

Final Report

“Substantiation of data for polymer production and processing in the Netherlands”

Elaborated for: **Netherlands Enterprise Agency**
(Rijksdienst voor Ondernemend Nederland, RVO)
Department of Industry, Agro and Finance |
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Netherlands Enterprise Agency

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Initial situation

Introduction/background

In the decision-making process on the Netherlands climate package, the outgoing cabinet decided on a national obligation (standard) for the application of a minimum share of recyclate and/or biobased polymers.

Before implementation, it is first necessary to analyze more clearly what exactly the target group and the scope will be.

The target group refers to the standard addressee (the group of companies that process polymers into semi-finished and finished products).

The scope initially includes all polymers in all applications

Description of the Circular Plastics Standard

The standard obliges parties in the Netherlands that process polymers into end and intermediate products to process at least 25%-30% plastic recyclate and/or bio-based polymers by 2030. The obligation starts in 2027 at a low level (for example 15%) and increases to 25%-30% in 2030. The precise percentage for 2030 will be determined by mid-2026 at the latest. The technical feasibility for the application of plastic recyclate and bio-based polymers may differ per application.

That is why an administrative trading system (register) is used in the implementation in which a Circular Plastic Unit (CPE) is assigned to mechanical recyclate, chemical recyclate and bio-based polymers. In this way, polymer processors can administratively trade the percentages of resources used by CPEs with each other in order to meet the obligation for an average share of 25%-30% in 2030.


Content and research questions

Research Content and questions of the survey

- Which polymers are **produced** by the chemical industry in the Netherlands? By which companies? Fossil-based, and (partly or wholly) recycled and biobased.
- What is the volume [kta] of polymers **processed** into semi or end products (plastics) in the Netherlands? Fossil-based, (partly or wholly) recycled and biobased.
- What is the **volume of products** [kta] produced from polymers? Are they sold on the Dutch market or exported? Fossil-based, (partly or wholly) recycled and biobased.
- Which polymers are used for which **applications**? What are the volumes [kta] involved for the Netherlands? Fossil-based, (partly or wholly) recycled and biobased.
- Overall question/conclusion: Which factors should be taken into account when determining the scope when it comes to polymers, which advantages and disadvantages should be weighed?

Project framework

Outlines of the project

Regional scope	Polymers	Applications/products	Polymer specification
Netherlands 	<p>Focus on polymers (without additives) ...</p> <div> <div> Thermoplastics <ul style="list-style-type: none"> • PE-LD/LLD • PE-HD/MD • PP • PS • PS-E • PVC • ABS, ASA, SAN • PA • PET • other technical thermoplastics </div> <div> Thermosets <ul style="list-style-type: none"> • PUR • other thermosets </div> <div> Fibers <ul style="list-style-type: none"> • PP • PA • PET </div> </div>	By application <ul style="list-style-type: none"> • Packaging • Construction • Electrical and Electronics • Automotive • Agriculture • Houseware, Leisure, Sport • others 	<ul style="list-style-type: none"> • Fossil-based • Recycled • Bio-based

Definitions

Definitions and explanations of different feedstock sources for plastic production

Fossil-based plastics	Plastics based on fossil raw materials are molding compounds (e.g., powder, granules) produced by polymerization that are sold to the plastics processing industry. Raw materials obtained from the recycling of post-industrial or post-consumer waste are not included (see “recycled plastics”). Fossil-based plastics include fossil-based thermoplastics, PUR and other fossil-based thermosets used for plastic product applications.
Bio-based plastics	Bio-based plastics are plastics that are fully or partially produced from bio-based feedstock.
Pre-consumer waste	Material diverted during a manufacturing process, <u>excluding</u> re-utilized material, such as rework, regrind or scrap that has been generated in a given process and is capable of being reclaimed within that same process. Same process means the same manufacturing operation for the same type of product in the same or different physical location. The term “post-industrial material” is sometimes used synonymously.
Post-consumer waste	Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which has fulfilled its intended purpose or can no longer be used. This includes returns of material from the distribution chain. This category also includes waste that is generated during installation and assembly processes (i.e., pipes, cables, flooring, films/tarpaulins).
Mechanically recycled plastics	Plastic recyclates obtained from mechanical recycling of plastics waste. Mechanical recycling is a method by which plastics waste is recycled into recovered plastics without changing the basic structure of the material. Plastics waste undergoes sorting processes in specialized sorting facilities to separate different plastics streams. After cleaning and grinding the sorted plastics waste, the material is generally recovered by melting and re-granulating processes (pellets or powders), to be used in the manufacture of new plastic parts and products.
Chemically recycled plastics	Chemical recycling converts e. g. polymeric waste by changing its chemical structure to produce substances that are used as products or as raw materials for the manufacturing of products. Products exclude those used as fuels or means to generate energy. Chemical recycling covers various technologies changing the chemical structure of the plastics waste, turning polymers back into their original molecules so they can be processed and used again and again: depolymerization / solvolysis (hydrolysis, glycolysis, alcoholysis, etc.) and thermal processes (pyrolysis, gasification, hydrogenation, etc.). European legislation does not qualify as recycling the conversion of waste through these technologies when they produce materials used as fuels.

Definitions

Applications	Definitions of included applications
Packaging <ul style="list-style-type: none"> • Household packaging • C&I packaging 	Packaging are all products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer. This includes all sales (primary) packaging, grouped (secondary) packaging or transport (tertiary) packaging.
Building, construction (B&C)	Waste collected from construction, renovation, demolition of buildings and installation. B&C sector covers resilient flooring, carpet, roofing, building membranes and sheets, windows, doors and related building products, pipes and fittings, building profiles cladding, insulation materials, cables.
Electrical/electronics (E&E)	Waste from electrical and electronic equipment (commonly referred to as WEEE) from households and all kinds of commercial and industrial activities. WEEE directive 2012/19/EU categorizes E&E waste by six categories (Temperature exchange equipment, Screens, Lamps, Large Appliances, Small Appliances, Information and telecommunication equipment (ITC))
Agriculture, farming & gardening	Waste collected from agricultural, farming and gardening applications. The agriculture sector is meant to cover non-packaging items (film, twine, netting and pipe). Farming includes e.g., handling & transport material and horticulture/gardening are cans, flower & plant pots etc.
Automotive	This is either “service material” coming from repair workshops or material generated from End-of-life Vehicles waste (ELV) like car dismantlers and shredder facilities. Applications like interiors, exteriors and under-the-hood are considered.
Housewares, leisure, sports (HLS)	Waste arising from private houses, such as housewares, toys or sport & leisure equipment (sales packaging waste is included in the <i>Packaging</i> application)
Others	All other applications of plastics, not explicitly listed (e.g., furniture, medical sector, office supplies, machinery parts)

General Methodology and Approach

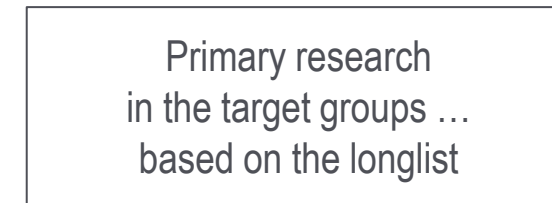
All necessary information will be collected by a multi-methodological approach:

- Secondary research (desk research), data research, data collection and analysis, data modelling, data assessment, reporting data as a main basis
- Additional primary research to fill possible data gaps



Sources (incl. additional overall expert interviews where necessary)

- Analysis of Conversio database and available reports
- Data from Poly Globe
- Analysis of official statistics, e.g. Eurostat or available country
- Netherland's production statistics
- Data from associations, roof organizations
- Web-research
- Publications in magazines and newspapers



e.g. Interviews with ...

