanwhile advocates for the mass balance proportional (technical) allocation method.

CR impact

Supply:

Chemical recycling acceptance is not expected to affect mixed plastic/films waste feedstock supply.

Demand:

Demand is expected to increase due to its ability to produce food-grade and other difficult to mechanically recyclable plastics. The significance of the impact is dependent on the chosen measurement point and improvement in yield.

MR impact

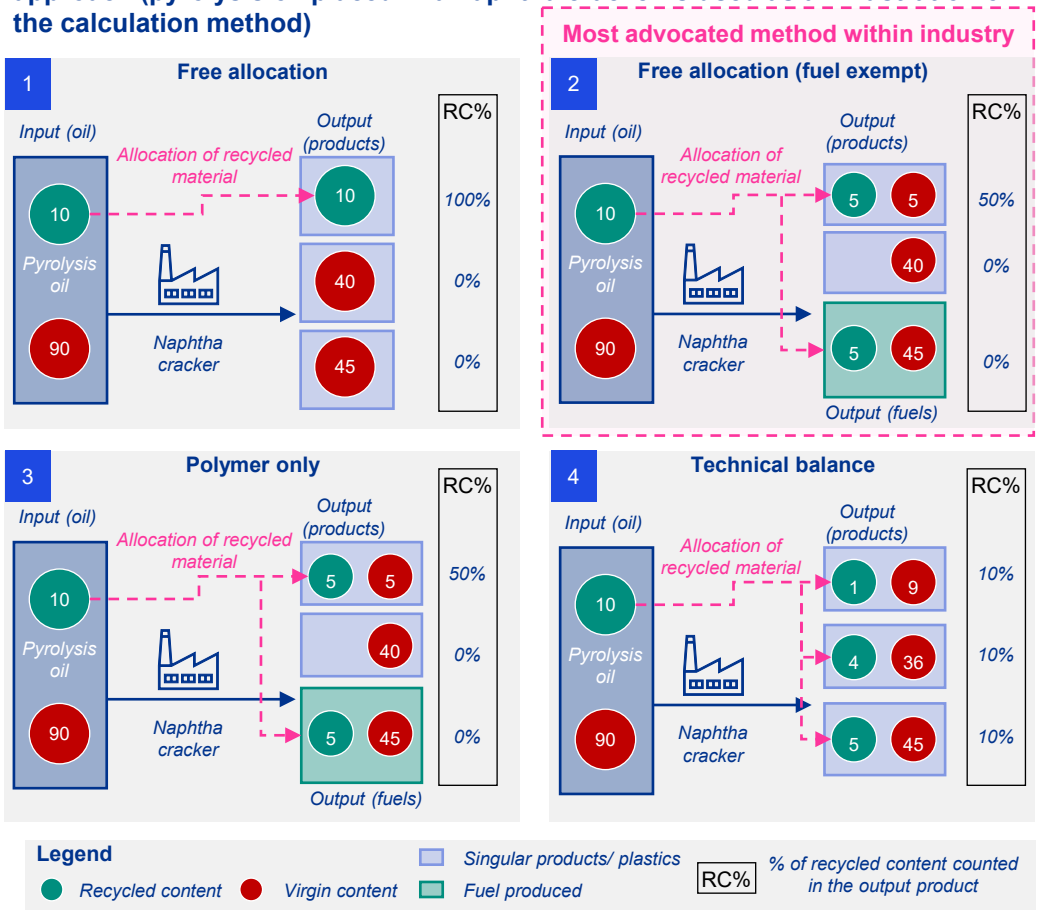
Supply:

No impact expected

Demand:

No impact expected

Proposed calculation methods for chemical recycling within the mass-balance approach (pyrolysis oil placed in a naphtha cracker is used as an illustration of the calculation method)



Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Note: (a) *Landelijk afvalbeheer plan 3* (b) Estimated yield per recycling step.
Source: Eunomia Research & Consulting; European Commission; Plastics Europe; Rebel; KPMG analysis.

The Dutch MCR is expected to increase recycling demand from 2027 as most will go to product categories where recycling is the most economical and easy

XVII Climate goals – minimum recycled content
All plastics[a] to be comprised of 25%-30% reused/ bio material

Description

The Dutch minister of climate and energy, Rob Jetten, has announced extra measures (Circulaire plastic norm) to accelerate the process of reaching the Dutch 2030 climate goals. The minister announced that from 2027 all plastics are to be made up out of 25% - 30% of recycled material and/ or biopolymers.

