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Ministry of Environment and Food of Denmark
Environmental Protection Agency

Preliminary assessment of plastic material flows in Denmark

Technical Report

Environmental Project no. 2090

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Sources must be acknowledged.

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Summary

Plastic is a material used extensively throughout the world, and Denmark is not an exception. Primary concerns with regards to plastic relate to improper management of waste plastic. If not collected, plastic contribute to littering, which may result in environmental impacts; if collected and incinerated, plastic generates CO2 emissions contributing to adverse climate change. In order to assess the current state of waste plastic management, as well as improve and optimize the plastic flows, a systematic assessment of plastic material flows is needed. A system-perspective assessment of material flows can be done by employing material flow analysis (MFA) methodology, which accounts for system inputs, outputs, stocks and material flows between processes within a system.

The aim of this report was to provide an overview of initial quantitative estimates of plastic flows in Denmark through MFA, based on existing and available data. The work was based on the Material Flow Analysis (MFA) methodology and use of readily-available data, while identifying the lack (or insufficient quality) of quantitative data and further research needs.

Overall, in 2016 3,100,000 tonnes of plastic (including primary plastic, plastic products, plastic-containing products and waste plastic) were imported into Denmark, while 2,500,000 tonnes were exported in the same year. The exported amounts included 420,000 tonnes that were incinerated resulting in approximately 960,000 tonnes of CO2 emitted into the environment, as well as 6,500 tonnes of air-pollution-control (APC) residues. The difference between exports and imports resulted in a buildup of plastic stock of approximately 610,000 tonnes. Largest share of waste plastic (330,000 tonnes) ended up in mixed and combustible waste, while 110,000 tonnes were separately collected. Approximately 52% (or 59,000 tonnes) of waste plastic recovered for recycling were exported, while the remaining 48% (or 54,000 tonnes) were treated in Denmark. Waste plastic recycling rates were calculated to be 22 and 26%, depending on whether waste plastic imports were included or excluded from the calculations, respectively. However, in both cases losses resulting from further waste plastic sorting or reprocessing were not taken into account.

22-26%

Plastic recycling rate in Denmark

Finally, data about potentially important plastic flows were either lacking or were of insufficient quality. For example, the fate of a large share of waste plastic trade was undocumented and plastic composition of plastic-containing products was based on an outdated report. Few data about polymer composition of the selected plastic flows were available. Overall, this calls for an additional effort in establishing and collecting the up-to-date and quality data about plastic flows and waste plastic management in Denmark and at the end destination for exported flows.

Resume

Plast anvendes i stort omfang i hele verden, og Danmark er ikke en undtagelse. Den primære bekymring i forbindelse med plast er ukorrekt håndtering af affaldsplast. Hvis plasten ikke indsamles, bidrager det til affald i naturen, hvilket kan medføre negative påvirkninger på miljøet; hvis plasten i stedet indsamles og forbrændes udledes der CO2-emissioner, der bidrager til uønskede klimaforandringer. For at vurdere den nuværende affaldshåndtering af plast, samt forbedre og optimere plaststrømmene i samfundet, er det nødvendigt med en systematisk vurdering af strømmen af plastmaterialer. En vurdering af materialestrømme i et systemperspektiv kan udføres ved brug af materialestrømsanalyse (MFA), der fastlægger input, output, lagring samt materialestrømme mellem processer i et undersøgt system.

Formålet med denne rapport var at give et indledende kvantitativt estimat af plaststrømme i Danmark via MFA, baseret på eksisterende og tilgængelige data. Derudover blev manglende data (eller data af utilstrækkelig kvalitet) samt behov for yderligere forskning identificeret.

Samlet set blev der i 2016 importeret 3.100.000 tons plast (herunder primær plast, plastprodukter, plastholdige produkter og affaldsplast) til Danmark, mens 2.500.000 tons blev eksporteret samme år. De eksporterede mængder omfattede 420.000, der blev afbrændt på forbrændingsanlæg, hvilket resulterede i ca. 960.000 tons CO2 udledt til atmosfæren samt 6.500 tons røggas rester. Forskellen mellem eksport og import resulterede i en oplagring af plast i samfundet på ca. 610.000 tons. Den største andel af plastaffaldet (330.000 tons) endte i blandet og brændbart affald, mens 110.000 tons blev indsamlet separat. Cirka 52 % (eller 59.000 tons) af den separat indsamlede affaldsplast blev eksporteret, mens de resterende 48 % (eller 54.000 tons) blev behandlet i Danmark. Plastgenanvendelsesraten blev beregnet til henholdsvis 22 og 26 % alt efter, om importeret affaldsplast blev inkluderet eller udelukket fra beregningerne. I begge tilfælde blev der ikke taget hensyn til eventuelle tab som følge af yderligere plast sortering eller oparbejdning til nye materialer.

Data relateret til potentielt vigtige plaststrømme enten manglede eller var af utilstrækkelig kvalitet. For eksempel var skæbnen af en stor del af handelen med affaldsplast udokumenteret, og indholdet af plast i plastholdige produkter var baseret på en forældet rapport. Kun få data var tilgængelige om polymersammensætning af de udvalgte plaststrømme. Alt i alt er der et behov for en yderligere indsats for at få fastlagt og indsamlet opdaterede kvalitetsdata om plaststrømme og affaldshåndtering (i Danmark og ved slutdestinationen for eksporterede strømme).

22-26%

Plast genanvendelse i Danmark

Preface

This report is an initial attempt to provide a quantitative overview of plastic flows in Denmark.

The study was commissioned by the Danish Environmental Protection Agency (EPA). The work was carried out by DTU Environment in the period from September 2018 to November 2018. This work takes into account import, production, raw material and product trade, plastic consumption in selected sectors, plastic waste generation, collection and management, as well as waste plastic trade. With respect to plastic recycling, only the amounts collected for recycling were included. Hence, the amounts of new plastic products produced from waste plastic, the details of the associated material losses from plastic sorting or recycling and the content of recycled plastic in plastic products consumed in Denmark (from domestic production or imports) were not estimated. The geographical scope was Denmark, while the temporal scope was the year 2016. While data from 2016 may incompletely represent the current situation with plastic flows in Denmark, this was the most recent year for which data from public statistical repositories were available.

As the study was based on existing data that were currently available in literature, statistical repositories and/or readily accessible via stakeholders, the results facilitate screening and identification of plastic material flows with no or incomplete information. This can serve as the basis for a more detailed and comprehensive analysis and discussion of plastic flows in Denmark. Extensive literature reviews or data collections was not part of the work.

This technical report represents an initial data screening that was intended to serve as a basis for future updates as more reliable and up-to-date information becomes available.

Abbreviations and definitions

APC residues	Air-pollution-control solid residues resulting from flue gas cleaning (e.g., bag filters) in the waste incineration
Combustible waste	Waste fraction collected for incineration. This includes small combustibles and large (i.e., bulky) items, commonly collected at recycling stations in Denmark
Finished plastic products	Products made predominantly of plastic. For example, bottles, boxes, windows, doors, tableware, sacks/bags
Other polymers	Polymers excluding PET, PE and PP
PE	Polyethylene. Includes both low and high density PE
PET	Polyethylene terephthalate
Plastic-containing products	Products made predominantly of non-plastic material, but containing plastic. For example, electric and electronic equipment with plastic components, cars with plastic bumpers. Product packaging is included
PP	Polypropylene
Primary plastic	Plastic as raw material for manufacturing. Commonly in form of powders, granules, flakes and similar bulk forms
PS	Polystyrene
PVC	Polyvinyl chloride
Residual (mixed and combustible) waste	Residual fraction of waste once target materials have been sorted out. This includes mixed and combustible waste
Semi-finished plastic products	Intermediate plastic products to be converted into final plastic or plastic-containing products. Commonly in form of foil rolls, rods, sticks and profile shapes
Sorted waste plastic	Refers to the waste plastic after sorting (source-segregation, mechanical sorting, etc.)
Stock	A material reservoir within the analysed system for a process that has a growth or depletion of material stored

1. Objectives and Methodology

1.1 Aim and scope

The aim of this report was to provide a quantitative overview of plastic flows in Denmark for a given year. The work was based on the Material Flow Analysis (MFA) methodology and use of readily-available data, while identifying the lack (or insufficient quality) of quantitative data and further research needs. The specific objectives were:

1. Construct a conceptual overview of plastic flows in Denmark.

2. Review and gather readily-available data from publicly-available statistical repositories.

3. Identify information gaps and collect relevant data from readily-available scientific and technical literature.

4. Use the collected data to provide quantitative estimates of flows previously identified.

5. If possible, provide quantitative estimates for the remaining (unquantified) flows, based on mass balance of processes.

The geographical scope of the work was Denmark, while the temporal scope was set as the year 2016, since it was typically the most recent year where the data (for example from statistics) was available. This may partially represent the current situation with plastic flows in Denmark, as recent measures to increase waste plastic recovery (e.g., from households) have been implemented. The focus was on plastic material in general, however, relevant data for the individual polymers (PET, PE and PP) were included in the assessment. The intention of this report was to serve as the basis for a more detailed and comprehensive analysis and discussion of plastic flows in Denmark.

1.2 Methodology

The work in the present report was based on the MFA methodology. MFA is a systematic assessment of the state and change of flows and stocks of materials within a system defined in space and time (Brunner and Rechberger, 2017). Within the MFA approach, the sources, the pathways, and the intermediate and final sinks of a material are connected. Due to the law of conservation of matter, the results of an MFA can be controlled by a mass balance, comparing all inputs, changes in stocks, and outputs of a process. The same law can be applied to estimate a single unknown flow (or stock) for a process, if all the remaining defined flows can be estimated.

1.2.1 Overall steps

The methodology of the present work was divided into the following five (1-5) steps:

1. Construct an overview of plastic flows in Denmark based around a number of sectors and main processes (a-i):

a. **Market.** This is the entity that combines plastic imports, exports, outputs of domestic production and inputs to consumption in different sectors of the economy;
b. **Plastic product manufacturing.** This entity represents industry sectors which manufacture plastic products. The input is plastic in the form of raw material, while the outputs are (semi-finished and finished) plastic products and plastic waste (i.e., residue);
c. **Consumption.** This is the entity where the sectors of economy consuming plastic are grouped. This is further sub-divided into industry (excluding plastic manufacturing), construction and building, households, services, utilities, agriculture and the remaining sectors grouped as “other”. The outputs from consumption are waste plastic streams split into packaging, source-segregated (non-packaging), residual (mixed and combustible) waste and other waste fractions;
d. **Waste collection and management.** This entity represents the part of the waste management sector where waste plastic is collected and managed towards different streams. Imports and exports of waste plastic as part of combustible waste trade are included here;
e. **Recyclable plastic management.** This entity distributes waste plastic recovered for recycling into export and plastic managed in Denmark;
f. **Plastic recycling.** This entity represents plastic recycling industry in Denmark. Imports of waste plastic sorted from other materials are included here;
g. **Plastic processing residues.** This entity represents residues from plastic processing. This includes production residues (e.g., offcuts) and residues resulting from plastic recycling;
h. **Incineration.** This entity represents waste plastic incineration in Denmark. The incineration of waste plastic results in three outputs: bottom ashes, APC residues and air emissions. In Denmark bottom ashes are used for road construction, hence contributing the stock of material, APC residues are being exported (either to Norway or to Germany) and air emissions are released into the environment (CEWEP, 2016; ISWA, 2008). Since air emissions are not constrained by the geographical boundaries of a country, they are considered export in the report;
i. **Other treatment.** This entity represents management of waste plastic other then (recovery for) recycling and incineration (e.g., temporary storage).

2. Review and gather readily-available statistics data from Statistics Denmark (SD, 2018) and The Danish Environmental Protection Agency (EPA) (Miljøstyrelsen, 2018). Since most of the relevant data was available up until the year 2016, the year was assumed as the most recent. Specifically the following data derived from Statistics Denmark (a-d) and the Danish EPA (e-g):

a. Imports and exports of plastic in primary forms, semi-finished and finished plastic products, and plastic-containing products;
b. Domestic production of primary plastic, semi-finished and finished plastic products;
c. Consumption of plastic by industry, building and construction sector;
d. Imports and exports of waste plastic;
e. Generation of packaging, non-packaging, mixed and combustible waste;
f. Imports and exports of waste plastic for recycling;
g. Treatment of plastic waste and plastic-containing waste.

3. Identify information gaps in the amounts of plastic in the defined flows. Identify readily-available scientific or technical literature that can provide concrete data (e.g., sample measurements) to be used in calculating the plastic amounts in the identified flows. Collect relevant data.

4. Calculate the amounts of plastic in the flows identified in Step 3, using the data collected in the same step.

5. Based on the principle of mass conservation and the knowledge of the amounts of plastic in flows leading to/from a process, calculate the amounts of plastic in some of the remaining flows of the process (i.e., estimate based on a mass balance), if possible.

1.2.2 Recycling rate

Plastic recycling rates were calculated in the report, with only the amounts recovered for recycling included in the recycling rate calculations. This means that the amounts of new plastic products produced from plastic waste, the associated material losses from this production and the content of recycled plastics in plastic products consumed in Denmark (from domestic production or imports) were beyond the scope of this report.

A plastic recycling rate (RR) can be calculated using the following equations:

$$RR_1 = \frac{waste\ plastic\ recovered\ for\ recycling}{waste\ plastic\ generated} \cdot 100\% \qquad (1)$$

$$RR_1 = \frac{waste\ plastic\ recovered\ for\ recycling + waste\ plastic\ imported\ for\ recycling}{waste\ plastic\ generated + waste\ plastic\ imported} \cdot 100\% \qquad (2)$$

While in equation (1) only waste plastic generated in Denmark is considered, equation (2) takes into account imports of plastic as well. The calculation of a plastic recycling rate using the equation (1) or equation (2) does not take into account the composition of waste plastic for recycling, as well as losses in additional sorting steps prior to recycling. Presence of non-plastic contaminants or non-target polymer types within waste plastic recovered for recycling can lower the overall recycling rate (Eriksen et al., 2018). This issue can partially be solved by calculating recycling rates using the amounts of waste plastic after sorting and before entering the recycling operation (as already proposed for packaging in the EU (EU, 2018)), however, detailed estimation of losses of plastic either in waste plastic sorting or recycling was beyond the scope of the report.