- plastic producer
- plastic compounder
- plastic convertor

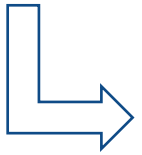


Methodology and Approach in Detail

Production

Basis Polyglobe data

Polyglobe data is the basis for calculation of plastic production of fossil-based material quantities within the Netherlands in 2022 – Including data for polyolefins (PE-LD/LLD, PE-HD/MD, PP), PS, EPS, PVC, PET, ABS/SAN, PMMA, PA, PC, other thermoplastics, PUR and other plastics. Not included are elastomers, adhesives, coatings and sealants.



Assumption of utilization

Most of the total capacities are listed in the Polyglobe database. Depending on polymer type, an average plant utilization of >80% was assumed.



Additional information source

Cross-checks with further existing country-specific data as a result of secondary research e.g. trade data etc.

Bio-based plastics and chemical recycled plastics figures were analyzed in cooperation with the nova-Institut GmbH.

Mechanical recycled plastics identified by internal interviews with recycler.

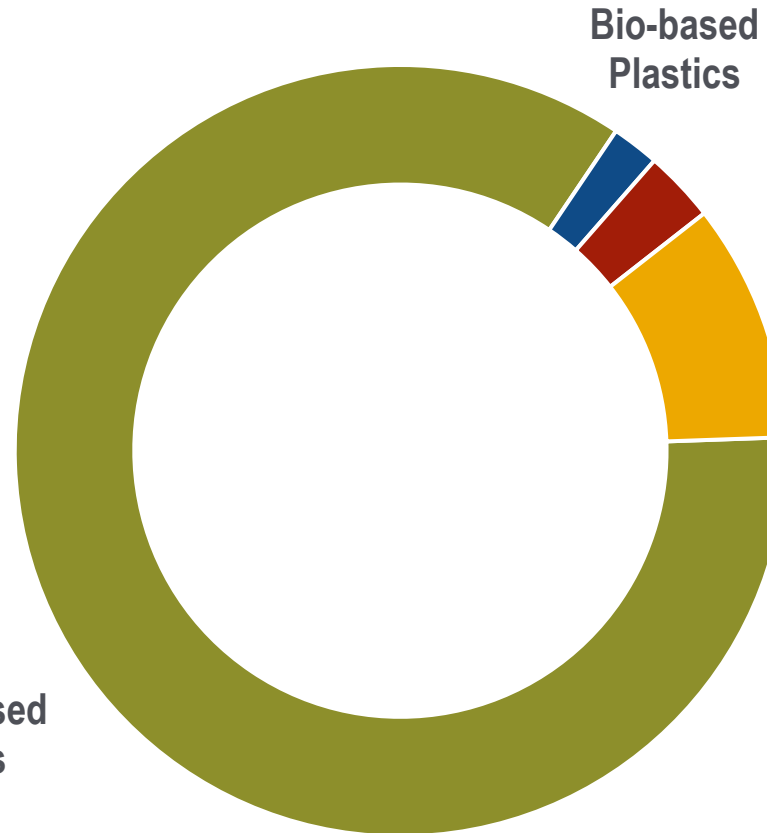
Methodology and Approach in Detail

Processing and plastic manufactured products

Converters' demand data provided by PERMG members and revised by Conversio for the fossil-based plastics demand of plastic converters subdivided into major plastic types, applications for the relevant country.

Around 7% of the total plastics demand resulted from internal converting and processing residues respectively waste. These quantities were subtracted.

**Fossil-based
Plastics**



**Bio-based
Plastics**

**Chemical
Recycled
Plastics**

**Mechanical
Recycling
Plastics**

Analysis of biobased plastic production plants in cooperation with the nova-Institute

Analysis of chemical recycling plants in cooperation with the nova-Institute

Development of recyclates demand in Netherlands by applications based on converter interviews – differentiation into recyclates from post-consumer and pre-consumer waste.

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Results at a Glance

Plastic production

- The **total plastics production quantity** in Netherlands – including fossil-based plastics, bio-based plastics and recycled plastics – is estimated to an amount of about 6.200 kt (base year 2022). The plastics production industry in the Netherlands has a very strong position with high production capacities. This leads also to a high export volume with an export overlap of around 3.900 kt.
- Considering the total plastics production in the EU27+3, the Netherlands is among the top three plastics producing countries (with Germany and Belgium) with a share of almost 11% of the total plastics production.
- Major part (89%) of the total plastics production quantity resulted from **fossil-based plastics**. Within fossil-based plastics, thermoplastics accounted for around 73%, while PUR and other thermosets for plastic products applications accounted for 16% in total.
- The production volume of **bio-based plastics** (for plastic product applications) in the Netherlands accounted for around 9 kt in 2022. The bio-based share is estimated to an order of 0.1%. Production volumes of bio-based plastics are expected to increase within the next years. In addition to fossil-based, bio-based and bio-attributed plastics, a quantity of 413 kt of **plastic recyclates** from mechanical recycling of post-consumer waste were produced in 2022. Another 272 kt resulted from mechanical recycling of pre-consumer waste.
- **Polyolefins** (PE and PP) accounted for ~40% of the fossil-based plastics production and therefore represented with around **2,500 kt the largest segment** within thermoplastics.
- In the area of bio-based plastics production, the Netherlands is currently significantly weaker at about 2%-3% of the total EU 27+3 bio-based plastic production as well as regarding the usage of recycled (from mechanical and chemical recycling) plastics coming from the post-consumer waste with a share of about 5% of the total amount of recycled plastics production in EU 27+3.

Results at a Glance

Plastic processing

- The **total plastics processing quantity (incl. additives)** in Netherlands – including fossil-based plastics, bio-based plastics and recycled plastics – is estimated to an amount of about 2.295 kt (base year 2022).
- About 80% of the total plastics processing resulted from **fossil-based plastics**, a share of almost 20% resulted from **recyclates** from mechanical and chemical recycling of **post- and pre-consumer waste**. **Less than 1%** of the processing volume are accounted for **by bio-based plastics**.
- **Polyolefins** (PE-LD/LLD, PE-HD/MD and PP) account for the largest share of **~48%** at around 1,100 kt of the total plastics processing quantity.
- In addition to fossil-based and bio-based plastics, a quantity of **293 kt of plastic recyclates from mechanical and chemical recycling of post-consumer waste** were used for the product manufacturing in 2022 (~13%). Another **154 kt** resulted from mechanical recycling of pre-consumer waste (~7%).
- Focusing the recyclates which were used in the plastic processing the share **of mono-streams**, for example **PE and PP** are on a significant higher level compared to mixed plastics recyclates especially for recyclates coming from post-consumer waste.
- The quantity of **plastic additives** used within plastics processing amounts to a total of about **253 kt**, of which more than half is used for **PVC polymers**. Plasticizers, fillers, stabilizers and other additives are used in order to develop specific properties for PVC especially in the building and construction industry but also in other industries like agriculture and electronics.
- In the Netherlands, **more plastic products are exported than imported**. In the packaging sector, 34% more plastics are exported, whereas in HLS 25% more plastics are imported into the Netherlands.