The regulation is expected to be enforced in 2027 for all plastic converters of plastic in the Netherlands to comply with the 25-30% target by 2030.

CR impact

Supply:

The recycled material minimum is not expected to significantly affect mixed plastics/films feedstock supply.

Demand:

Depending on how the regulations take shape, chemical recycling demand will be driven for use in high quality and contact sensitive products.

MR impact

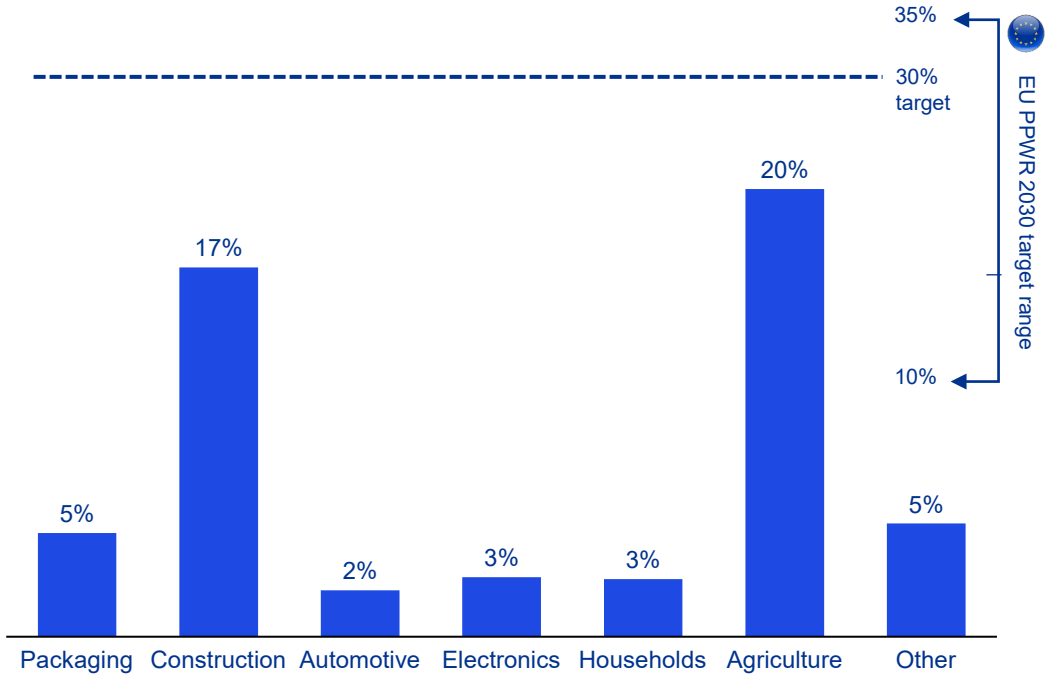
Supply:

No direct impact expected

Demand:

Although the exact scope of the regulations are still uncertain, it is expected that a significant share of the recycled material will be processed through low-grade/ easily recyclable plastic groups through mechanical recycling

Share of recycled plastics in the Netherlands per sector (%), 2018 - indicative



The Circulaire plastic norm is expected to be enforced on an all plastics level. A trading system is expected to be implemented where rebalancing between the product (group) categorizes will be possible

Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.
Note: (a) Petrochemical polymers.
Source: Rijksoverheid; Plastic Pact NL; Nationale Programma Circulaire economie; Interview programme; Plastics Europe; KPMG analysis.

The Dutch CO2 levy increases over time, making emissions costly for incinerators and could positively swing the business case for (further) post-sorting

XVIII

CO2 levy

Yearly increasing levy to 125 euro per tonne CO2 in 2030.

Description

The Dutch CO2 levy system, introduced in 2021, is expected to significantly impact the costs and profitability of mainly incinerators but also the chemical industry.

The Dutch government implemented the levy to ultimately reach the target of a CO2 reduction of 14.3 million tonnes

CR impact

Supply:

The CO2 levy increases incineration costs, strengthening the case for post-sorting and separate collection to reduce waste incineration which improves the supply of sorted mixed plastics/film. The CO2 levy is however also relevant for the emissions created by the chemical industry and thus could impact future capacity planning

Demand:

No impact expected

MR impact

Supply:

The CO2 levy increases incineration costs, strengthening the case for post-sorting and separate collection to reduce waste incineration which improves the supply of monostreams

Demand:

No impact expected

Introduction year

2021

Based on ETS system

1. All companies receive allowances minus a reduction factor

2. The reduction factor has been 'given' by the Dutch government until 2030

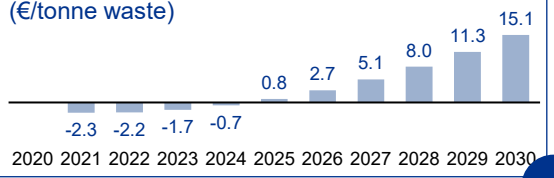
Target

Reduction of 14.3 million tonnes of CO2

Fossil tonne CO2 /tonne waste

0.38

Expected Dutch CO2 levy costs for incinerators (€/tonne waste)



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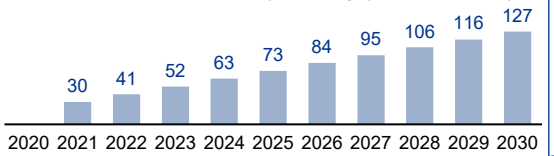
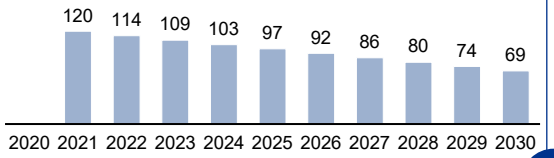
Forecast Dutch CO2 levy pricing (€/tonne CO2)



x

Forecast NL dispensation (index)



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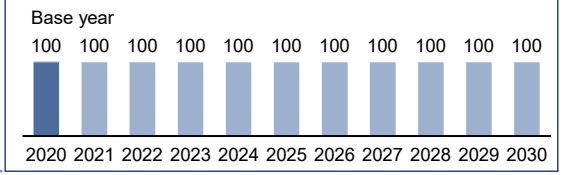
Expected emissions (index) – Stable scenario



Key: Expected impact: ● Very positive; ● Slightly positive; ● Limited or no effect; ● Slightly negative; ● Negative.

Source: Rijksoverheid; KPMG analysis.

Other regulatory changes that are also driving plastic recycling include new EU safety regulations and a globally enforced plastic treaty (1/4)

Other regulations with a potential impact on the European plastics recycling market

	Regulation	Region	Description
I	SUPD: minimum recycled content requirement		• Minimum recycled content requirement of 25% of PET bottles by 2025 and; • At least 30% for plastic beverage bottles by 2030.
II	SUPD: mass balance calculation		• The European Commission has published a draft implementing decision where the rules for calculating, verifying and reporting on recycled plastic content in single-used plastic beverage bottles are outlined • The draft decision states that the calculation of recycled plastic content will be done through the following methodology: “proportion of recycled plastic content in beverage bottles shall be calculated by dividing the weight of recycled plastic in beverage bottles placed on the market by the weight of the plastic parts of beverage bottles placed on the market.” Labels and sleeves are considered part of the beverage bottle • Member states shall calculate and report the weight of the plastic parts and of recycled plastics in beverage bottles as well as the recycled content on an annual basis. • The commission has opened for public consultation regarding the rules of calculation and is expected to revise the draft with the feedback.

III	New EU safety rules regarding recycled plastics used in contacts of food		• The EU has adopted new safety rules regarding recycled plastics that come in contact with food. The rules came into force on the 10th of October 2022 and outline the following set of standards:
			  ◦ It is no longer possible to use recycled plastic Food Contact Materials (FCMs) subject to national legislation
			  ◦ There are specific rules to the placing on the market of plastic with recycled content. Including on the collection and sorting of the plastic input, its decontamination and conversion
			  ◦ There will be a register of recyclers and recycling installations
			  ◦ A variety of the recycling technologies are in scope of the regulation such as mechanical and chemical recycling
			  ◦ New rules regarding novel recycling technologies and the evaluation of new technologies will become applicable
			• From July 2023
			  ◦ Mechanical PET recyclers must receive authorization to be allowed to recycle plastics
			  ◦ Only recycled plastics manufactured with an authorized technology can be placed on the market
			• From October 2024, collection and pre-processing systems within plastic recycling need to be certified by a third party.

IV	UN plastic treaty negotiation		• The UN completed the second session regarding the negotiation to develop a nationally binding instrument on plastic pollution. The aim of the UN is to complete negotiations by the end of 2024 and enforce a global, legally binding plastics treaty to end plastic pollution • Around 170 countries agreed to develop a first draft of the treaty by November 2023.

.Source: European Commission; KPMG analysis.