1.2.3 Data sources

While quantitative estimation of uncertainty related to the amounts reported in this report was beyond the scope of the present work, qualitative estimates were reported. Qualitative estimates were based on the source of the data used, and were subdivided into “small”, “medium” and “large” potential uncertainty. The data sources used and a qualitative estimation of the degree of uncertainty related to them are provided in Table 1.1, namely:

- Columns A and B refer to the data that were taken from statistics (either directly or using proxy statistics (e.g., monetary equivalency));
- Column C refers to estimates based on concrete data (e.g., sample measurements);
- Column D means a flow was the only unknown flow within a process and, hence, was calculated balancing respective inputs and outputs (i.e., estimated based on a mass balance);
- if concrete data were unavailable, the flows were reported as unknown (column U), to avoid ambiguity.

The overview of the main estimations and assumptions made is provided in Table 1.2.

TABLE 1.1 Overview of flows of plastic comprising Figure 1.1, their data sources and qualitative estimate of the degree of uncertainty. “x” refers to plastic material; “•” refers to specific polymer types. Table 1.1 continues in page 14.

	A	B	C	D	U
Data source	**Available[1] (Direct)**	**Available (Proxy)**	**Estimation[2]**	**Mass balance**	**Unknown**
Qualitative degree of uncertainty	**Small**	**Medium/ Large**	**Large**	**(-)[3]**	**(-)**
Flow name					
Market					
Plastic in primary form trade (F1, F5)	x	•			
Semi-finished products trade (F2, F6)		x/•			
Finished products trade (F3, F7)		x/•			
Plastic-containing products trade (F4, F8)			x/•		
Plastic to consumption (F14)				x	•
DK non-plastic industry output (F13)				x	•
Plastic product manufacturing					
Semi-finished products (F9)		x/•			•
Finished products (F10)		x/•			•
Raw materials for production (F11)				x	•
Residues (F12)				x	•
Consumption					
Plastic consumed by industry (F15, F16)		x			•
Plastic consumed in construction and building (F17)		x			•
Plastic and products to other sectors (F18)				x	•
Plastic consumed by households (F19)					x/•
Plastic consumed by services (F20)					x/•
Plastic consumed by utilities (F21)					x/•
Plastic consumed in agriculture (F22)					x/•
Plastic consumed by other businesses (F23)					x/•
Plastic in use (stock)				x	•

[1]data judged to be too uncertain by Statistics Denmark is not reported and is specified as “data too uncertain” in the Appendices; [2]only concrete estimates (i.e., limited level of uncertainty) are included here; [3]the level of uncertainty of this flows will depend on the level of uncertainty of the flows used in the mass balance.

TABLE 1.1 Continued.

Data source	A Available[1] (Direct)	B Available (Proxy)	C Estimation[2]	D Mass balance	U Unknown
Qualitative degree of uncertainty	**Small**	**Medium/ Large**	**Large**	**(-)[3]**	**(-)**
Flow name					
Waste collection and trade					
Packaging waste (F45)	x				•
Sorted waste plastic (F46)	x				•
Residual (mixed and combustible) waste plastic (F47)			x		•
Other waste fractions (F48)					x/•
Residues (F49)	x				•
Combustible waste trade (F53, F55)			x		•
Unknown fate (F54)					x/•
Waste management					
Waste plastic recovered for recycling (F50)	x				•
Waste plastic for incineration (F51)			x		•
Unknown fate (F54)				x	•
Bottom ash (stock)			x		•
APC residues (F56)			x		•
Air emissions to the environment (F57)				x	•
Waste plastic for other treatment (F52 or stock)			x		•
Recyclable plastic management					
Waste plastic export (for recycling) (F59)	x	(•)	(•)		
Waste plastic export (unknown fate) (F58)		(•)	(•)	x	
Waste plastic managed in DK (F60)				x	•
Plastic recycling					
Waste plastic imports (F61)	x	•	•		
Unknown fate (F62)				x	•
Waste plastic for recycling (F63)	x				•
Recycling residues (F64)				x	•
Secondary plastic (F65)	x	•			

[1]data judged to be too uncertain by Statistics Denmark is not reported and is specified as “data too uncertain” in the Appendices; [2]only concrete estimates (i.e., limited level of uncertainty) are included here; [3]the level of uncertainty of this flows will depend on the level of uncertainty of the flows used in the mass balance.

TABLE 2.2 Overview of the estimations and assumptions made when calculating plastic flows. "x" refers to plastic material; "•" refers to specific polymer types.

Flow name	x/•	Assumptions made
Plastic in primary form trade (F1, F5, F65)	•	The polymer distribution was based on commodity description (e.g., Table A.1).
Semi-finished and finished products (F2, F3, F6, F7, F9, F10)	x/•	Distribution of plastic between semi-finished and finished products was based on monetary distribution of broad economic categories (Table C.1). The polymer composition was based on commodity description and, due to lack of data, did not take into account the distribution between semi-finished and finished products.
Plastic-containing products trade (F4, F8)	x/•	Plastic and polymer content of all of the traded commodities derived from a product survey conducted in 1993 (Miljøstyrelsen, 1995). Details about PET plastics were not provided, hence, PET was assumed to be 50% of the non-specified (excluding ABS, PVC, PS, PMMA, PC, etc.) plastic.
Residue (from plastic product manufacturing) (F12)	x/•	The waste from "Manufacture of rubber and plastic products" is associated predominantly with plastic industry.
Mixed waste from households (F30)	x/•	Plastic content and polymer composition were based on the data from 2013 reported in (Edjabou et al., 2015).
Mixed waste from non-households (F24, F27, F33, F36, F39, F42)	x/•	Plastic content and polymer composition assumed to be the same as in household waste.
Packaging and non-packaging waste from households (F31, F32)	•	Polymer composition (%) of packaging and non-packaging household waste based on data in (Eriksen and Astrup, 2019).
Combustible waste* (F47)	x/•	Plastic content and polymer composition based on the data reported in (Edjabou et al., 2017; Faraca et al., 2019; Faraca and Astrup, 2019; Petersen, 2018).
Combustible waste trade (F53, F55)	x	The content of plastic (20%) represents a maximum value allowed in the waste imported for incineration in Denmark (Nedenskov, 2018). Exports were assumed to have the same plastic content as imports.
Bottom ash (stock) and APC residues (F56)	x	The amounts of bottom ash (2.2%) and APC residues (1.6%) resulting from incineration of mixed waste plastic in municipal waste incinerator were representative for Europe in the period 2006-2012 (Ecoinvent, 2018).
Waste plastic exports (for recycling or unknown fate) (F58, F59)	x/•	Both Statistics Denmark (SD, 2018) and the Danish EPA (Miljøstyrelsen, 2018) report exports of waste plastic. Only the amounts reported by the latter were assumed to be exported for recycling. The polymer distribution was based on commodity description (Table A.1.4). The share of PET in other polymers was based on the assumption that all of the plastic collected through deposit-return system in Denmark was PET and was exported (Table C.9).
Waste plastic imports (F61)	x/•	Both Statistics Denmark (SD, 2018) and the Danish EPA (Miljøstyrelsen, 2018) report imports of waste plastic. Only the amounts reported by the latter were assumed to be recycled, while fate of the remaining waste plastic was reported as unknown. The polymer distribution was based on commodity description (Table A.1.4). The share of PET in other polymers was assumed to be the same as in waste plastic exports.

*Residual waste (F47) is composed of mixed and combustible waste fractions. See "Abbreviations and definitions" for details.

2. Plastic flows overview

2.1 Plastic material

A schematic overview of the plastic flows and the respective amounts in Denmark in 2016 is provided in Figure 1.1. The width of the flow arrows in the figure is relative to the amounts being depicted. In addition, the flows are colour-coded, with the legend showing the colour for the letters A, B, C, D, and U that are representing the respective columns in Table 1.1. The flows with letters “I” or “E” represent import and export flows, respectively. The amounts of plastic illustrated in “consumption” represent increase (+) in plastic material stock being in use, while for “other treatment” the stock represents waste plastic material recovered for or treated other than being recycled or incinerated (e.g., temporary storage or landfilling). Overall, approximately 3,100,000 tonnes of plastic were imported into Denmark in 2016. In the same year, approximately 2,500,000 tonnes of plastic were exported (including 400,000 tonnes (F57) and 6,500 tonnes (F56) of waste plastic resulting as air emissions and APC residues from waste plastic incineration, respectively). The difference between exports and imports resulted in a buildup of plastic stock of approximately 610,000 tonnes.

3,100,000 t

The amount of plastic imported into Denmark in 2016

In the following sub-sections, plastic trade (2.1.1), domestic production and consumption (2.1.2), waste plastic generation, collection, treatment (2.1.3) and waste management (2.1.4) are described in more details.

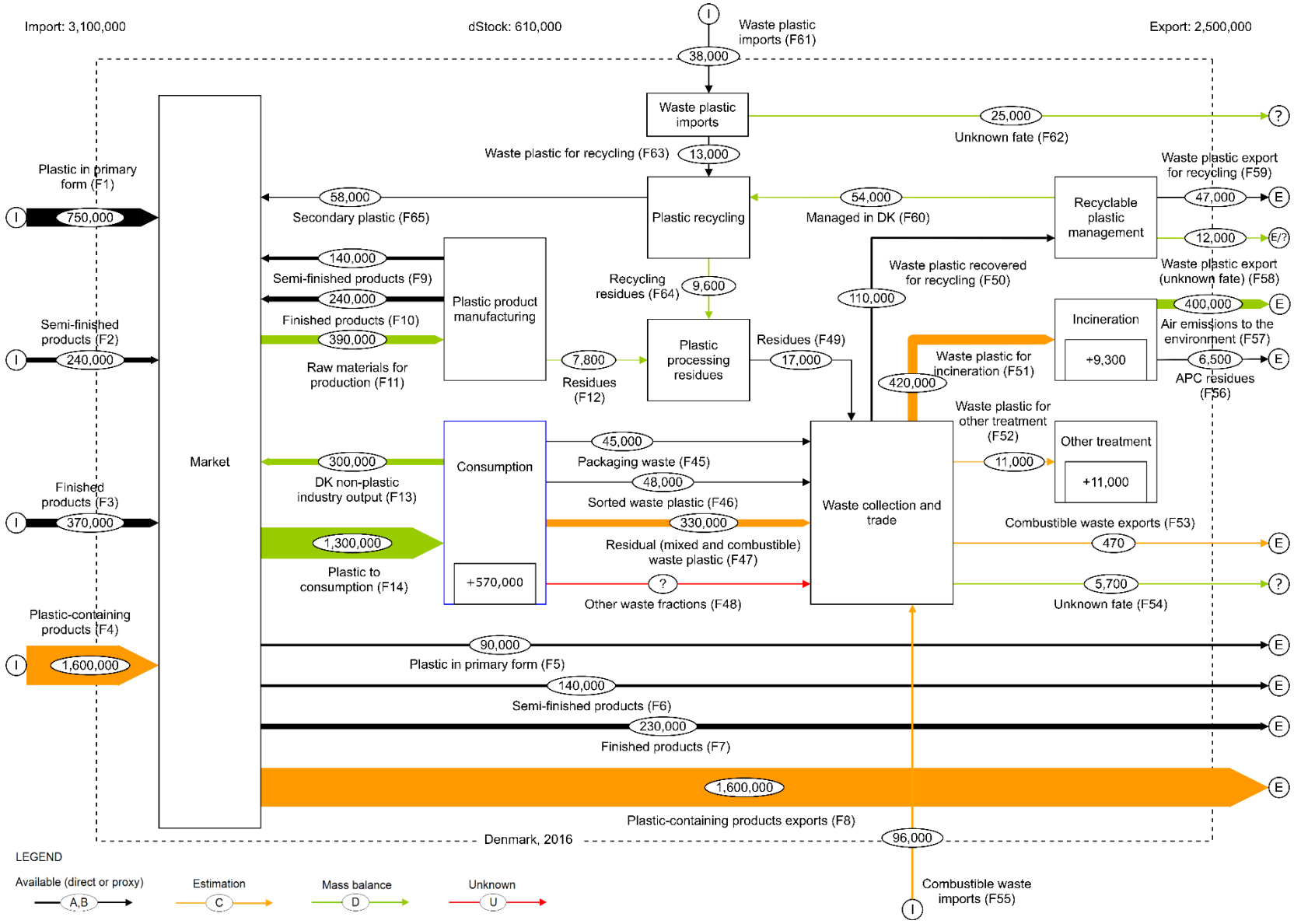

FIGURE 1.1 *Schematic overview of the plastic flows in Denmark in 2016. Unit: tonnes. The flows are colour-coded, with the letters A, B, C, D, and U representing the respective columns in Table 1.1. Reported numbers were rounded to two significant digits after calculations.*

2.1.1 Plastic trade

In Figure 1.1 plastic trade is illustrated as import and export flows denoted with letters “I” and “E”, respectively (including air emissions). Table 1.3 provides an overview of plastic imports and exports of the system, which include plastic trade, exports of APC residues (F56) and air emissions to the environment (F57) from waste plastic incineration. In 2016, 3,100,000 tonnes of plastic were imported into Denmark. Approximately 750,000 tonnes were imported in the form of primary plastic (F1). In addition, 610,000 tonnes were imported either as semi-finished (i.e., intermediate plastic products to be converted into final plastic or plastic-containing products (F2)), or finished plastic products (F3)[1]. Finally, 1,600,000 tonnes were imported as part of the non-plastic products (F4). Examples of such products are different types of vehicles, electric and electronic equipment, processed food packaging, etc.