Conclusion

What factors should be taken into account when determining the scope of application for polymers - which advantages and disadvantages should be weighed?

Initial situation:



In the decision-making process on the Netherlands climate package, the outgoing cabinet decided on a national obligation (standard) for the application of a **minimum share of recycle and/or biobased polymers**.

Before implementation, it is first necessary to analyze more clearly what exactly the target group and the scope will be.



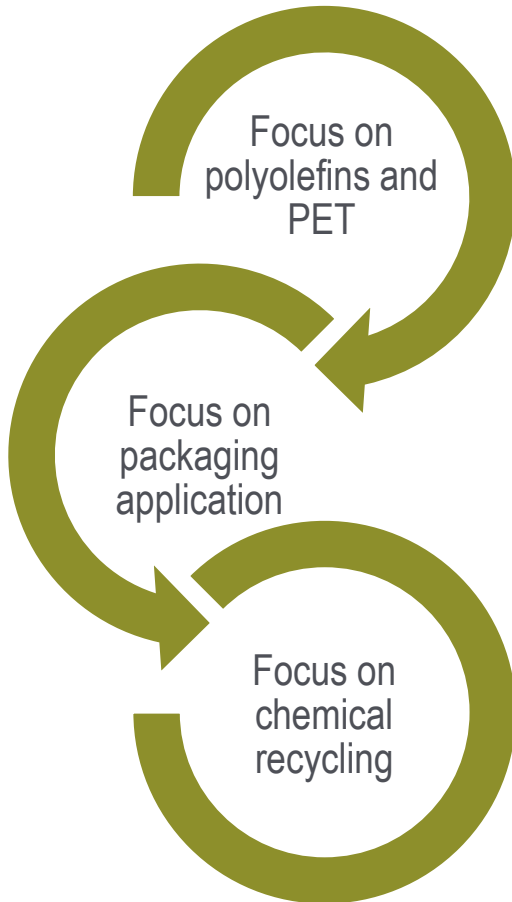
The target group refers to the standard addressee – the group of **companies that process polymers** into semi-finished and finished products.

→ The scope initially includes **all polymers** in **all applications**

- Improving the **circular economy** of plastics must consider the **whole value chain** from plastics production, processing, consumption, waste collection habits and infrastructure until sorting and recycling.
- **Barriers which have to be overcome to increase plastic circularity:**
- **Quality concerns:** Plastic manufacturer of specific industries e.g. medical, pharma and food packaging have high quality standards (regulations regarding food-contact and transport packaging of dangerous goods, such as fire protection) that cannot be met with recyclates from post-consumer waste, besides PET at the present moment. Additionally high concerns regarding loss of physical or chemical characteristics of compounds which reduce the final product quality and regarding aesthetic material proposition (e.g. colour, clarity, surface properties)
- **Supply issues:** Suppliers cannot provide high quality recyclates in sufficient quantity of specific polymer types that can substitute virgin material adequately. The market is highly volatile and prices for recyclates with adequate qualities are comparatively high compared to virgin material.
- **Technical issues:** Technical issues in the production process due to differing input qualities have caused production inefficiencies. This has resulted in higher production costs, especially for products requiring recycled polymers that are not yet available in standard qualities and quantities.
- **Driver for increase of plastic circularity:**
- Due to the European regulatory landscape recyclates especially for Polyolefins and PET bears strong potential.
- **Growing demand:** Usage of recyclates coming from mechanical and/or chemical recycling grows. There is a high demand for recyclates with high quality and within specific applications like construction or agriculture. Future developments in chemical recycling technologies and processing of bio-based plastics should be taken into account.

Conclusion

Focusing polyolefins, packaging and chemical recycling



- Netherlands is among the top three plastics producing countries in EU27+3.
- The share of **20% for circular materials** in the plastics processing sector in the Netherlands is minimal above the European average with 19%. This is in fact the result of higher share within the usage of pre-consumer recyclates which shows that the Dutch processing industry is very strong.
- **Polyolefins** (PE-LD/LLD, PE-HD/MD and PP) account for the largest share of fossil-based plastics but also within the post- and pre-consumer recyclates used for plastics processing.
- Polyolefins are mostly used in **packaging products**, on the one hand for household packaging applications and on the other hand for larger commercial and industrial packaging e.g. grouped (secondary) packaging or transport (tertiary) packaging.
- The share of recyclates used in packaging application is still on a lower level compared to other EU countries. But converters ask for high-quality recyclates with more or less equivalent characteristics to fossil-based compounds.
- Due to quality issues the share of used recyclates in the plastic processing industry is still on a lower level – therefore certifications would help to assure the quality of the recyclates. Basis for certificates could for example be the “European standard on recycled plastics traceability” (EN 15343:2007) or the “Plastics-Guidelines for the Recovery and Recycling of Plastic Waste” (ISO 15270:2008).
- Additional food contact approvals for other plastics than PET would significantly improve the acceptance of recycled plastics in many packaging products. Stimulating the demand for products with recycled plastic content (e.g., through incentives) will also improve the quantity of recycled plastics in new product solutions.
- Currently the Netherlands is one of the EU countries with the highest input capacities in **chemical recycling** with an estimated amount of about 50-55 kt per year. In the Netherlands, many (pilot) plants for chemical recycling exist and several commercial plants are planned for future operations.