Other regulatory changes that are also driving plastic recycling include new EU safety regulations and a globally enforced plastic treaty (2/4)

Other regulations with a potential impact on the European plastics recycling market

	Regulation	Region	Description

V	Critical Raw Materials Act		• On march 16th 2023, the EU commission put forward a proposal for a regulation regarding critical raw materials (CRM). In the act the commission presents the idea of key strategic raw materials (SRM) that are vital for key strategic technologies and susceptible to shortages.
			• The regulation would pursue four strategic objectives: 1. strengthening the SRM value chain, 2. diversifying the EU's imports of SRM, 3. improving the EU's ability to monitor and mitigate the CRM supply risk and 4. ensure the free movement of CRMs and products containing CRMs placed on the EU market
			• Clear targets have been proposed to diversify the EU supply by 2030:
			  • At least 10% of the EU's annual consumption for extraction, at least 40% of the EU's annual consumption for processing and at least 15% of the EU's annual consumption for recycling,
			  • Not more than 65% of the Union's annual consumption of each strategic raw material at any relevant stage of processing from a single third country
			• The EU is setting precedent to significantly expand the capacity of the recycling of high-quality metals and thereby exploring to make targeted changes to waste legislation to achieve this.

VI	Renewable Energy Directive III		• The EU co-legislators have reached a provisional agreement regarding the Renewable Energy Directive (April 4th 2023) • The Renewable Energy Directive establishes a common framework for the promotion of energy from renewable sources • As part of the agreement, the binding renewable target for 2030 will be raised to 42.5% from the current 32% for the overall share of energy from renewable sources target.

VII	EU Taxonomy		• The EU taxonomy is a tool used to help direct investments to the economic activities that are in need for a green transition
			• The EU has recently approved in principle a set of new taxonomy criteria, namely for the following objectives: sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, and protection and restoration of biodiversity and ecosystems
			• Manufacture of plastic packaging goods, the collection and transport of non-hazardous and hazardous waste, sorting and material recovery of non-hazardous waste, and depollution and dismantling of end-of-life products all fall under the activities on the transition to a circular economy
			• The EU has set strict requirements for when plastic manufacturing can be seen as sustainable:
			  • "Plastics in primary form must be fully manufactured by mechanical recycling of plastic waste, fully manufactured by chemical recycling of plastic waste, or be manufactured wholly or partially from renewable feedstock in order to qualify as sustainable.
			  • It must also have greenhouse gas emissions lower than those of equivalent plastics from fossil fuel feedstock
			  • To qualify as sustainable, plastic packing goods must meet criteria for both choice of feedstock, and design of the product. Plastic packing goods should be made from feedstock that is 95% mechanically recycled, chemically recycled, biobased or CCU (Carbon Capture and Utilization) feedstock, and should apply design-for-recycling principles".

.Source: European Commission; KPMG analysis.

Other regulatory changes that are also driving plastic recycling include new EU safety regulations and a globally enforced plastic treaty (3/4)

Other regulations with a potential impact on the European plastics recycling market

	Regulation	Region	Description
VIII	Review of the proposal of the Industrial Emissions Directive (IED)		• The Industrial Emissions Directive sets the conditions for which industrial plants are allowed to operate. Operating permits are granted according to maximum amounts of emission levels and other environmental targets. In 2022, the commission adopted proposals to revise the IED. • While landfilling is already included in the IED, no BAT (Best Available Techniques) conclusions are currently applied within the directive for landfilling, which is expected to be implemented. The BAT process is where the commission organizes an exchange of information with experts from member states and industry organisations to reflect on industry standards, rules and techniques and ultimately implementing the advice in the regulation • The level of emissions allowed and other environmental targets for landfilling are expected to be impacted significantly depending on how the IED will be revised by the European Commission

IV	Nationaal Programma Circulaire Economie (NPCE)		• The NPCE is a publication by the Dutch Ministry of Infrastructure and Water Management in cooperation with the Ministries of Economic Affairs, Climate Policy, Interior and Kingdom Relations, Agriculture, Nature and Food quality and Foreign affairs regarding the Dutch circularity targets and proposed changes to existing and new regulations to reach such targets.
			• The NPCE have proposed investigating the following regulatory recommendations:
			  • Investigation of mandatory share % of non-fossil co2 for polymer producers from 2027, rising to 55% in 2030
			  • Primary fossil raw material levy on a national and EU level to stimulate the market for secondary raw materials
			  • Investigate whether further tariff increases of the waste disposal levy from 2027-2029 would stimulate recycling
			  • Investigate the possibility of taxing the production of plastic made from fossil material
			  • Supporting the gradual reduction of capacity for incineration at waste incineration plants
			  • Encourage the creation of a plastics and textile hub
			  • Prevent recyclable material from being incinerated or landfilled through targeted measures dependent on the given value chain. Measures explored include pre-sorting, post-sorting, sorting/collection obligations, financial incentives and mandatory recycling percentages through EPR schemes.
			  • The introduction of the following EPR schemes:
			  • Furniture
			  • Textiles (developed EPR proposal)
			  • Disposable plastics
			  • Diapers (currently only a preliminary study, EPR expected in 2026)
			  • Investigate the possibility of an EPR scheme for agricultural and gardening plastic
			  • Investigate the possibility of an EPR scheme for construction and demolition plastic