TABLE 1.3. Overview of plastic imports and exports of the system. Unit: tonnes. Based on detailed data presented in Tables A.1-A.5 and rounded to two significant digits after calculations.

	Imports	Export	Imports-Exports
Primary plastic (F1, F5)	750,000	90,000	660,000
Semi-finished plastic products (F2, F6)	240,000	140,000	100,000
Finished plastic products (F3, F7)	370,000	230,000	140,000
Plastic-containing products (F4, F8)	1,600,000	1,600,000	51,000*
Waste plastic (F58, F59, F61)	38,000	59,000	-21,000
Waste plastic (as part of combustible waste) (F53, F55)	96,000	470	96,000
APC residues (F56)	-	6,500	-6,500
Air emissions (F57)	-	400,000	-400,000
Total	3,100,000	2,500,000	610,000

*Value calculated as a difference between import and export before the numbers were rounded to two significant digits.

The total exports from Denmark were 2,500,000 tonnes (Table 1.3). This included 1,600,000 tonnes of plastic exported as part of plastic-containing products (F8). Approximately 230,000 tonnes and 140,000 tonnes of exports were finished (F7) and semi-finished plastic products (F6), respectively. Finally, primary plastic exports accounted for approximately 90,000 tonnes (F5). The data in statistics did not distinguish between virgin and recycled plastics, hence, exports of primary plastic (as well as imports) may include virgin and recycled plastic raw materials. Finally, 6,500 tonnes were converted into APC residues and exported (F56), while 400,000 tonnes[2] were converted into air emissions (F57) and released into the environment following waste plastic incineration (see Methodology for details).

Additional amounts of plastic were imported and exported, either as sorted waste plastic (typically used for plastic recycling) or as part of combustible waste (i.e., mixed waste typically used for incineration in Denmark). Imports of waste plastic amounted to 38,000 tonnes, as part of sorted waste plastic (F61) and 96,000 tonnes as part of residual waste (F55). However, approximately 59,000 tonnes were also exported as sorted waste plastic (F58 and F59) and 470 tonnes[3] as part of the residual waste (F53), respectively.

[1] Distribution of plastic products between semi-finished and finished was based on monetary distribution of broad economic categories (BEC). See Table A.1 for details.

[2] This amount only considers the original plastic material incinerated, while excluding the reaction products formed in the incineration process (e.g.,i.e. O_2 or CO_2).

[3] The content of plastic in mixed waste exported for incineration was assumed to be the same as in the waste imported (Table A.5), since the fact that mixed waste can be traded is governed primarily by the calorific value of the waste.

2.1.2 Domestic production and consumption

Production
While there was no production of virgin primary plastic in Denmark (Plastindustrien, 2018), approximately 58,000 tonnes (F65) were reported as produced in 2016 (Table A.6). It was assumed that this production volume resulted from plastic recycling in Denmark. Since household waste plastic is a rather heterogeneous material flow with impurities (Eriksen et al., 2018), the recyclers of plastic in Denmark typically use non-household waste in their production (AVL, 2018; Plastindustrien, 2018). With respect to semi-finished and finished plastic products, approximately 140,000 (F9) and 240,000 tonnes (F10) were produced in 2016, respectively (Table A.7).

Consumption
The plastic manufacturing industry in Denmark generated approximately 7,800 tonnes of waste plastic (F12) and, assuming that no material remains as stock in plastic production[4], the amount of plastic used as raw materials for production by the plastic industry was calculated to be approximately 390,000 tonnes (F11). This value has been calculated as a mass balance of the process.

Figure 1.2 illustrates consumption of plastic by the remaining sectors of the economy, including industry (excluding plastic industry, previously covered and illustrated in Figure 1.1) and building and construction sector. Approximately 260,000 tonnes of plastic raw materials (F16) were consumed by the industry (excluding plastic industry), in addition to 69,000 tonnes of plastic packaging (F15) purchased in 2016 (Table A.8). Considering the known amounts of waste plastic generated by the industry and assuming no plastic stock in the industry[4], the industry's outputs in terms of plastic products were calculated to be 300,000 tonnes (F13). This value has been calculated as a mass balance of the process. This amount includes semi-finished and finished plastic products, as well as plastic-containing products.

The construction and building sector of the economy consumed approximately 130,000 tonnes of plastic (F17) in 2016 (Table A.9). The majority of plastic used in the sector contributed to the in-use stock build up, which increased by 97,000 tonnes in 2016 (Figure 1.2). This value has been calculated as a mass balance of the process.

The remaining sectors of the economy (i.e., households, services, utilities, agriculture and other) consumed approximately 840,000 tonnes of plastic (F18 in Figure 1.2). A large share of the plastic consumed remained in use at the end of the year, hence, contributing with 470,000 tonnes to growth of stock in the sectors. Due to lack of data, consumption of plastic and in-use stock change for each of the individual sectors was not established. The overall growth of stock of plastic in the Danish economy was estimated to be approximately 610,000 tonnes in 2016 (Figure 1.1).

[4] This is a simplification, since some plastic containing products (e.g., machinery or electronic equipment) will be in use by the industry, contributing to a stock of plastic material. Such stocks are expected to be negligible in comparison to the amounts of plastic consumed as raw materials and produced as plastic products.

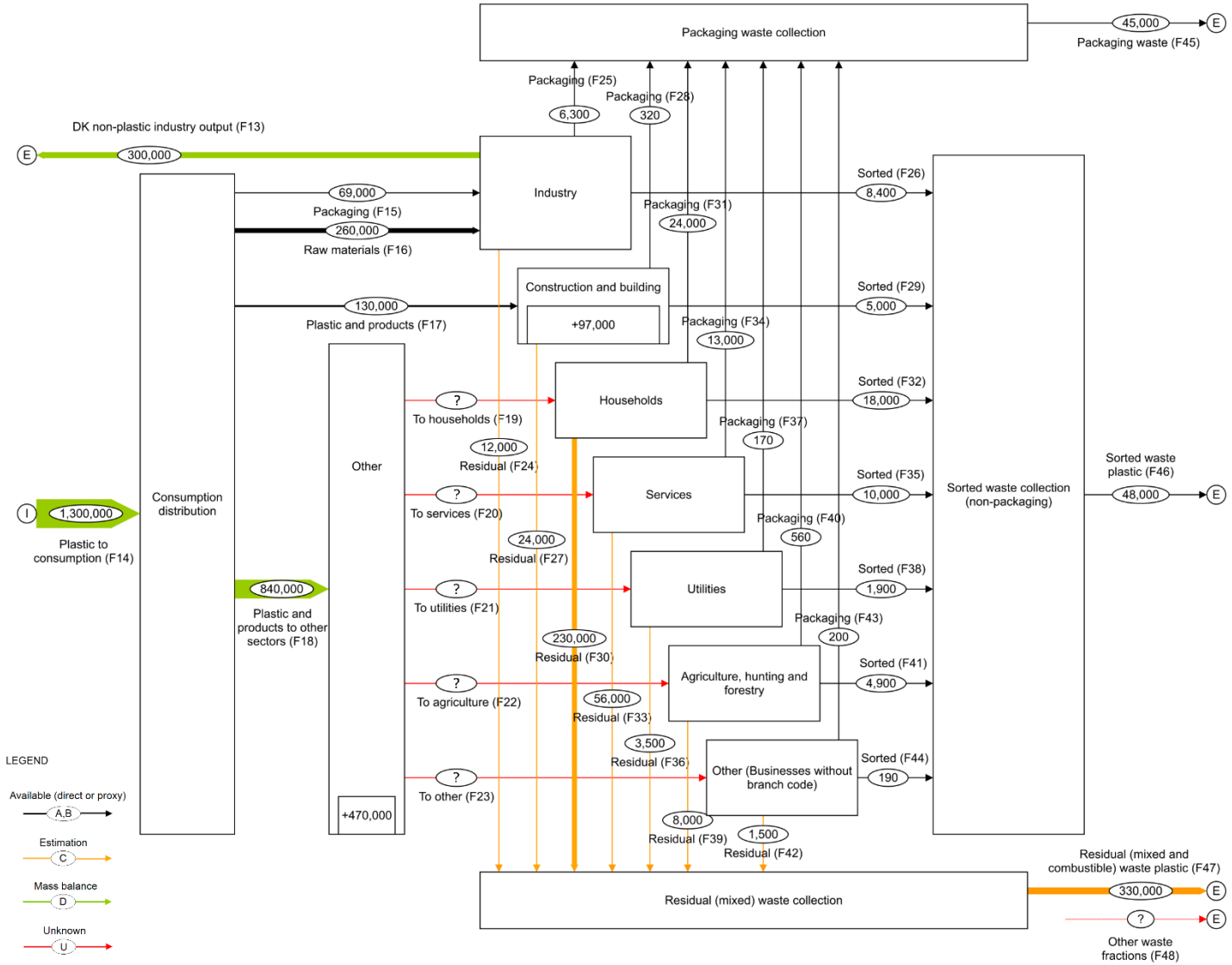

FIGURE 1.2 *Schematic overview of the plastic consumption and waste generation of plastic by different sectors of economy (excluding plastic product manufacturing and plastic recycling, which are depicted in Figure 1.1) in Denmark in 2016. Unit: tonnes. Flows F13, F14, F45-F48 can be seen in the Figure 1.1, as well. The flows are colour-coded, with the letters A, B, C, D, and U representing the respective columns in Table 1.1. Reported numbers were rounded to two significant digits after calculations.*

2.1.3 Plastic waste generation, collection and treatment

Table 1.4 provides an overview of waste plastic generated in Denmark in 2016. The majority of waste plastic was generated as part of residual waste flow, which included plastic content of mixed and combustible waste. The overall flow was calculated to be approximately 330,000 tonnes (F47 in Figure 1.1). Some 200,000 tonnes of waste plastic were part of mixed residual waste, while 130,000 tonnes were part of combustible waste (Table 1.4). When considering sorted waste plastic (e.g., waste plastic source-segregated in households or services), packaging waste plastic accounted for 48,000 tonnes (F45 and 2,600 tonnes as part of F49), while non-packaging for 62,000 tonnes (F46 and 13,000 tonnes as part of F49) (Table 1.4).

While there are additional waste types generated in Denmark (e.g., sludge, gardening waste, hazardous waste), their plastic content is practically unknown. Hence, these waste fractions were grouped into "Other waste fractions" material flow and included in the Figure 1.1 (F48), however, due to the lack of data, amounts of plastic in this flow were not estimated.

TABLE 1.4. Overview of plastic waste generated in Denmark in 2016. Unit: tonnes. Based on detailed data presented in Tables A.10 and A.11 and rounded to two significant digits after calculations.

	Sorted packaging waste plastic (W1)	Sorted non-packaging waste plastic (W2)	Plastic in mixed waste (W3)	Plastic in combustible waste (W4)	Total
Industry (F12, F24-F26)	8,900	22,000	1,000	13,000	45,000
Construction and building (F27-F29)	320	5,000	250	24,000	29,000
Households (F30-F32)	24,000	18,000	190,000	37,000	270,000
Services (F33-F35)	13,000	10,000	8,700	48,000	80,000
Utilities (F27-F29)	160	1,900	410	3,100	5,500
Agriculture (F39-F41)	560	4,900	250	7,700	13,000
Other businesses (F42-F44)	200	190	48	1,400	1,900
Total	48,000	62,000	200,000	130,000	440,000

2.1.4 Plastic waste management

The majority (approximately 99%) of sorted waste plastic was recovered for recycling (Table A.12), while the majority of waste plastic in residual waste (>95%) was incinerated. In total, 420,000 tonnes of waste plastic (F51) were incinerated in 2016, resulting in approximately 960,000 tonnes[5] of CO_2 emitted into the environment. This represents the majority of the 1,300,000 tonnes of CO_2-eq. associated with the Danish waste management sector in 2016 (EEA, 2017). Small amounts (<2%) of the mixed and combustible waste were recovered for recycling, after a sorting step. In total 59,000 tonnes (52%) of sorted waste plastic were exported in 2016, of which 47,000 tonnes were exported for recycling (F59) and the fate of the additional 12,000 tonnes (F58) was unknown. The remaining 54,000 tonnes (48%) of waste plastic were managed in Denmark (F60 in Figure 1.1). In addition, 38,000 tonnes of sorted waste plastic (F61) were imported (Table 1.3). Approximately 13,000 tonnes of the sorted

960 Kt

The amount of CO_2 emitted from plastic waste incineration

[5] Based on the emission of 2.3 kg of CO_2 for every kg of mixed waste plastic incinerated. Data covers European municipal waste incineration in the period 2006 - 2012 (Ecoinvent, 2018).

waste plastic (F63) were imported for recycling, while the fate for the majority of imported sorted waste plastic (25,000 tonnes) was unknown (F62). On the other hand, 96,000 tonnes of waste plastic (F55) were imported as part of the combustible waste used for incineration (Table 1.3).

Using the information from Figure 1.1 (F55, F61 and F63) and Table 1.4 (W1, W2, W3 and W4) and the equations (1) and (2) (see Methodology for details), the plastic recycling rates in Denmark can be calculated as follows:

$$RR_1\ (\%) = \frac{W1+W2}{W1+W2+W3+W4} \cdot 100\% \qquad (1)$$

$$RR_2\ (\%) = \frac{W1+W2+F63}{W1+W2+W3+W4+F55+F61} \cdot 100\% \qquad (2)$$

Following the equation (1), the overall plastic recycling rate for Denmark in 2016 was calculated as RR_1 = 26%[6]. If the imports of plastic are to be considered (equation (2), see Methodology for details), the recycling rate decreases to RR_2 = 22%[6]. The decrease is mainly related to the fact that while approximately 130,000 tonnes of waste plastic were imported in 2016, only 13,000 tonnes were imported for recycling (F63). The remaining waste plastic was either incinerated as part of the combustible waste (96,000 tonnes, F55) or had an unknown fate (25,000 tonnes, F62). Some literature sources report higher recycling rates for Denmark (approximately 36%); however, it was impossible to verify the reported recycling rates or identify the source of discrepancy due to the lack of transparency in these sources (PlasticsEurope, 2017).