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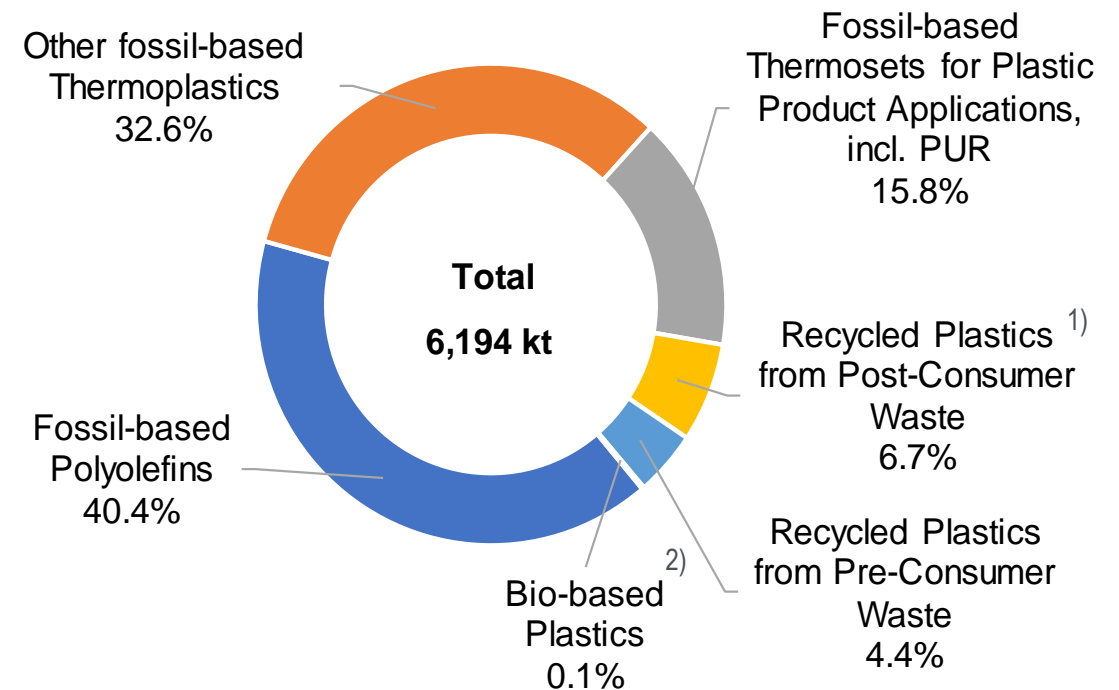
Plastic production

Plastic processing

Plastic Production 2022: Overview

- The **total plastics production quantity** in Netherlands – including fossil-based plastics, bio-based plastics and recycled plastics – is estimated to about **6,194 kt** (base year 2022). This corresponds to a share of about 11% of the total European production (~59 Mt).
- In the Netherlands major part (89%) of the total plastics production quantity resulted from **fossil-based plastics with an amount of 5,500 kt**. About 11% of plastics production resulted from circular feedstock – including mechanically and chemically recycled plastics, bio-based plastics. In comparisons to the EU average of 20% resulted from circular feedstock, the Netherlands on a significant lower level.
- Within fossil-based plastics, thermoplastics accounted for around 73% (4520 kt), while **PUR and other thermosets** for plastic products applications accounted for around 16% (**980 kt**) in total.
- The production volume of **bio-based plastics** (for plastic product applications) in the Netherlands accounted for about **9 kt** in 2022. The bio-based share in the total quantity of 6,194 kt is estimated to an order of only about 0.1%. Production volumes of bio-based plastics are expected to increase within the next years. Within the EU27+3 countries the Netherlands has a share of 2,25% of the total bio-based plastics production.
- In addition to fossil-based, bio-based and bio-attributed plastics, a quantity of **413 kt** of **plastic recyclates** from **recycling of post-consumer (mechanical and chemical)** waste were produced in 2022. Another **272 kt** resulted from mechanical **recycling of pre-consumer waste**.

Plastics production in the Netherlands (2022)



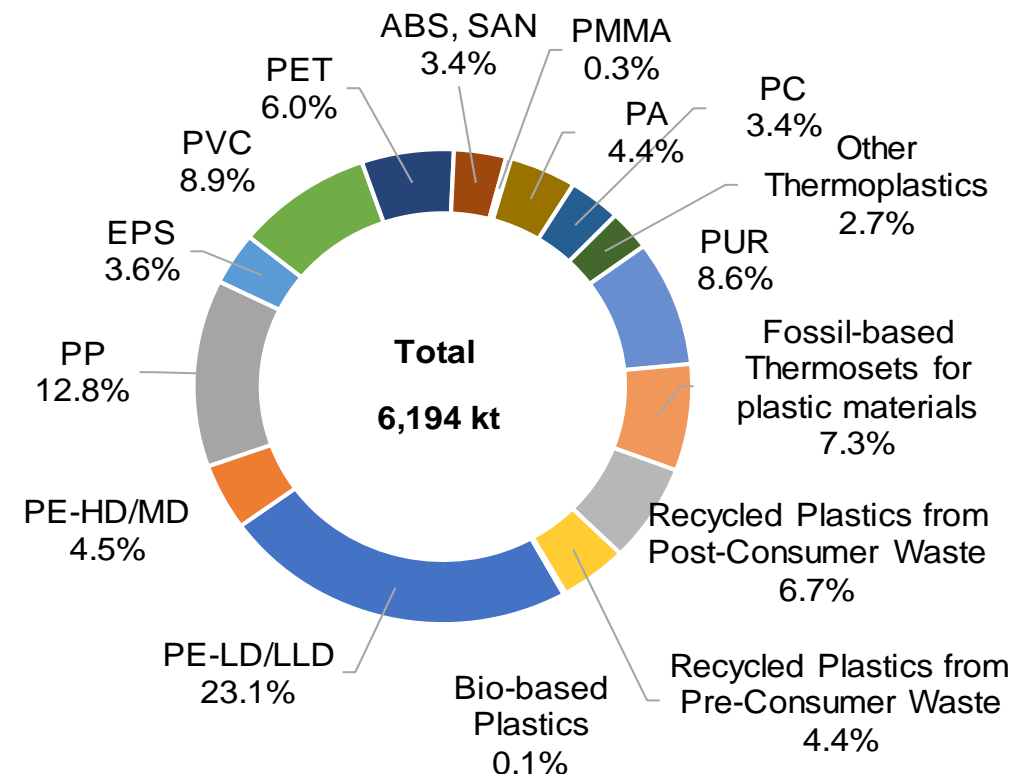
1) ~19 kt recyclates from chemical recycling of Post-consumer waste (~5%)

2) More than 40% of the bio-based plastics production resulted from bio-based PP and PE, about 15%-20% resulted from the production of starch-containing polymer compounds and about 10%-15% from PBAT, remaining share resulted from other polymer types. Bio-attributed plastics not included, estimated amount <5 kt.

Plastic Production 2022: By polymers

- **Polyolefins** (PE and PP) accounted for ~40% of the fossil-based plastics production and therefore represented with around **2,500 kt the largest segment** within thermoplastics. Polyolefins are often used for packaging applications but also a broad range of other applications.
- Around ~9% of the fossil-based plastics production resulted from **PVC (550kt)** – especially used for building & construction related applications, another ~6% from **PET with 370 kt** – especially used for bottles and other packaging applications.
- The engineering plastics **ABS, SAN (210 kt)**, **PMMA (20 kt)**, **PA (270 kt)** and **PC (210 kt)** together accounted for around ~12% of the fossil-based plastics production.
- **PUR (530 kt)** and **other thermosets (450 kt)** have a share of another ~11% of the fossil-based plastics production.
- Most important polymer **producer** in the Netherlands (based on capacity volume):
 - Sabic Europe with several lines in Geleen for PE-LD and PE-HD with a total capacity of about 940 kt and PP with about 620 kt
 - Dow Benelux BV with four PE-LD production lines in Terneuzen with a total capacity volume of almost 1,000 kt in 2022
 - Shin-Etsu PVC BV - PVC line with a total capacity of 450 kt in Rotterdam
 - Indorama Polymers - PET line with a capacity of about 426 kt in Rotterdam
 - Huntsman Corp with two PUR lines in Rotterdam with a total capacity of 430 kt