.Source: Cefic; European Commission; Rijksoverheid; KPMG analysis.

Other regulatory changes that are also driving plastic recycling include new EU safety regulations and a globally enforced plastic treaty (4/4)

Other regulations with a potential impact on the European plastics recycling market

	Regulation	Region	Description
X	Developments regarding Substances of Very High Concern (SVHC)[a] and Per- and polyfluoroalkyl substances (PFAS)		• The European Chemicals Agency (ECHA) has recently published a PFAS restriction proposal. PFAS are man-made substances that do not naturally occur in the environment and have been placed in many products such as lubricants, food-packaging material, non-stick coating spray in pans and textiles. Such chemicals do not degrade and remain in the environment for a long time • A recent study in the Netherlands has shown that the Dutch population has been ingesting high levels of PFAS through water and food • The ECHA in its proposal, identifies over 10,000 PFAS to be banned for production, use, sale and import. The European Commission is required to present such as proposal to member states in 2025, and if passed could be considered one of the largest bans of chemical substances to date • The proposal also advices a transition period of a year and a half to a maximum of twelve years for companies to implement safe alternatives depending on the application • The proposal indicates also that mechanical recycling would also need to remove PFAS from its products especially from plastic packaging. Currently, the recycling processes do not explicitly remove PFAS • Chemical recycling, especially solvent based purification, could, at least partially, remove some of the hazardous chemicals. It is still unclear however whether other technologies within chemical recycling (such as pyrolysis) are able to remove the PFAS and other hazardous chemicals • If the proposal by the ECHA is passed, the demand for especially solvent purification could skyrocket

Note: (a) Difference between Dutch ('ZZS') and European ('SVHC') policy: Dutch policy covers even more hazardous chemicals

.Source: ECHA; RIVM; European Commission; Rijksoverheid; KPMG analysis.

8.
Appendix

Engagement letter

Appendix I: Engagement letter – Proposed scope of work – (1)

Topic	Suggested procedure
General	

General	Coverage of our scope
	— Forecast period: until 2030 with high-level estimate until 2040 (directional)
	— Geographic scope of our work is the Netherlands
	— Relevant plastics in the scope of our work are all plastics, but key focus on the largest plastic types (polyolefin plastics and PET)
	— Relevant waste streams are *all* post-consumer waste streams with substantial plastic volumes:
	  — Pre-sorted light weight packaging materials (households)
	  — MSW / residual household waste
	  — Pre-sorted Commercial & Industrial waste
	  — Residual Commercial & Industrial waste (combustible waste)
	  — Civil amenities

Appendix I: Engagement letter – Proposed scope of work – (2)

Topic	Suggested procedure
Introduction	
Introduction into Dutch plastic waste market	Overview of existing plastic recycling value chains including key existing archetypes — Describe for each of the relevant waste streams, leakage, the key collection methods and the subsequent sorting and processing steps, as well as leakage through other (separate) waste streams such as glass and paper pre-sorted waste. — High-level analysis of overlap and differences between different value chains.
Regulations	Overview of key EU and Dutch policies and regulations that impact the plastic waste-to-recycling value chain in the Netherlands — Describe the current policies & regulations — Describe ongoing policy and regulatory debates re. anticipated changes to legislation — For key policies analyse the impact on the mechanical and chemical recycling business case in terms of: — Demand — Competitiveness of recycling technologies — Availability of feedstock — Pricing of feedstock

Appendix I: Engagement letter – Proposed scope of work – (3)