22-26%

Plastic recycling rate in Denmark

The recycling rates calculated above were expected to have a considerable uncertainty, due to the uncertainty in the data used. As illustrated in Tables 1.1 and 1.2, the lack of knowledge about some flows means that either those flows were excluded from the calculations (e.g., unknown fate for some of the imported plastic (F62)) or the data used for these flows were expected to be more uncertain (e.g., content of plastic in the residual waste plastic (F47)). Since these flows were of considerable size and were important in calculations presented above, the recycling rates calculated here should be interpreted with care. Finally, equations (1) and (2) only consider plastic recovered for recycling and do not consider potential losses, e.g., associated with further sorting and re-processing.

[6] This includes 5,600 tonnes of waste plastic as part of residual waste (W3 and W4 in Table 1.4) reported to be recycled.

2.2 Plastic polymers

Figures 1.3 – 1.6 present the flows of plastic on the polymer level, including PET, PE, PP, and the remaining polymers grouped as “other plastic”. Apart from trade of plastic, production of plastic products in Denmark, plastic recycling output and composition of waste plastic currently not being recycled, the data about polymer composition of flows was unavailable. Flows with no data about polymer composition are marked with a question mark. Flows are colour-coded to reflect on the source of the data about the overall plastic flows, rather than specific polymers.

In the following sub-sections, plastic trade (polymer specific) (2.2.1) and waste plastic generation, collection, treatment (2.2.2) are described in more details.

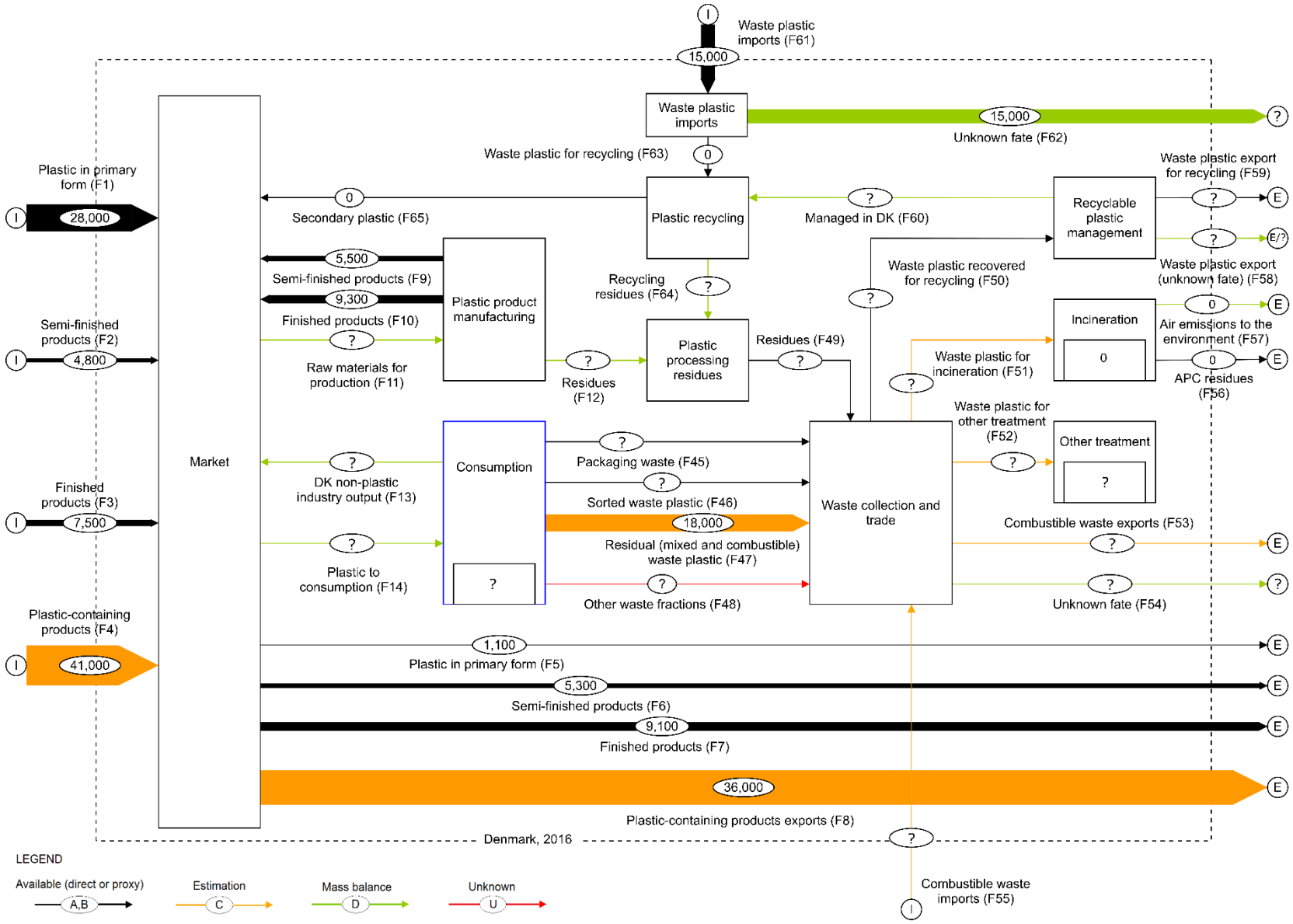

FIGURE 1.3 *Schematic overview of the polyethylene terephthalate (PET) flows in Denmark in 2016. Unit: tonnes. The flows are colour-coded, with the letters A, B, C, D, and U representing the respective columns in Table 1.1 for plastic as a material. Reported numbers were rounded to two significant digits after calculations.*

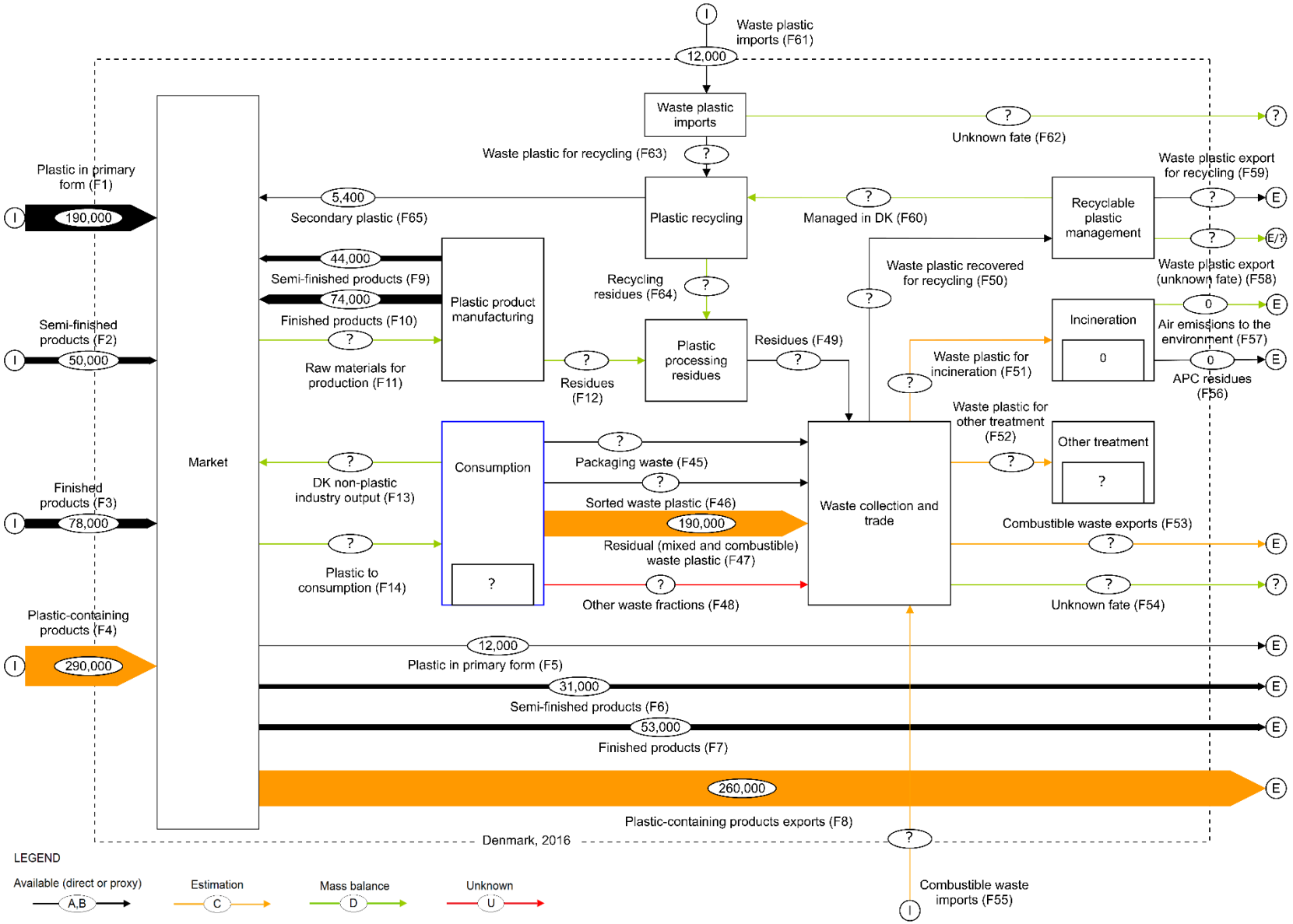

FIGURE 1.4 *Schematic overview of the polyethylene (PE) flows in Denmark in 2016. Unit: tonnes. The flows are colour-coded, with the letters A, B, C, D, and U representing the respective columns in Table 1.1 for plastic as a material. Reported numbers were rounded to two significant digits after calculations.*

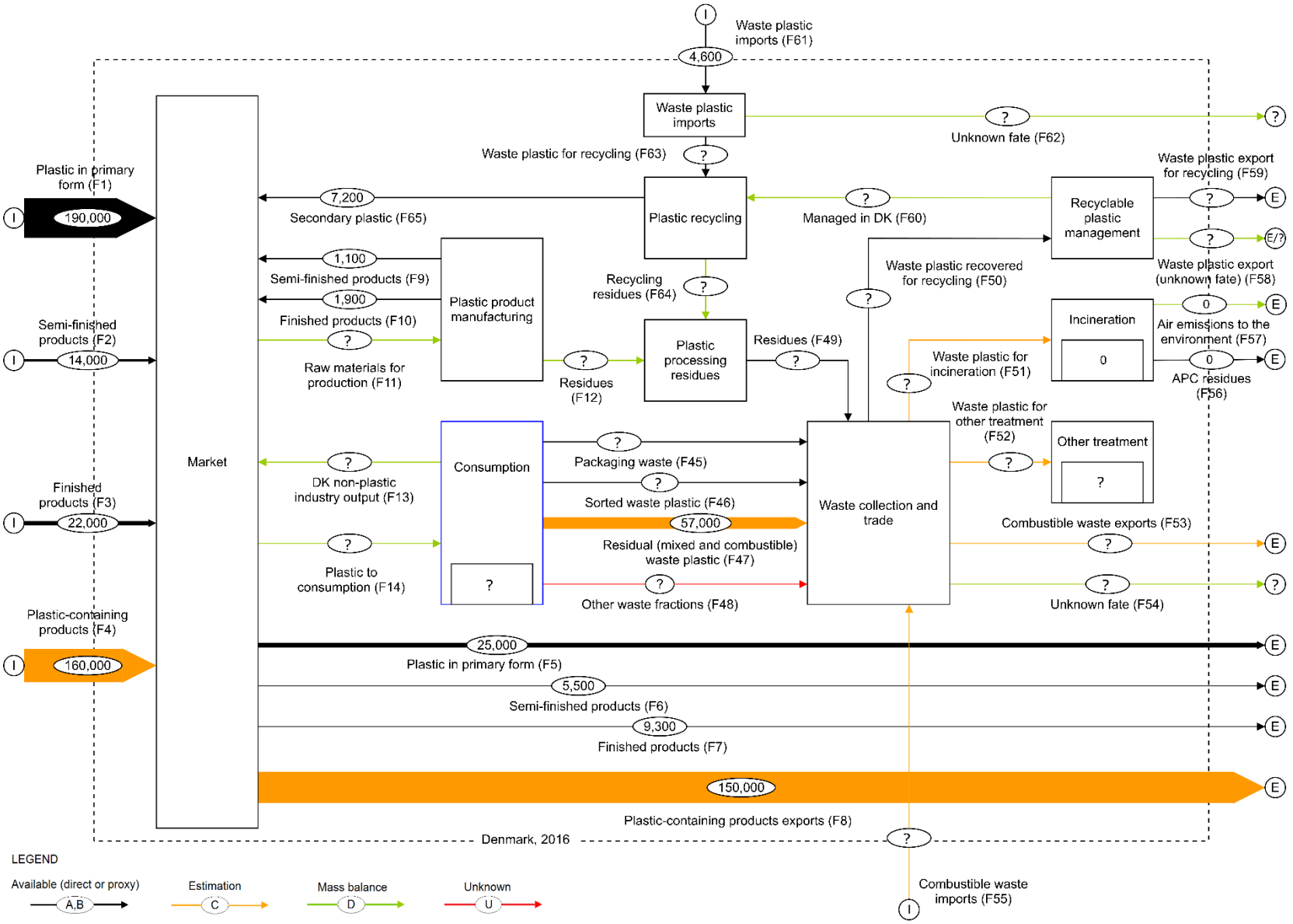

FIGURE 1.5 *Schematic overview of the polypropylene (PP) flows in Denmark in 2016. Unit: tonnes. The flows are colour-coded, with the letters A, B, C, D, and U representing the respective columns in Table 1.1 for plastic as a material. Reported numbers were rounded to two significant digits after calculations.*