Plastics production in the Netherlands
(2022)



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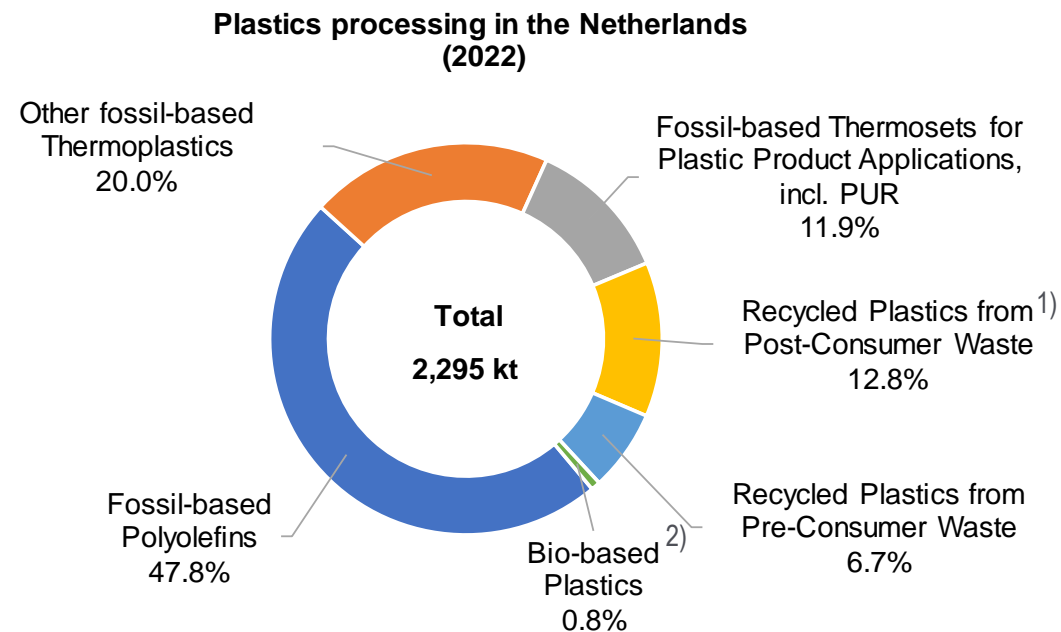
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Plastic Processing 2022: Overview (incl. additives)

- The **total plastics processing quantity** in Netherlands – including fossil-based plastics, bio-based plastics and recycled plastics – is estimated to an amount of **2,295 kt** (base year 2022) inclusive additives.
- Major part (80%) of the total plastics processing quantity resulted from **fossil-based plastics with an amount of ~1,831 kt**. Within fossil-based plastics, **thermoplastics** accounted for around **68% (1,557 kt)**, while **PUR and other thermosets** for plastic products applications accounted for 12% in total with an amount of **274 kt** in 2022.
- More than 20% of plastics processing resulted from circular feedstock – including mechanically and chemically recycled plastics and bio-based plastics. This share of circular material is comparable with the EU average of 19%
- The volume of **bio-based plastics** processed for plastic product applications in the Netherlands accounted for about **17 kt** in 2022. The bio-based share in the total quantity of 2,295 kt is estimated to an order of only about 0.8%.
- In addition to fossil-based and bio-based plastics, a quantity of **293 kt of plastic recyclates from mechanical and chemical recycling of post-consumer waste** were used for the product manufacturing in 2022 (~13%). Another **154 kt** resulted from mechanical recycling of pre-consumer waste (~7%).

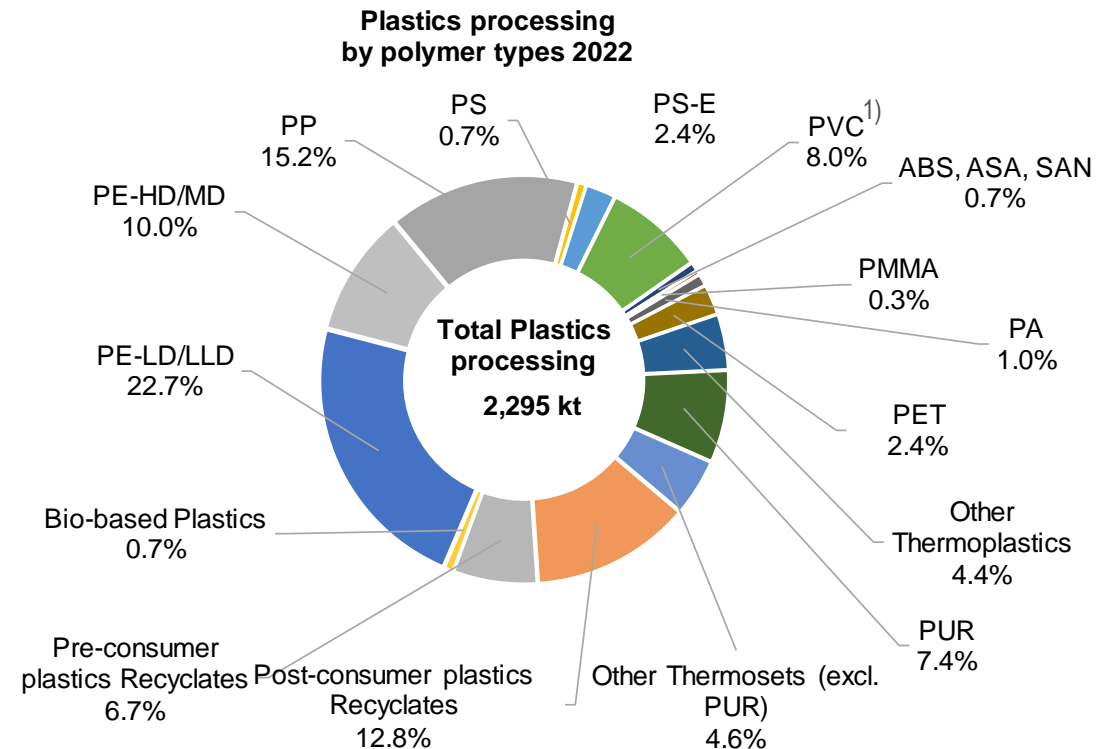


- 1) ~33 kt recyclates from chemical recycling of Post-consumer waste (~1%)
- 2) More than 40% of the bio-based plastics production resulted from bio-based PP and PE, about 15%-20% resulted from the production of starch-containing polymer compounds and about 10%-15% from PBAT, remaining share resulted from other polymer types. Bio-attributed plastics not included, estimated amount <5 kt.

Plastic Processing 2022: Polymers types (incl. additives)

- Around 80% of the total plastics processing in 2022 resulted from fossil-based plastics and about 20% of plastics processing in the Netherlands resulted from circular feedstock – including mechanically and chemically recycled plastics, bio-based plastics.
- **Polyolefins** (PE-LD/LLD, PE-HD/MD and PP) account for the largest share of **~48%** at around 1,100 kt.
- **Other fossil-based thermoplastics**, such as PET, EPS, PS, etc., are on a significant lower level at **~460 kt (20%)**.
- PUR and other thermosets with a share of 12% (274 kt).