Topic	Suggested procedure
Demand	
Recycling capacity and feedstock demand	Overview of existing and expected recycling capacity in the Netherlands, in total and per plastic type — Describe current mechanical and chemical recycling plants and their (input and output) capacity (*to the extent possible*) — Analyse the current required feedstock volume per plastic type and quality (*based on interviews with VNCI and VA members, external interviews and market analysis*) — Analyse the new chemical recycling capacity expected to enter the market (*based on interviews with VNCI members, external interviews and market analysis*), including the type of feedstock (plastic and quality) required
Competition	Overview of non-recycling capacity that uses plastic waste as a feedstock (*high-level*), primarily sustainable aviation fuel (SAF) and other fuels — Overview of current non-recycling capacity that use plastics as a feedstock — High-level analysis of new capacity of non-recycling plants that use plastics as a feedstock

Appendix I: Engagement letter – Proposed scope of work – (4)

Topic	Suggested procedure
Feedstock / supply	
Available volumes (current & future)	Analyse and comment on current and expected plastic waste volumes across the different waste streams — Analyse and comment on the current and expected volume of plastic waste per waste stream, in total, per plastic type and quality — Analyse and comment on plastic content per waste stream (specifically for residual waste) — Comment on the relevant trends and developments which may impact volume development of each of the relevant waste streams, including development of plastic usage and waste, the development of pre- versus post-sorting and the recycling rate. — Analyse and comment on current capacity and capacity development for each of different waste streams — Analyse and comment on the current and expected volumes towards destinations (mechanical & chemical recycling, WtE incineration, SRF/RDF, mechanical downcycling, …) Analyse and comment on subsidies offered for plastic recycling to the different waste streams — Analyse and comment on the different ERP schemes in the relevant countries and the price setting method(s) used. — Analyse and comment on the current and expected subsidy levels for different waste streams
Availability within the value chain	Analyse and comment on where in the value chain feedstock currently and in the future is expected to be available for each of the different waste streams — Analysis of market structure of the plastic waste value chain — Analysis of ownership of plastic waste across the value chain — Analysis of operations of plastic waste across the value chain — Analysis of ease of availability Overview of key players across the different value chains in the addressable countries, including: — Position(s) in the value chain — Current and expected role in the plastic sorting & recycling — Capacity & investments (*best effort basis)* — High-level analysis of available plastics

Appendix I: Engagement letter – Proposed scope of work – (5)

Topic	Suggested procedure
Feedstock / Supply	
Import & export dynamics of plastic waste	Analyse and comment on the current and expected export volumes of recyclable plastic waste from the Netherlands, in total and per type and quality of plastic (*to the extent possible*) — Analysis of export volumes per destination country / region — Analysis of key drivers of export (including the anticipated regulations on export to non-EU countries) — Analyse the attractiveness / applicability of exported plastic waste for different types of recycling (i.e. alternative use) Analyse and comment on the current and expected import (and transit) volumes of recyclable plastic waste from the Netherlands, in total and per type and quality of plastic (*to the extent possible*) — Analysis of import volumes per source country / region — Analysis of transit volumes per source and destination country / region — Analyse the reasons and drivers of import and transit now and towards the future
Import & export dynamics of pyrolysis oil	Analyse and comment on the current and expected import and export volumes of pyrolysis oil to and from the Netherlands (*high-level & to the extent possible*) — High-level analysis of pyrolysis capacity development in Europe (in output capacity) — Analyse level of lock-in and free availability of European pyrolysis oil — Analyse the competitiveness of the Netherlands for pyrolysis oil, including role of transport

Appendix I: Engagement letter – Proposed scope of work – (6)

Topic	Suggested procedure
Supply & demand balance	
Dutch supply & demand for recyclable plastic waste	Develop a view on supply & demand balance in the Netherlands, in total and for different types and quality levels of plastics — Match supply & demand on a per plastic type and quality basis — Analyse potential supply imbalances / shortages and the *potential* availability of feedstock Analyse technical, financial, organizational and regulatory aspects that may impede or speed up the realization of this *potential* feedstock — High-level analysis of business case of making the *potential* feedstock available — Overview of key drivers of the business case and how this is affected by technical, organizational and regulatory aspects
View on risk, opportunities and (regulatory) requirements for chemical recycling	
Dutch supply & demand for recyclable plastic waste	Develop a view on risks and opportunities of chemical recycling in the Netherlands — Overview of risks and opportunities of chemical recycling in the Netherlands in international perspective, including feedstock availability and technical and organizational and — Overview of key regulatory uncertainties / risks that negatively affect the ramp-up of chemical recycling Develop a view on the regulatory requirements to speed up chemical recycling, including the enlarging the availability of feedstock — Overview of the impact of different potential regulatory interventions on the business case of the end-to-end chemical recycling value chain — Analyse level of policy requirements and interventions (EU vs. Dutch)