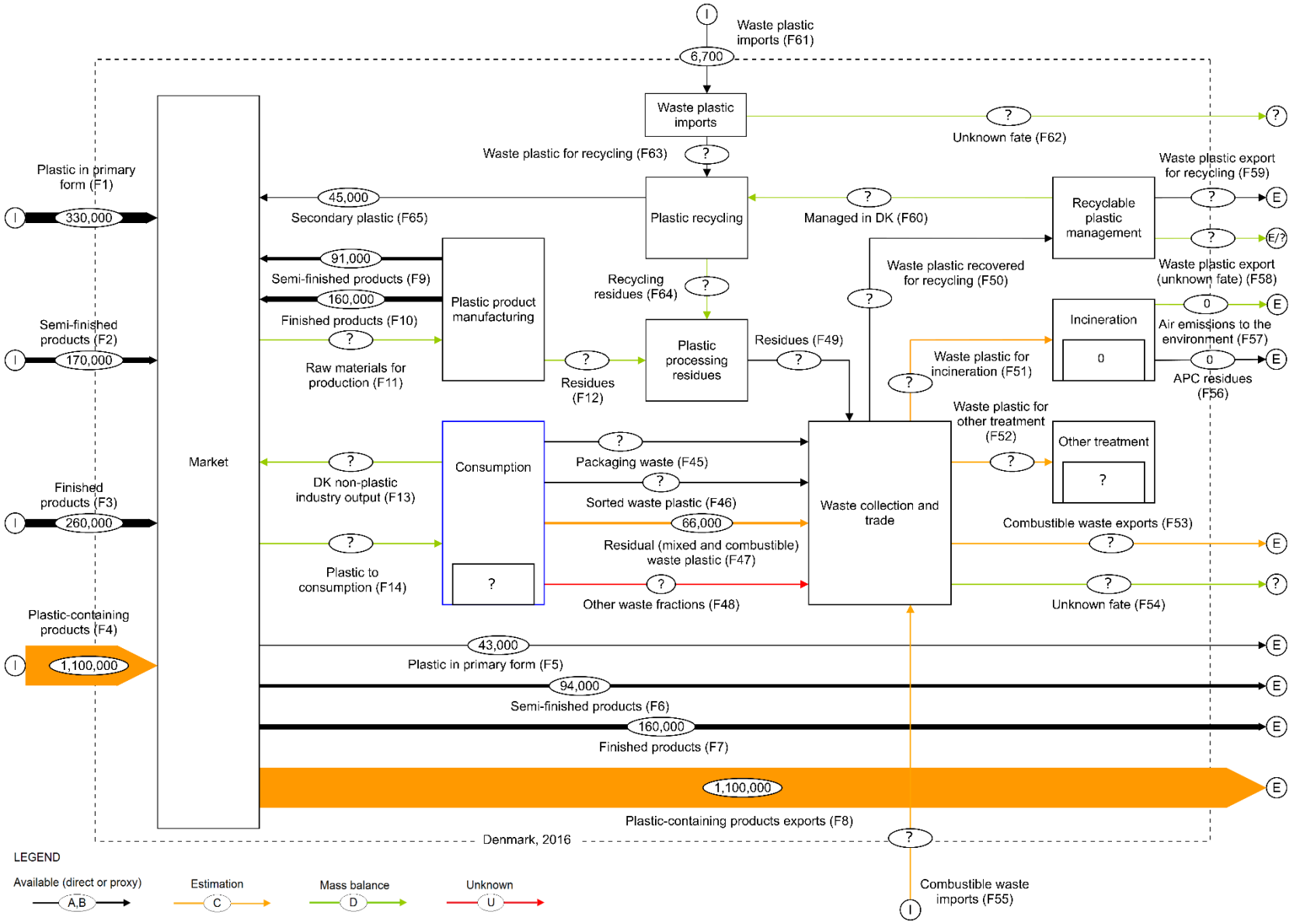

FIGURE 1.6 *Schematic overview of the polypropylene (PP) flows in Denmark in 2016. Unit: tonnes. The flows are colour-coded, with the letters A, B, C, D, and U representing the respective columns in Table 1.1 for plastic as a material. Reported numbers were rounded to two significant digits after calculations.*

2.2.1 Plastic trade (Polymer specific)

Table 1.5 provides an overview of polymers imported to Denmark in 2016. Among the specified polymers (i.e., PET, PE; PP), PE was imported in the largest amounts, followed by PP and PET. However, the majority of the imported plastic was in the form of other polymers[7] or was not specified. Since the polymer composition of a substantial share of semi-finished and finished products was not specified, the actual amounts of polymers (PET, PE, PP or other polymers) in the import category reported in Table 1.5 may be underestimated. In most of the cases the majority of import for a specific polymer was as part of plastic-containing products. However, for PP the largest share of import was in the form of primary plastic, followed by imports as part of the plastic-containing products.

TABLE 1.5. Imports of plastic in different polymers. Unit: tonnes. Based on detailed data presented in Tables B.1-B.5 and rounded to two significant digits after calculations.

Import category	PET	PE	PP	Other polymers	Not specified	Total
Primary plastic (F1)	28,000	190,000	190,000	330,000	-	750,000
Semi- and finished plastic products (F2, F3)	12,000	130,000	36,000	110,000	330,000	610,000
Plastic-containing products (F4)	41,000	290,000	160,000	1,100,000	-	1,600,000
Sorted waste plastic (F61)	15,000	12,000	4,600	6,700	-	38,000
Total Import	82,000	620,000	390,000	1,600,000	330,000	3,000,000

Table 1.6 provides an overview of polymers exported from Denmark in 2016. Similarly to polymer imports (Table 1.5), the exports were dominated by the other polymers. In addition, PE was exported in higher amounts when compared to PET or PP. However, in contrast to the imports, the largest share for all of the polymer types exported was as part of plastic-containing products. Similarly to plastic imports, polymer composition for the majority of commodities within semi-finished and finished plastic products was not specified, potentially underestimating the polymer amounts in the export category.

TABLE 1.6. Exports of plastic in different polymers. Unit: tonnes. Based on detailed data presented in Tables B.1-B.5 and rounded to two significant digits after calculations.

Export category	PET	PE	PP	Other polymers	Not specified*	Total
Primary plastic (F5)	1,100	20,000	25,000	43,000	-	90,000
Semi- and finished plastic products (F6, F7)	14,000	84,000	15,000	51,000	200,000	370,000
Plastic-containing products (F4, F8)	36,000	260,000	150,000	1,100,000	-	1,600,000
Sorted waste plastic (F58, F59)	19,000	28,000	2,600	9,200	-	59,000
Total exports	52,000	360,000	190,000	1,200,000	200,000	2,100,000

[7] Examples of polymers included in “other” are PVC, PS, ABS, PC, PUR. The actual polymer composition of this category will be different depending on the industry, application, product group, waste flows, etc.

2.2.2 Plastic waste generation, collection and treatment (Polymer specific)

Table 1.7 provides an overview of polymer composition of mixed waste generated in 2016. The dominant polymer fraction of the waste plastic was PE, followed by other polymers, PP and PET. The majority of the residual waste generated in Denmark comes from households (Miljøstyrelsen, 2018). Hence, the polymer composition of the residual waste from non-household sources was assumed to be similar to that from households (Table C.7).

TABLE 1.7. Polymer composition of plastic waste generated from mixed waste from different sources. Unit: tonnes. Based on detailed data presented in Table B.8 and rounded to two significant digits after calculations.

Waste source	PET	PE	PP	Other	Total
Industry (F12, F24)	66	690	85	170	1,000
Construction and building (F27)	16	170	21	43	250
Households (F30)	13,000	130,000	16,000	33,000	190,000
Services (F33)	570	5,900	730	1,500	8,700
Utilities (F36)	27	280	35	70	410
Agriculture (F39)	16	170	21	43	250
Other businesses (F42)	3	33	4	8	48
Total	13,000	140,000	17,000	34,000	200,000

Table 1.8 provides an overview of polymer composition of combustible waste generated in 2016. The largest share of a polymer in plastic in combustible waste was PET, followed by PP, other polymers and PE. The total PE in combustible waste was almost an order of magnitude lower when compared to the other polymer types. This can be related to the fact that relatively large amounts of PE end up in the residual waste, as illustrated in Table 1.7. Unlike, the residual waste, combustible waste is commonly collected at recycling stations and is not limited to household waste. The polymer composition across different sources of waste was based on data from combustible waste collected at recycling centers in Denmark (Table C.8).

TABLE 1.8. Polymer composition of plastic waste generated from combustible waste from different sources. Unit: tonnes. Based on detailed data presented in Table B.9 and rounded to two significant digits after calculations.

Waste source	PET	PE	PP	Other	Total
Industry (F12, F24)	5,300	440	3,900	3,100	13,000
Construction and building (F27)	9,900	810	7,200	5,700	24,000
Households (F30)	15,000	1,300	11,000	8,900	37,000
Services (F33)	20,000	1,600	14,000	12,000	48,000
Utilities (F36)	1,300	110	940	750	3,100
Agriculture (F39)	3,200	260	2,300	1,900	7,700
Other businesses (F42)	600	49	440	350	1,400
Total	56,000	4,600	40,000	32,000	130,000

A share of waste plastic collected is exported, while some waste plastic is imported as well. Polymer composition data for waste plastic traded was only available for sorted waste trade, as illustrated in Tables 1.5 and 1.6. The majority of waste plastic traded was in the form of PE, followed by PET, other polymers and PP. According to Table 1.5, approximately 15,000 tonnes of PET (F62 in Figure 1.3) were imported in 2016. However, since no recycled PET (reported as primary PET in Table B.6) production was reported in 2016, the share of PET imports used in recycling was zero and the fate of 15,000 tonnes of PET imported as part of sorted waste plastic was unknown (Figure 1.3). Imported plastic waste can potentially be used for energy recovery in waste incinerators or cement production (e.g., Asamany et al., 2017).

3. Concluding remarks

3.1 Plastic flows

While some information about plastic flows in Denmark was available, data about potentially important flows were either lacking or were of insufficient quality (see Table 1.9 for an overview). Due to the lack of domestic primary plastic production, the majority of plastic used in Denmark was imported. The largest flows of traded plastic was associated with plastic-containing products. However, the data used for these calculations were considered outdated (based on a survey performed in 1993 (Miljøstyrelsen, 1995)) and newer data on such a level of detail was not available.

TABLE 1.9. Overview of important plastic flows where no or little information was available (see Figure 1.1 and 1.2 for details).

Flow name	Estimation in the report (plastic/polymer type)	Amount (tonnes)
Market		
Plastic to consumption (F14)	Mass balance/Unknown	1,300,000
DK non-plastic industry output (F13)	Mass balance/Unknown	300,000
Plastic product manufacturing		
Raw materials for production (F11)	Mass balance/Unknown	390,000
Residues (F12)	Mass balance/Unknown	7,800
Consumption		
Plastic and products to other sectors (F18)	Mass balance/Unknown	840,000
Plastic consumed by households (F19)	Unknown/Unknown	Unknown
Plastic consumed by services (F20)	Unknown/Unknown	Unknown
Plastic consumed by utilities (F21)	Unknown/Unknown	Unknown
Plastic consumed in agriculture (F22)	Unknown/Unknown	Unknown
Plastic consumed by other businesses (F23)	Unknown/Unknown	Unknown
Plastic in other waste fractions (F48)	Unknown/Unknown	Unknown
Waste management		
Plastic flow of unknown fate (F54)	Mass balance/Unknown	5,700
Air emissions to the environment (F57)	Mass balance/-	400,000*
Recyclable plastic management		
Waste plastic export (unknown fate) (F58)	Mass balance/Unknown	12,000
Waste plastic managed in DK (F60)	Mass balance/Unknown	54,000
Plastic recycling		
Imported waste plastic of unknown fate (F62)	Mass balance/Unknown	25,000
Recycling residues (F64)	Mass balance/Unknown	9,600

*Refers to the amount of plastic converted into air emissions and released into the environment after waste plastic incineration.

When considering the domestic consumption of plastic, data about the distribution of plastic between households, services, utilities, etc. did not exist. Hence, the majority of important sectors of the economy were grouped as “other”. The consumption of industries and construction sectors was based on monetary equivalents, increasing the uncertainty of the estimates.

Data about plastic recycling in Denmark (amounts, sources, etc.) was not readily available. Identifying and interviewing companies recycling waste plastic, could provide additional information. As such, the recycling rates calculated in the report were based on the amounts of waste plastic recovered for recycling, rather than e.g., plastic displacing virgin production. This excludes the presence of non-plastic or non-recyclable plastic materials and, hence, potential losses of plastic during sorting and processing. The amounts of waste plastic traded in 2016 were either exclusively based on the available statistics, or a combination of statistics and concrete estimates (e.g., sample measurement). While the overall amounts of sorted waste plastic trade were known, the fate of a large share of such waste plastic was unknown. In addition, the final fate of the waste plastic exported for recycling was also unknown. Hence, the fate of imported or exported plastic should be better documented.

Additional sources of waste plastic, other than waste plastic packaging, sorted non-packaging waste plastic, mixed waste and combustible waste, were not addressed nor evaluated in the report. Examples of such sources are garden waste, hazardous waste, and sludge from different sources. While the amounts of plastic in such waste are expected to be relatively low, an attempt to quantify these flows should be made in the future as they may represent potential emissions to the environment.