Plastic converting	Total
PE-LD/LLD	520 kt
PE-HD/MD	229 kt
PP	349 kt
PS	16 kt
PS-E	55 kt
PVC ¹⁾	183 kt
ABS, ASA, SAN	17 kt
PMMA	8 kt
PA	22 kt
PET	56 kt
Other Thermoplastics	102 kt
PUR	169 kt
Other Thermosets (excl. PUR)	105 kt
Post-consumer plastics Recyclates	293 kt
Pre-consumer plastics Recyclates	154 kt
Bio-based Plastics	17 kt
Total	2,295 kt



1) "Pure" PVC, not mixed with any other substances or additives (PVC resins)

Plastic Production/Processing 2022: Further information regarding recyclates

Approach regarding in-depth analysis of recyclates by polymer type:

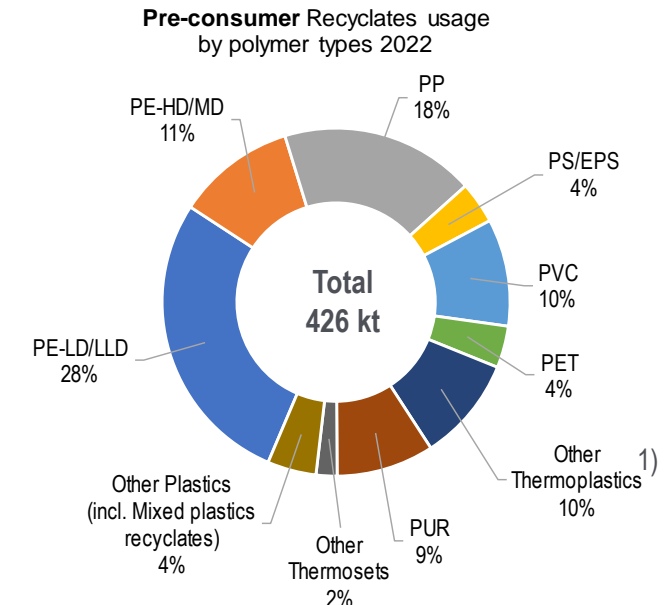
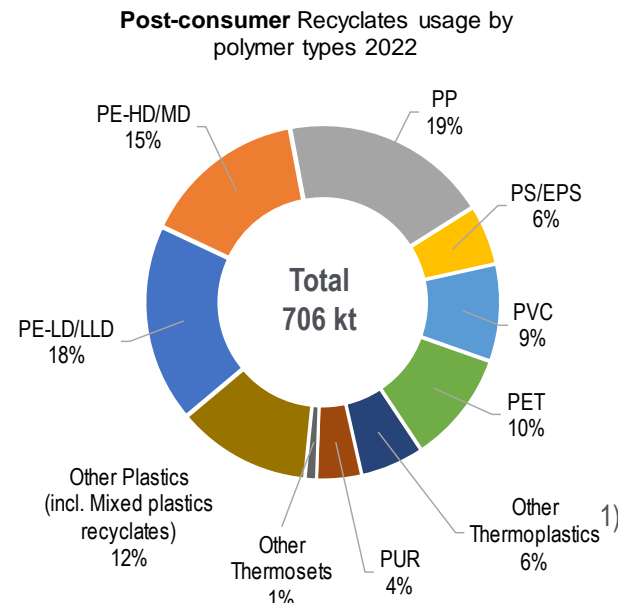
Post-Consumer recyclates:

- Derivation of the polymer types based on the distribution in the waste collection as well as in relation to input amounts by polymer types in recycling plants in the Netherlands (crosscheck with other European countries)
- No further information of imported/exported recyclates on polymer base available
- Similar approach regarding the calculation of post-consumer recyclates used for production and processing in the Netherlands
- Determination of the average share of the polymer types

Pre-Consumer recyclates:

- Derivation of the polymer types based on the distribution in the converters' demand data provided by PERMG members (crosscheck with other European countries)
- No further information of imported/exported recyclates on polymer base available
- Similar approach regarding the calculation of pre-consumer recyclates used for production and processing in the Netherlands
- Determination of the average share of the polymer types

1) Other Thermoplastics includes for example ABS; ASA, SAN, PMMA; PA, PC and POM



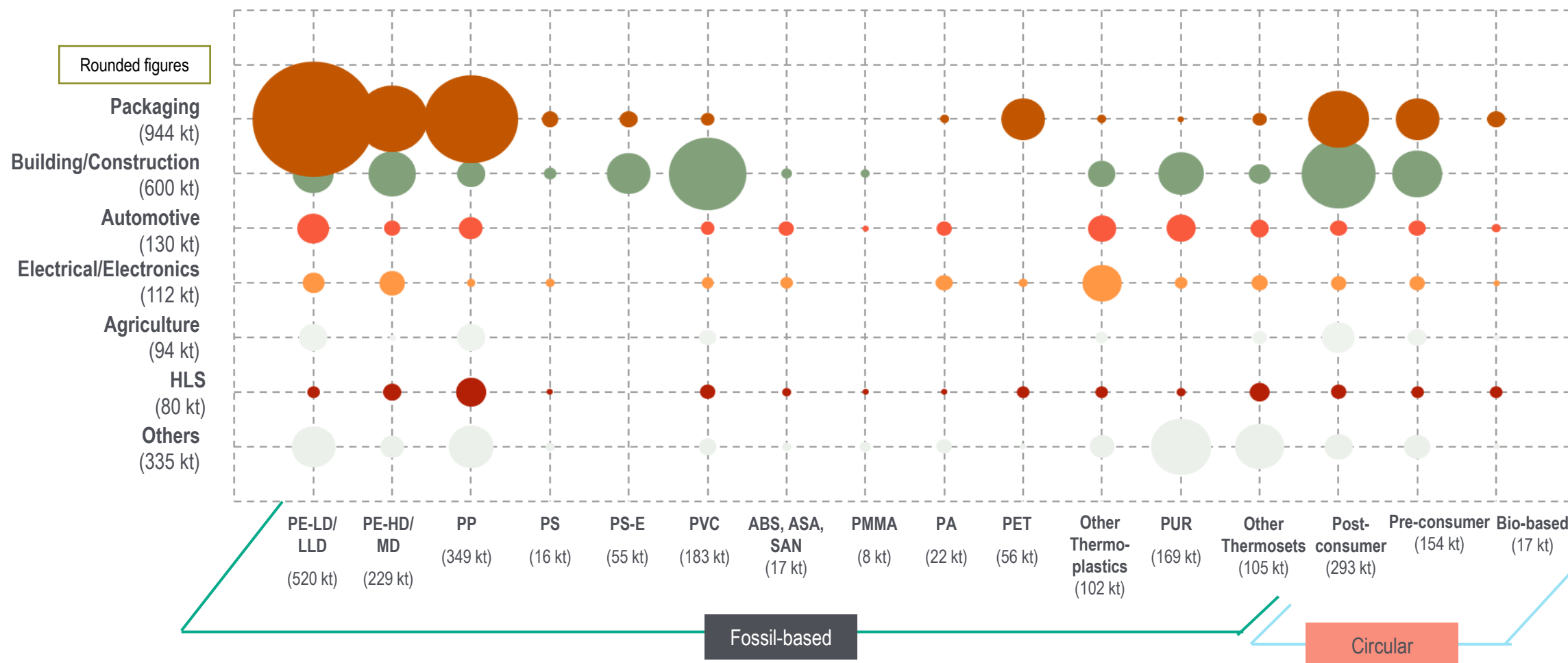
- Focusing on the total recyclates used for the production and processing of plastic products there are some differences regarding the share of the polymer structure between post- and pre-consumer recyclates.
- More than half of the post-consumer recyclates were covered by Polyolefins (52%) thereof PP with about 19% followed by PE-LD with 18% and PE-HD with a share of 15%.
- The same applies within pre-consumer recyclates with an even higher share of PE-LD (28%).
- Largest differences within mixed plastics recyclates (~12% post-consumer recyclates vs. 4% pre-consumer recyclates) and PET (~10% post-consumer vs. 4% pre-consumer recyclates).