Finally, the temporal scope of the analysis was the year 2016, reflecting the available data. However, this may only be partially representative of the current system, as there have been measures implemented for increasing sorting and recovery of waste plastic, for example from households. This could suggest that the amounts of waste plastic recovered for recycling were underestimated in this report. On the other hand, recovered waste plastic amounts were considered when calculating the recycling rates, which are expected to be lower if material losses (e.g., in sorting) were taken into account. Furthermore, restrictions on the export of waste plastic to China may have influenced the amount and fate of waste plastic exported from Denmark.

3.2 Polymer flows

Compared to the plastic flows, the overall data about polymer composition of those flows were rather limited and usually concerns few commodity polymers (i.e., PET, PE, PP). Most of the polymer data presented in this report relate to trade of plastic. However, the polymer composition of semi-finished and finished products was based on descriptions of specific commodities, for the majority (by weight) of which the polymers were not specified. Furthermore, the polymer composition of plastic-containing products was based on an outdated report (similarly to plastic flows), while more recent data was unavailable.

Concerning waste plastic, concrete estimates for polymer composition of packaging and non-packaging plastic collected from sources other than households, e.g., polymer composition of plastic residues from production, were unavailable. Hence, the polymer composition of the overall waste plastic recovered for recycling could not be estimated. Finally, while the polymer composition of mixed and combustible waste generated in Denmark was based on concrete estimates, the composition of waste plastic imported or exported as part of the residual waste was unknown.

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Appendix A

A.1 Plastic trade
A.1.1 Primary plastic

TABLE A.10 Imports and exports of primary plastic in 2016 (SD, 2018). Unit: tonnes.

Commodity code	Commodity description	Imports	Exports
39011010	Linear polyethylene with a specific gravity of < 0,94, in primary forms	18783	1825
39011090	Polyethylene with a specific gravity of < 0,94, in primary forms (excl. linear polyethylene)	37295	1608
39012010	Polyethylene in blocks of irregular shape, lumps, powders, granules, flakes and similar bulk forms, of a specific gravity of >= 0,958 at 23°C, containing <= 50 mg/kg of aluminium, <= 2 mg/kg of calcium, of chromium, of iron, of...	14987	5917
39012090	Polyethylene with a specific gravity of >= 0,94, in primary forms (excl. polyethylene in blocks of irregular shape, lumps, powders, granules, flakes and similar bulk forms, of a specific gravity of >= 0,958 at 23°C, containing <...	77083	3349
39013000	Ethylene-vinyl acetate copolymers, in primary forms	15105	109
39019030	Ionomer resin consisting of a salt of a terpolymer of ethylene with isobutyl acrylate and methacrylic acid, in primary forms, and A-B-A block copolymer of ethylene of polystyrene, ethylene-butylene copolymer and polystyrene, con...	4665	1
39019090	Polymers of ethylene, in primary forms (excl. polyethylene, ethylene-vinyl acetate copolymers, ionomer resin consisting of a salt of a terpolymer of ethylene with isobutyl acrylate and methacrylic acid and A-B-A block copolymer...	26514	7663
39021000	Polypropylene, in primary forms	159987	16406
39022000	Polyisobutylene, in primary forms	887	21
39023000	Propylene copolymers, in primary forms	27797	8653
39029010	A-B-A block copolymer of propylene or of other olefins, of polystyrene, ethylene-butylene copolymer and polystyrene, containing by weight <= 35% of styrene, in blocks of irregular shape, lumps, powders, granules, flakes and simi...	1397	28
39029020	Polybut-1-ene, a copolymer of but-1-ene with ethylene containing by weight <= 10% of ethylene, or a blend of polybut-1-ene with polyethylene and/or polypropylene containing by weight <= 10% of polyethylene and/or <= 25% of polyp...	557	1
39029090	Polymers of propylene or of other olefins, in primary forms (excl. polypropylene, polyisobutylene, propylene copolymers, and a A-B-A block copolymer of polystyrene, ethylene-butylene copolymer and polystyrene, containing by weig...	458	148
39031100	Expansible polystyrene, in primary forms	29420	86
39031900	Polystyrene, in primary forms (excl. expansible)	8173	475
39032000	Styrene-acrylonitrile copolymers SAN, in primary forms	934	3
39033000	Acrylonitrile-butadiene-styrene copolymers ABS, in primary forms	24171	1498
39039010	Copolymer solely of styrene with allyl alcohol, of an acetyl value of >= 175, in primary form	201	0
39039090	Polymers of styrene, in primary forms (excl. polystyrene, styrene-acrylonitrile copolymers SAN, acrylonitrile-butadiene-styrene ABS, copolymer solely of styrene with allyl alcohol, of an acetyl value of >= 175 and brominated pol...	6400	779
39041000	Polyvinyl chloride, in primary forms, not mixed with any other substances	24795	2023
39042100	Non-plasticised polyvinyl chloride, in primary forms, mixed with other substances	5087	388
39042200	Plasticised polyvinyl chloride, in primary forms, mixed with other substances	6615	78
39043000	Vinyl chloride-vinyl acetate copolymers, in primary forms	12	1
39044000	Vinyl chloride copolymers, in primary forms (excl. vinyl chloride-vinyl acetate copolymers)	4078	294
39045090	Vinylidene chloride polymers, in primary forms (excl. copolymer of vinylidene chloride with acrylonitrile, in the form of expansible beads of a diameter of >= 4 but <= 20 micrometres)	563	233

Commodity code	Commodity description	Imports	Exports
39046100	Polytetrafluoroethylene, in primary forms	881	19
39046910	Polyvinyl fluoride in blocks of irregular shape, lumps, powders, granules, flakes and similar bulk forms	3	2
39046920	Fluoroelastomers FKM, in primary forms	60	0
39046980	Fluoropolymers of vinyl chloride or of other halogenated olefins, in primary forms (excl. fluoroelastomers FKM, polytetrafluoroethylene, poly(vinyl fluoride) in blocks of irregular shape, lumps, powders, granules, flakes and sim...	862	1
39049000	Polymers of vinyl chloride or other halogenated olefins, in primary forms (excl. polyvinyl chloride, copolymers of vinyl chloride, polymers of vinyl chloride and fluoropolymers)	302	214
39051200	Polyvinyl acetate, in aqueous dispersion	2721	535
39051900	Polyvinyl acetate, in primary forms (excl. in aqueous dispersion)	2192	62
39052100	Vinyl acetate copolymers, in aqueous dispersion	3804	105
39052900	Vinyl acetate copolymers, in primary forms (excl. in aqueous dispersion)	5894	2950
39053000	Polyvinyl alcohol, in primary forms, whether or not containing unhydrolyzed acetate groups	1981	77
39059100	Copolymers of vinyl, in primary forms (excl. vinyl chloride-vinyl acetate copolymers and other vinyl chloride copolymers, and vinyl acetate copolymers)	188	25
39059910	Polyvinyl formal in blocks of irregular shape, lumps, powders, granules, flakes and similar bulk forms, of a molecular weight of >= 10.000 but <= 40.000 and containing by weight >= 9,5% but <= 13% of acetyl groups evaluated as v...	0	0
39059990	Polymers of vinyl esters and other vinyl polymers, in primary forms (excl. those of vinyl chloride or other halogenated olefins, polyvinyl acetate, copolymers and polyvinyl alcohol, whether or not containing unhydrolised acetate...	351	80
39061000	Polymethyl methacrylate, in primary forms	903	32
39069010	Poly[N-3-hydroxyimino-1,1-dimethylbutylacrylamide], in primary forms	15	7
39069020	Copolymer of 2-diisopropylaminoethyl methacrylate with decyl methacrylate in the form of a solution in N,N-dimethylacetamide, containing by weight >= 55% of copolymer	0	9
39069030	Copolymer of acrylic acid with 2-ethylhexyl acrylate containing by weight >= 10% but <= 11% of 2-ethylhexyl acrylate, in primary forms	1	0
39069040	Copolymer of acrylonitrile with methyl acrylate, modified with polybutadiene-acrylonitrile NBR, in primary forms	0	0
39069050	Polymerization product of acrylic acid with alkyl methacrylate and small quantities of other monomers, for use as a thickener in the manufacture of textile printing pastes	3	2
39069060	Copolymer of methyl acrylate with ethylene and a monomer containing a non-terminal carboxy group as a substituent, containing by weight >= 50% of methyl acrylate, whether or not compounded with silica, in primary forms	34	0
39069090	Acrylic polymers in primary forms (excl. polymethyl methacrylate, poly[N-3-hydroxyimino-1,1-dimethylbutylacrylamide], copolymer of 2-diisopropylaminoethyl methacrylate with decyl methacrylate in the form of a solution in N,N-dim...	50035	2551
39071000	Polyacetals, in primary forms	4606	146
39072011	Polyethylene glycols, in primary forms	1813	422
39072020	Polyether alcohols, in primary forms (excl. polyethylene glycols)	26874	5484
39072091	Copolymer of 1-chloro-2,3-epoxypropane with ethylene oxide, in primary forms	171	19
39072099	Polyethers in primary forms (excl. polyether alcohols, polyacetals and copolymer of 1-chloro-2,3-epoxypropane with ethylene oxide)	798	66
39073000	Epoxide resins, in primary forms	18562	1006
39074000	Polycarbonates, in primary forms	11160	976
39075000	Alkyd resins, in primary forms	6848	576
39076020	Polyethylene terephthalate, in primary forms, having a viscosity number of >= 78 ml/g	6188	34
39076080	Polyethylene terephthalate, in primary forms, having a viscosity number of < 78 ml/g	22251	1051
39077000	Polylactic acid, in primary forms	10	1
39079110	Unsaturated liquid polyesters, in primary forms (excl. polycarbonates, alkyd resins, polyethylene terephthalate and polylactic acid)	12244	5319
39079190	Unsaturated polyesters, in primary forms (excl. liquid, and polycarbonates, alkyd resins, polyethylene terephthalate and polylactic acid)	839	155

Commodity code	Commodity description	Imports	Exports
39079910	Polyethylene naphthalene-2,6-dicarboxylate, saturated, in primary forms	33	0
39079990	Polyesters, saturated, in primary forms (excl. polycarbonates, alkyd resins, polyethylene terephthalate, polylactic acid and polyethylene naphthalene-2,6-dicarboxylate)	3627	220
39081000	Polyamides-6, -11, -12, -6,6, -6,9, -6,10 or -6,12, in primary forms	11263	2703
39089000	Polyamides, in primary forms (excl. polyamides-6, -11, -12, -6,6, -6,9, -6,10 and -6,12)	5775	1655
39091000	Urea resins and thiourea resins, in primary forms	4450	1214
39092000	Melamine resins, in primary forms	244	95
39093000	Amino-resins, in primary forms (excl. urea resins, thiourea resins and melamine resins)	10033	3262
39094000	Phenolic resins, in primary forms	8004	119
39095010	Polyurethane of 2,2-tert-butyliminodiethanol and 4,4-methylenedicyclohexyl diisocyanate, in the form of a solution in N,N-dimethylacetamide, containing by weight >= 50% of polymer	160	360
39095090	Polyurethanes in primary forms (excl. polyurethane of 2,2-tert-butyliminodiethanol and 4,4-methylenedicyclohexyl diisocyanate, in the form of a solution in N,N-dimethylacetamide)	8092	4287
39100000	Silicones in primary forms	1938	463
39111000	Petroleum resins, coumarone, indene or coumarone-indene resins and polyterpenes, in primary forms	2139	187
39119011	Polyoxy-1,4-phenylenesulphonyl-1,4-phenyleneoxy-1,4-phenyleneisopropylidene-1,4-phenylene in blocks of irregular shape, lumps, powders, granules, flakes and similar bulk forms, whether or not chemically modified	109	2
39119013	Polythio-1,4-phenylene, whether or not chemically modified, in primary forms	114	2
39119019	Condensation or rearrangement polymerization products, whether or not chemically modified, n.e.s., in primary forms (excl. polyoxy-1,4-phenylenesulphonyl-1,4-phenylene-oxy-1,4-phenyleneisopropylidene-1,4-phenylene in blocks of ir...	2087	90
39119099	Polymer and prepolymer plastics produced by chemical synthesis, n.e.s., in primary forms (excl. copolymer of p-cresol and divinylbenzene in the form of a solution in N,N-dimethylacetamide containing by weight >= 50% of polymer a...	2258	287
39121100	Non-plasticised cellulose acetates, in primary forms	0	0
39121200	Plasticised cellulose acetates, in primary forms	20	58
39122011	Non-plasticised collodions and celloidin, in primary forms	1	2
39122019	Non-plasticised cellulose nitrates, in primary forms (excl. collodions and colloidin)	29	0
39122090	Plasticised cellulose nitrates, incl. collodions, in primary forms	0	0
39123100	Carboxymethylcellulose and its salts, in primary forms	2513	154
39123920	Hydroxypropylcellulose in primary forms	51	2
39123985	Cellulose ethers in primary forms (excl. carboxymethylcellulose and its salts and hydroxypropylcellulose)	534	86
39129010	Cellulose esters, in primary forms	15	3
39129090	Cellulose and chemical derivatives thereof, n.e.s., in primary forms (excl. cellulose acetates, cellulose nitrates, cellulose ethers and cellulose esters)	1174	262
39131000	Alginic acid, its salts and esters, in primary forms	955	287
39139000	Natural polymers and modified natural polymers, e.g. hardened proteins, chemical derivatives of natural rubber, n.e.s., in primary forms (excl. alginic acid and its salts and esters)	1746	295
39140000	Ion-exchangers based on polymers of heading 3901 to 3913, in primary forms	740	282
	TOTAL	746668	89893

A.1.2 Semi-finished and finished plastic products

TABLE A.2 Imports and exports of semi-finished and finished plastic products in 2016 (SD, 2018). Unit: tonnes.