Plastic Processing 2022: Overview of products by applications

Plastics processing 2022	Total (kt)	Plastics processing						Bio-based Plastics (%)	Mech. Recycled Plastics (%)	
		Fossil-based Plastics (kt)	Bio-based Plastics (kt)	Mech. Recycled Plastics (kt)		Fossil-based Plastics (%)	Circular material (%)		... from Pre-consumer waste	... from Post-consumer waste
				... from Pre-consumer waste	... from Post-consumer waste					
Packaging	944 kt	794 kt	7.8 kt	48 kt	94 kt	84.1%	15.9%	0.8%	5.1%	10.0%
Building/Construction	600 kt	403 kt	0.0 kt	63 kt	134 kt	67.2%	32.8%	0.0%	10.5%	22.3%
Automotive	130 kt	114 kt	2.4 kt	7 kt	7 kt	87.4%	12.6%	1.8%	5.4%	5.4%
Electrical/Electronics	112 kt	99 kt	0.9 kt	6 kt	6 kt	88.5%	11.5%	0.8%	5.4%	5.4%
Houseware, Leisure, Sports	80 kt	66 kt	4.4 kt	4 kt	6 kt	82.1%	17.9%	5.5%	5.0%	7.5%
Agriculture, Farming, Gardening	94 kt	57 kt	1.0 kt	9 kt	27 kt	60.7%	39.3%	1.0%	9.6%	28.7%
Others	335 kt	298 kt	0.8 kt	17 kt	19 kt	89.0%	11.0%	0.2%	5.1%	5.7%
Total	2,295 kt	1,831 kt	17.3 kt	154 kt	293 kt	79.8%	20.2%	0.8%	6.7%	12.8%

- Converted plastic for new products are mainly processed from fossil-based plastics (~1,831 kt). Almost 794 kt were used in the packaging industry (43%) and ~403 kt in building and construction applications (~22%).
- Approx. 17 kt of bio-based plastics are distributed mainly among the applications packaging (~7.8 kt) and houseware, leisure, sports (~4.4 kt).
- The highest share of recycled material is in agriculture, farming and gardening (39.3%), followed by the construction sector (32.8%).

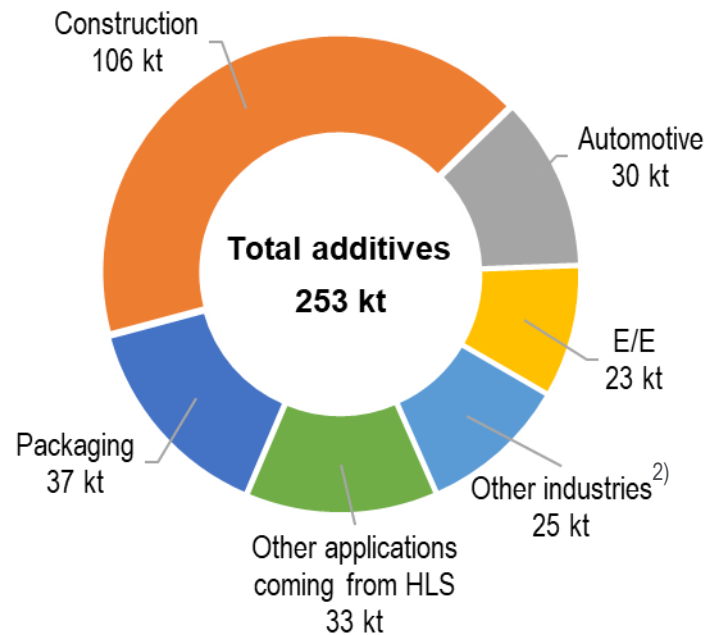
Plastic Processing 2022: Overview of products from polymers



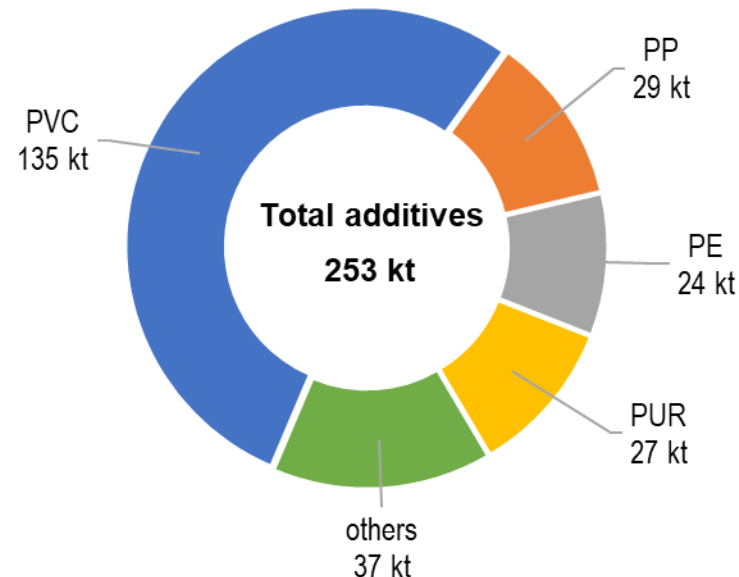
- The Polyolefins and PET were mostly used in the field of packaging processing.
- PVC were mostly used within the building and construction sector e.g. for windows, pipes, cables or floorings mostly for products with a life span of often more than 50 years.

Plastic Processing 2022: Amount of additives by application and polymers

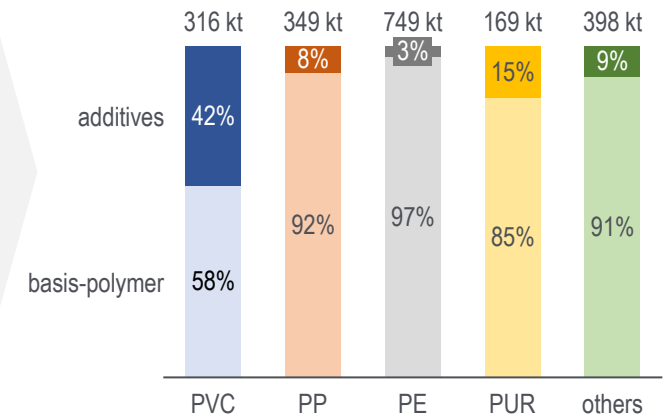
Quantity of additives in the Netherlands by application ¹⁾



Quantity of additives in the Netherlands by polymers



Share of additives and basis-polymers by polymer types



- In the Netherlands, the quantity of additives added in the plastic processing amounts to a total of 253 kt.
- More than half of the additives were used in PVC processing. Stabilizers, plasticizers and other additives extend the shelf life of PVC goods. PVC is mainly used for products in the building and construction industry (41%). By a clear gap, packaging was the second largest sales area (14%), ahead of other (13%) and automotive (11%).

¹⁾ Most used additives: fillers, plasticizers, pigments, flame retardants, stabilizers and other additives

²⁾ Other applications within different industries e.g. agriculture, furniture and medicine

Source: Calculation based on information Ceresana study

Manufactured products 2022: Overview import and export of plastic products

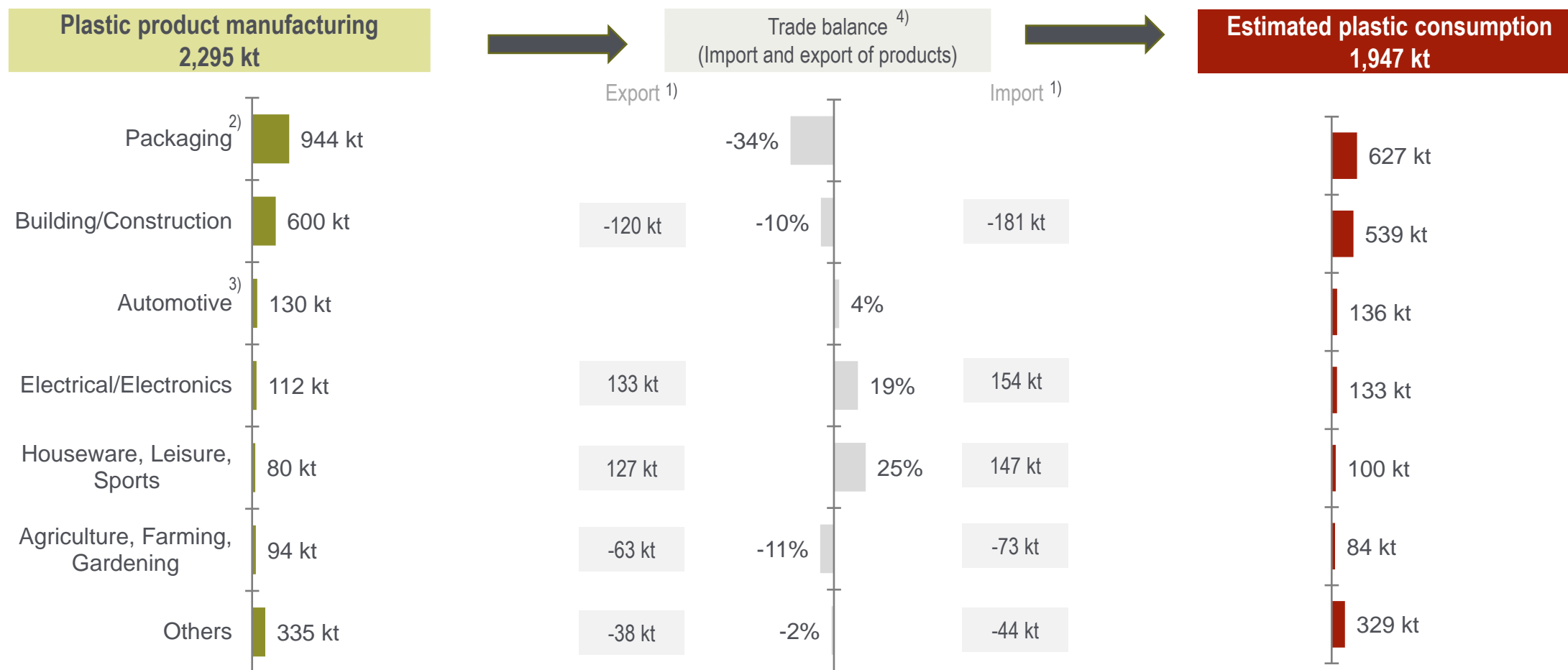
Analysis of consumption (=sold on the Dutch market) Netherlands based on the quantity of manufactured plastic products (fossil-based & circular material). The consumption figures are calculated by deduction of export/import-surplus quantities from manufactured plastic products.



Depending on plastic application the export-imports amounts are based on different sources:

- Packaging: Due to the short-life time of consumed packaging materials, quantities of packaging consumption (put on the market) are more or less comparable to packaging waste figures in the same year (internal data available)
- Building & construction: Export/import volumes are based on “Plastics Building Products” (Eurostat)
- Automotive: Assumptions for export/import quantities are based on OICA data (production and sale of cars)
- E&E: Assumptions for export/import quantities are based on ZVEI data (production and market of electronics)
- Agriculture, farming & gardening / HLS / Others : Export/import amounts are based on “Plates, Sheets, Tubes...” and “Other plastic products” (Eurostat)

Manufactured products 2022 : Overview import and export of plastic products



- 1) Export and import data are based export/import data and Conversio estimations – no further data regarding transit available
 2) Packaging: Data for packaging are based on empty packaging; the export surplus is 66% with an export of 1.866 kt and an import of 1.239 kt
 3) Export and import data from the automotive industry cannot be analyzed at component level
 4) Due to the large transshipment port in Rotterdam for example the Netherlands have large transits and so exported goods can consist of both manufactured and imported goods.

Plastic Production 2022: Focus on fibers

General information regarding synthetic fiber production in Netherlands

- In the Netherlands, the domestic synthetic fiber production does not play a major role considering the total plastic production volume.
- According to secondary research and expert discussions, the only major manufacturer of polyester filaments with a capacity of 45 kt per year went bankrupt in 2008.
- In the Netherlands, most synthetic fibers such as polyester, polyamide and other synthetic fibers are imported (especially from outside Europe with focus on Asia and China).
- Focusing European countries, synthetic fibers with focus on polyester, polyamide and other synthetic fibers are mainly produced in Turkey, Germany and Austria.
- Considering the total European fibre production, the proportion of synthetic fibers produced and processed in the Netherlands contrasts with the European share with only around 20-25% of the total Dutch fibre market. Netherlands has a stronger focus on other material within the fibre production and processing (~60-65% of the fibre production/processing are cotton, wool or linen).
- Based on secondary research and expert discussions the estimated synthetic fibre¹⁾ production in Netherlands in 2022 is about 20-30 kt. Highest share is estimated within the polyester fibers with about 75% of the total volume- other fibers e.g. polyamide and PET are estimated with a share of about 25%.

¹⁾ Synthetic fibres include polyester, polyamide and polypropylene. Aramid and Dyneema fibres are not included.