Commodity code	Commodity description	Imports	Exports
39161000	Monofilament of which any cross-sectional dimension > 1 mm, rods, sticks and profile shapes, of polymers of ethylene, whether or not surface-worked but not further worked	669	92
39162000	Monofilament with any cross-sectional dimension of > 1 mm, rods, sticks and profile shapes, whether or not surface-worked but not otherwise worked, of polymers of vinyl chloride	4233	5011
39169010	Monofilament of which any cross-sectional dimension > 1 mm, rods, sticks and profile shapes, of condensation or rearrangement polymerization products, whether or not surface-worked but not further worked, whether or not chemical...	986	153
39169050	Monofilament of which any cross-sectional dimension > 1 mm, rods, sticks and profile shapes, of addition polymerisation products, whether or not surface-worked but not further worked (excl. that of polymers of ethylene and vinyl...	681	1725
39169090	Monofilament of which any cross-sectional dimension > 1 mm, rods, sticks and profile shapes, of plastics, whether or not surface-worked but not further worked (excl. that of addition polymerization products, condensation or rear...	2148	4136
39171010	Artificial guts sausage casings of hardened protein	45	10
39171090	Artificial guts sausage casings of cellulose materials	462	187
39172110	Rigid tubes, pipes and hoses, of polymers of ethylene, seamless and of a length > the maximum cross-sectional dimension, whether or not surface-worked, but not otherwise worked	7905	10196
39172190	Rigid tubes, pipes and hoses, of polymers of ethylene (excl. seamless and cut to length only)	2960	2263
39172210	Rigid tubes, pipes and hoses, of polymers of propylene, seamless and of a length > the maximum cross-sectional dimension, whether or not surface-worked, but not otherwise worked	9721	1312
39172290	Rigid tubes, pipes and hoses, of polymers of propylene (excl. seamless and cut to length only)	1329	96
39172310	Rigid tubes, pipes and hoses, of polymers of vinyl chloride, seamless and of a length > the maximum cross-sectional dimension, whether or not surface-worked, but not otherwise worked	4104	1593
39172390	Rigid tubes, pipes and hoses, of polymers of vinyl chloride (excl. seamless and cut to length only)	2884	3908
39172900	Rigid tubes, pipes and hoses, of plastics (excl. those of polymers of ethylene, propylene and vinyl chloride)	1580	989
39173100	Flexible tubes, pipes and hoses, of plastics, burst pressure >= 27,6 MPa	1171	1518
39173200	Flexible tubes, pipes and hoses of plastics, not reinforced or otherwise combined with other materials, without fittings	5938	3907
39173300	Flexible tubes, pipes and hoses of plastics, not reinforced or otherwise combined with other materials, with fittings, seals or connectors	639	166
39173900	Flexible tubes, pipes and hoses, of plastics, reinforced or otherwise combined with other materials (excl. those with a burst pressure of >= 27,6 MPa)	3868	1060
39174000	Fittings, e.g. joints, elbows, flanges, of plastics, for tubes, pipes and hoses	11244	8760
39181010	Floor coverings, whether or not self-adhesive, in rolls or in the form of tiles, and wall or ceiling coverings in rolls with a width of >= 45 cm, consisting of a layer of plastics fixed permanently on a backing of any material o...	8394	510
39181090	Floor coverings of polymers of vinyl chloride, whether or not self-adhesive, in rolls or in the form of tiles (excl. those on a backing coated, impregnated or covered with polyvinyl chloride)	2508	67
39189000	Floor coverings of plastics, whether or not self-adhesive, in rolls or in the form of tiles, and wall or ceiling coverings in rolls with a width of >= 45 cm, consisting of a layer of plastics fixed permanently on a backing of an...	5360	862
39191012	Plastic strips of polyvinyl chloride or of polyethylene, coated with unvulcanised natural or synthetic rubber, self-adhesive, in rolls <= 20 cm wide	1429	821
39191015	Plastic strips of polypropylene, coated with unvulcanised natural or synthetic rubber, self-adhesive, in rolls <= 20 cm wide	2180	489
39191019	Plastic strips, coated with unvulcanised natural or synthetic rubber, self-adhesive, in rolls <= 20 cm wide (excl. such products of polyvinyl chloride, polyethylenes or polypropylenes)	612	341

Commodity code	Commodity description	Imports	Exports
39191080	Self-adhesive plates, sheets, film, foil, tape, strip and other flat shapes, of plastics, in rolls <= 20 cm wide (excl. plastic strips coated with unvulcanised natural or synthetic rubber)	3128	1118
39199000	Self-adhesive plates, sheets, film, foil, tape, strip and other flat shapes, of plastics, whether or not in rolls > 20 cm wide (excl. floor, wall and ceiling coverings of heading 3918)	17248	16992
39201023	Non-cellular polyethylene film of a thickness of >= 20 micrometres but <= 40 micrometres, for the production of photoresist film used in the manufacture of semiconductors or printed circuits	10026	17374
39201024	Stretch film of non-cellular polyethylene, not printed, of a thickness of <= 0,125 mm and of a specific gravity of < 0,94	21960	7530
39201025	Plates, sheets, film, foil and strip, of non-cellular polyethylene, printed, not reinforced, laminated, supported or similarly combined with other materials, unworked or not further worked than surface-worked or only cut to squa...	16831	12494
39201028	Plates, sheets, film, foil and strip, of non-cellular polythene, not reinforced, laminated, supported or similarly combined with other materials, unworked or not further worked than surface-worked or only cut to square or rectan...	6371	9161
39201040	Plates, sheets, film, foil and strip, of non-cellular polymers of ethylene, not reinforced, laminated, supported or similarly combined with other materials, unworked or not further worked than surface-worked or only cut to squar...	4740	2962
39201081	Synthetic paper pulp in the form of moist sheets made from unconnected finely branched non-cellular polyethylene fibrils, whether or not blended with cellulose fibres in a quantity <= 15%, containing poly(vinyl alcohol) dissolve...	174	1
39201089	Plates, sheets, film, foil, tape, strip, of unexpanded polymers of ethylene, not reinforced and non-cellular laminated or supported or similarly combined with other materials, unworked or not further worked than surface-worked o...	12183	7349
39202021	Plates, sheets, film, foil and strip, of non-cellular polymers of propylene, not reinforced, laminated, supported or similarly combined with other materials, not further worked or only surface-worked and not cut to shapes other...	8410	4323
39202029	Plates, sheets, film, foil and strip, of non-cellular polymers of propylene, not reinforced, laminated, supported or similarly combined with other materials, not further worked or only surface-worked and not cut to shapes other...	5296	312
39202080	Plates, sheets, film, foil and strip, of non-cellular polymers of propylene, not reinforced, laminated, supported or similarly combined with other materials, not further worked or only surface-worked and not cut to shapes other...	8903	8208
39203000	Plates, sheets, foil, film and strip, of non-cellular polymers of styrene, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into sq...	7714	4291
39204310	Plates, sheets, film, foil and strip, of non-cellular polymers of vinyl chloride, containing by weight >= 6% of plasticisers, of a thickness of <= 1 mm, not reinforced, laminated, supported or similarly combined with other mater...	466	4655
39204390	Plates, sheets, film, foil and strip, of non-cellular polymers of vinyl chloride, containing by weight >= 6% of plasticisers, of a thickness of > 1 mm, not reinforced, laminated, supported or similarly combined with other materi...	380	137
39204910	Plates, sheets, film, foil and strip, of non-cellular polymers of vinyl chloride, containing by weight < 6% of plasticisers, of a thickness of <= 1 mm, not reinforced, laminated, supported or similarly combined with other materi...	4120	1447
39204990	Plates, sheets, film, foil and strip, of non-cellular polymers of vinyl chloride, containing by weight < 6% of plasticisers, of a thickness of > 1 mm, not reinforced, laminated, supported or similarly combined with other materia...	1971	432
39205100	Plates, sheets, film, foil and strip, of non-cellular polymethyl methacrylate, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut int...	2985	5750
39205910	Copolymer of non-cellular acrylic and methacrylic esters, in the form of film of a thickness of <= 150 micrometres	306	0
39205990	Plates, sheets, foil, film and strip of non-cellular acrylic polymers, not reinforced, coated, laminated or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into squares o...	151	135
39206100	Plates, sheets, film, foil and strip, of non-cellular polycarbonates, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into squares...	3255	398
39206212	Poly(ethylene terephthalate) film of a thickness of 72 micrometres or more but not exceeding 79 micrometres, for the manufacture of flexible magnetic disks, and polyethylene terephthalate film, not reinforced, of a thickness of...	35	0

Commodity code	Commodity description	Imports	Exports
39206219	Plates, sheets, film, foil and strip, of non-cellular polyethylene terephthalate, not reinforced, laminated, supported or similarly combined with other materials, without support, unworked or not further worked than surface-work...	7099	5412
39206290	Plates, sheets, film, foil and strip, of non-cellular polyethylene terephthalate, not reinforced, laminated, supported or similarly combined with other materials, without support, unworked or not further worked than surface-work...	5179	9045
39206300	Plates, sheets, film, foil and strip, of non-cellular unsaturated polyesters, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into...	254	10
39206900	Plates, sheets, film, foil and strip, of non-cellular polyesters, not reinforced, laminated, supported or similarly combined with other materials, not worked or only surface-worked, or only cut to rectangular, incl. square, shap...	4012	757
39207100	Plates, sheets, film, foil and strip, of non-cellular regenerated cellulose, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into...	83	12
39207310	Film backing in rolls or strips for use as carriers for sensitised surfaces in the manufacture of films, of non-cellular cellulose acetate	0	3
39207380	Plates, sheets, film, foil, tape and strip of non-cellular cellulose acetates, not reinforced, laminated, supported or similarly combined with other materials, not worked or only surface-worked, or only cut to rectangular, incl....	14	10
39207910	Plates, sheets, film, foil and strip of vulcanised fibre, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into squares or rectangl...	1	0
39207990	Plates, sheets, film, foil and strip, of non-cellular cellulose derivatives, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into...	0	0
39209100	Plates, sheets, film, foil and strip, of non-cellular polyvinyl butyral, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into squa...	526	7
39209200	Plates, sheets, film, foil and strip, of non-cellular polyamides, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into squares or...	2660	135
39209300	Plates, sheets, film, foil and strip, of non-cellular amino-resins, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into squares o...	1	5
39209400	Plates, sheets, film, foil and strip, of non-cellular phenolic resins, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into square...	323	23
39209921	Polyimide sheet and strip, non-cellular, uncoated, or coated or covered solely with plastic, not reinforced, laminated, supported or similarly combined with other materials, not worked or only surface-worked, or only cut to rect...	62	3
39209928	Plates, sheets, film, foil and strip, of non-cellular condensation polymerization products and rearrangement polymerization products, n.e.s., not reinforced, laminated, supported or similarly combined with other materials, not w...	279	163
39209952	Poly(vinyl fluoride) sheet, and biaxially oriented non-cellular polyvinyl alcohol film containing by weight >= 97% of polyvinyl alcohol, uncoated, of a thickness of <= 1 mm, not reinforced, laminated, supported or similarly comb...	1	0
39209953	Ion-exchange membranes of fluorinated non-cellular plastic material, for use in chlor-alkali electrolytic cells	1	1
39209959	Plates, sheets, film, foil and strip, of non-cellular addition polymerization products, n.e.s., not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked...	214	24
39209990	Plates, sheets, film, foil and strip, of non-cellular plastics, n.e.s., not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into squar...	2923	790
39211100	Plates, sheets, film, foil and strip, of cellular polymers of styrene, unworked or merely surface-worked or merely cut into squares or rectangles (excl. self-adhesive products, floor, wall and ceiling coverings of heading 3918 a...	4013	244
39211200	Plates, sheets, film, foil and strip, of cellular polymers of vinyl chloride, unworked or merely surface-worked or merely cut into squares or rectangles (excl. self-adhesive products, floor, wall and ceiling coverings of heading...	1651	286
39211310	Plates, sheets, film, foil and strip, of flexible cellular polyurethane, unworked or not further worked than surface-worked or merely cut into squares or rectangles (excl. such self-adhesive products, and floor, wall and ceiling...	1609	2959

Commodity code	Commodity description	Imports	Exports
39211390	Plates, sheets, film, foil and strip, of rigid cellular polyurethane, unworked or not further worked than surface-worked or merely cut into squares or rectangles (excl. such self-adhesive products, and floor, wall and ceiling co...	1158	720
39211400	Plates, sheets, film, foil and strip, of regenerated cellular cellulose, unworked or merely surface-worked or merely cut into squares or rectangles (excl. self-adhesive products, floor, wall and ceiling coverings of heading 3918...	127	85
39211900	Plates, sheets, film, foil and strip, of cellular plastic, unworked or merely surface-worked or merely cut into squares or rectangles (excl.those of polymers of styrene, vinyl chloride, polyurethanes and regenerated cellulose, s...	3104	1120
39219010	Plates, sheets, film, foil and strip, of polyesters, reinforced, laminated, supported or similarly combined with other materials, unworked or merely surface-worked or merely cut into squares or rectangles (excl. of cellular plas...	1374	807
39219030	Plates, sheets, film, foil and strip, of phenolic resins, reinforced, laminated, supported or similarly combined with other materials, unworked or merely surface-worked or merely cut into squares or rectangles (excl. self-adhesi...	136	173
39219041	High-pressure laminates of amino-resins, with a decorative surface on one or both sides but otherwise unworked or merely cut into squares or rectangles	14924	887
39219043	Plates, sheets, film, foil and strip, of laminated amino-resins, reinforced, laminated, supported or similarly combined with other materials, unworked or merely surface-worked or merely cut into squares or rectangles (excl. high...	1484	200
39219049	Plates, sheets, film, foil and strip, of unlaminated amino-resins, reinforced, laminated, supported or similarly combined with other materials, unworked or merely surface-worked or merely cut into squares or rectangles (excl. se...	380	61
39219055	Plates, sheets, film, foil and strip, of condensation or rearrangement polymerization products, whether or not chemically modified, reinforced, laminated, supported or similarly combined with other materials, unworked or merely...	506	376
39219060	Plates, sheets, film, foil and strip, of addition polymerization products, reinforced, laminated, supported or similarly combined with other materials, unworked or merely surface-worked or merely cut into squares or rectangles (...	2199	483
39219090	Plates, sheets, film, foil and strip, of plastics, reinforced, laminated, supported or similarly combined with other materials, unworked or merely surface-worked or merely cut into squares or rectangles (excl. of cellular plasti...	17086	12164
39221000	Baths, shower-baths, sinks and washbasins, of plastics	2886	1911
39222000	Lavatory seats and covers, of plastics	869	Data too uncertain*
39229000	Bidets, lavatory pans, flushing cisterns and similar sanitary ware, of plastics (excl. baths, shower-baths, sinks, washbasins, lavatory seats and covers)	2062	Data too uncertain*
3922HHHH	Baths, shower-baths, sinks, washbasins, bidets, lavatory pans, seats and covers, flushing cisterns and similar sanitary ware, of plastics. Confidential	0	3870
39231000	Boxes, cases, crates and similar articles for the conveyance or packaging of goods, of plastics	44787	42008
39232100	Sacks and bags, incl. cones, of polymers of ethylene	43129	14482
39232910	Sacks and bags, incl. cones, of polyvinyl chloride	1032	93
39232990	Sacks and bags, incl. cones, of plastics (excl. those of polyvinyl chloride and polymers of ethylene)	12351	3254
39233010	Carboys, bottles, flasks and similar articles for the conveyance or packaging of goods, of plastics, with a capacity of <= 2 l	18667	4060
39233090	Carboys, bottles, flasks and similar articles for the conveyance or packaging of goods, of plastics, with a capacity of > 2 l	8800	1165
39234010	Spools, reels and similar supports, of plastics, for photographic and cinematographic film or for tapes, films and the like, for sound or video recordings or the recording of signals, data or programmes	0	0
39234090	Spools, cops, bobbins and similar supports, of plastics (excl. those for photographic and cinematographic film or for tapes, films and the like, for sound or video recordings or the recording of signals, data or programmes)	469	414
39235010	Caps and capsules for bottles, of plastics	4175	1792
39235090	Stoppers, lids, caps and other closures, of plastics (excl. caps and capsules for bottles)	8408	6828
39239000	Articles for the conveyance or packaging of goods, of plastics (excl. boxes, cases, crates and similar articles, sacks and bags, incl. cones, carboys, bottles, flasks and similar articles, spools, spindles, bobbins and similar s...	21047	12480

Commodity code	Commodity description	Imports	Exports
39241000	Tableware and kitchenware, of plastics	26757	18697
39249000	Household articles and toilet articles, of plastics (excl. tableware, kitchenware, baths, shower-baths, washbasins, bidets, lavatory pans, seats and covers, flushing cisterns and similar sanitary ware)	10589	2466
39251000	Reservoirs, tanks, vats and similar containers, of plastics, with a capacity of > 300 l	2444	253
39252000	Doors, windows and their frames and thresholds for doors, of plastics	5206	4838
39253000	Shutters, blinds, incl. Venetian blinds, and similar articles and parts thereof, of plastics (excl. fittings and similar articles)	1223	431
39259010	Fittings and mountings intended for permanent installation in or on doors, windows, staircases, walls or other parts of buildings, of plastics	3721	4253
39259020	Trunking, ducting and cable trays for electrical circuits, of plastics	1379	247
39259080	Builders ware for the manufacture of flooring, walls, partition walls, ceilings, roofing, etc. guttering and accessories, banisters, fences and the like, fitted shelving for shops, factories, warehouses, storerooms, etc., archit...	15406	4804
39261000	Office or school supplies, of plastics, n.e.s.	5458	1942
39262000	Articles of apparel and clothing accessories produced by the stitching or sticking together of plastic sheeting, incl. gloves, mittens and mitts (excl. goods of 9619)	2818	1660
39263000	Fittings for furniture, coachwork and the like, of plastics (excl. building components for permanent mounting on parts of buildings)	2017	855
39264000	Statuettes and other ornamental articles, of plastics	1601	631
39269050	Perforated buckets and similar articles used to filter water at the entrance to drains, of plastics	1439	444
39269092	Articles made from plastic sheet, n.e.s.	11943	9349
39269097	Articles of plastics and articles of other materials of heading 3901 to 3914, n.e.s.	54362	33415
	TOTAL	608128	368844

*Data considered too uncertain to be reported by Statistics Denmark.

A.1.3 Plastic containing products

TABLE A.3 Imports and exports of all the commodities in the external trade and their content of plastic in 2016 (SD, 2018). Unit: tonnes. Shares of plastic in different commodities are based on the data provided in Table C.2.

Commodity group	Commodity group description	Imports (commodity)	Exports (commodity)	Imports (plastic)	Exports (plastic)
1-5	Live animals; animal products	1899308	3568810	104462	196285
6-14	Vegetable products	1984669	3087381	69463	108058
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	642260	533888	12845	10678
16-24	Prepared foodstuffs; beverages, spirits and vinegar; tobacco and manufactured tobacco substitutes	4812390	3043496	192496	121740
25-27	Mineral products	20519474	13922165	205195	139222
28-38	Products of the chemical or allied industries	4104438	1342219	164178	53689
39-40*	Plastics and articles thereof; rubber and articles thereof	-	-	-	-
41-43	Raw hides and skins, leather, furskins and articles thereof; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silkworm gut)	45676	48473	14616	15511
44-46	Wood and articles of wood; wood charcoal; cork and articles of cork; manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork	4588486	1348104	0	0
47-49	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard; paper and paperboard and articles thereof	1419530	1089150	56781	43566
50-63	Textiles and textile articles	352501	341848	111038	107682
64-67	Footwear, headgear, umbrellas, sun umbrellas, walking sticks, seat-sticks, whips, riding-crops and parts thereof; prepared feathers and articles made therewith; artificial flowers; articles of human hair	43797	16941	14672	5675
68-70	Articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware	1462226	1065532	51178	37294
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coin	994	669	0	0
72-83	Base metals and articles of base metal	3725292	3311013	279397	248326
84.85	Machinery and mechanical appliances; electrical equipment; parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	1177534	1266541	211956	227977
86-89	Vehicles, aircraft, vessels and associated transport equipment	809292	394131	76883	37442
90-92	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof	34523	30346	7077	6221
93	Arms and ammunition; parts and accessories thereof	3244	1837	97	55
94-96	Miscellaneous manufactured articles	545409	682317	58703	73439
97-99	Works of art, collectors' pieces and antiques	125188	1493699	13474	160769
	TOTAL	48296230	36588560	1644512	1593629

A.1.4 Waste plastic

TABLE A.4 Imports and exports of sorted waste plastic in 2016 (SD, 2018). Unit: tonnes.

Commodity code	Commodity description	Imports	Exports
39151000	Waste, parings and scrap, of polymers of ethylene	12020	28183
39152000	Waste, parings and scrap, of polymers of styrene	3242	3915
39153000	Waste, parings and scrap, of polymers of vinyl chloride	0	868
39159011	Waste, parings and scrap, of polymers of propylene	4591	2601
39159018	Waste, parings and scrap, of addition polymerization products (excl. that of polymers of ethylene, styrene and vinyl chloride and propylene)	0	0
39159080	Waste, parings and scrap, of plastics (excl. that of polymers of ethylene, styrene, vinyl chloride and propylene)	18638	23876
39159090	Waste, parings and scrap, of plastics (excl. that of addition polymerization products)	0	0
	TOTAL	38491	59442

TABLE A.5 Imports and exports of plastics within mixed residual waste in 2016 (Miljøstyrelsen, 2018).

	Imports	Exports
Amounts of mixed waste for incineration (tonnes)	481313	2332
Plastic content in the mixed waste for incineration (%)*	20	20
Amounts of plastic in the mixed waste for incineration (tonnes)	96263	466

*The content of plastic represents a maximum value allowed in the waste imported for incineration by the Amager Ressourcecenter (Nedenskov, 2018).

A.2 Domestic production

A.2.1 Primary plastic

TABLE A.6 Production of primary plastic in Denmark in 2016 (SD, 2018). Unit: tonnes.

Commodity code	Commodity description	Amounts
39011010	Linear polyethylene with a specific gravity of < 0,94, in primary forms	21
39011090	Polyethylene with a specific gravity of < 0,94, in primary forms (excl. linear polyethylene)	1
39012090	Polyethylene with a specific gravity of >= 0,94, in primary forms (excl. polyethylene in blocks of irregular shape, lumps, powders, granules, flakes and similar bulk forms, of a specific gravity of >= 0,958 at 23°C, containing <...	4671
39019090	Polymers of ethylene, in primary forms (excl. polyethylene, ethylene-vinyl acetate copolymers, ionomer resin consisting of a salt of a terpolymer of ethylene with isobutyl acrylate and methacrylic acid and A-B-A block copolymer...	668
39021000	Polypropylene, in primary forms	7152
39031900	Polystyrene, in primary forms (excl. expansible)	969
39033000	Acrylonitrile-butadiene-styrene copolymers ABS, in primary forms	45
39042100	Non-plasticised polyvinyl chloride, in primary forms, mixed with other substances	0
39043000	Vinyl chloride-vinyl acetate copolymers, in primary forms	0
39046100	Polytetrafluoroethylene, in primary forms	4
39051200	Polyvinyl acetate, in aqueous dispersion	183
39069010	Poly[N-3-hydroxyimino-1,1-dimethylbutylacrylamide], in primary forms	Data too uncertain*
39069050	Polymerization product of acrylic acid with alkyl methacrylate and small quantities of other monomers, for use as a thickener in the manufacture of textile printing pastes	0
39069090	Acrylic polymers in primary forms (excl. polymethyl methacrylate, poly[N-3-hydroxyimino-1,1-dimethylbutylacrylamide], copolymer of 2-diisopropylaminoethyl methacrylate with decyl methacrylate in the form of a solution in N,N-dim...	108
39072011	Polyethylene glycols, in primary forms	118

Commodity code	Commodity description	Amounts
39072020	Polyether alcohols, in primary forms (excl. polyethylene glycols)	667
39072099	Polyethers in primary forms (excl. polyether alcohols, polyacetals and copolymer of 1-chloro-2,3-epoxypropane with ethylene oxide)	357
39073000	Epoxide resins, in primary forms	95
39074000	Polycarbonates, in primary forms	68
39079990	Polyesters, saturated, in primary forms (excl. polycarbonates, alkyd resins, polyethylene terephthalate, polylactic acid and polyethylene naphthalene-2,6-dicarboxylate)	0
39081000	Polyamides-6, -11, -12, -6,6, -6,9, -6,10 or -6,12, in primary forms	56
39091000	Urea resins and thiourea resins, in primary forms	36641
39092000	Melamine resins, in primary forms	1
39093000	Amino-resins, in primary forms (excl. urea resins, thiourea resins and melamine resins)	500
39095010	Polyurethane of 2,2-tert-butyliminodiethanol and 4,4-methylenedicyclohexyl diisocyanate, in the form of a solution in N,N-dimethylacetamide, containing by weight >= 50% of polymer	4288
39095090	Polyurethanes in primary forms (excl. polyurethane of 2,2-tert-butyliminodiethanol and 4,4-methylenedicyclohexyl diisocyanate, in the form of a solution in N,N-dimethylacetamide)	48
39100000	Silicones in primary forms	355
39123100	Carboxymethylcellulose and its salts, in primary forms	110
39123985	Cellulose ethers in primary forms (excl. carboxymethylcellulose and its salts and hydroxypropylcellulose)	6
39129090	Cellulose and chemical derivatives thereof, n.e.s., in primary forms (excl. cellulose acetates, cellulose nitrates, cellulose ethers and cellulose esters)	229
39131000	Alginic acid, its salts and esters, in primary forms	45
39139000	Natural polymers and modified natural polymers, e.g. hardened proteins, chemical derivatives of natural rubber, n.e.s., in primary forms (excl. alginic acid and its salts and esters)	157
	TOTAL	57563

*Data considered to be too uncertain to be reported by Statistics Denmark.

A.2.2 Semi-finished and finished plastic products

TABLE A.7 Production of semi-finished and finished plastic products in 2016 (SD, 2018). Unit: tonnes. Distribution of plastic products between semi-finished and finished was based on monetary distribution of broad economic categories (Table C.1).

Commodity code	Commodity description	Amounts
39169010	Monofilament of which any cross-sectional dimension > 1 mm, rods, sticks and profile shapes, of condensation or rearrangement polymerization products, whether or not surface-worked but not further worked, whether or not chemical...	221
39169050	Monofilament of which any cross-sectional dimension > 1 mm, rods, sticks and profile shapes, of addition polymerisation products, whether or not surface-worked but not further worked (excl. that of polymers of ethylene and vinyl...	1251
39169090	Monofilament of which any cross-sectional dimension > 1 mm, rods, sticks and profile shapes, of plastics, whether or not surface-worked but not further worked (excl. that of addition polymerization products, condensation or rear...	3465
39172110	Rigid tubes, pipes and hoses, of polymers of ethylene, seamless and of a length > the maximum cross-sectional dimension, whether or not surface-worked, but not otherwise worked	23469
39172190	Rigid tubes, pipes and hoses, of polymers of ethylene (excl. seamless and cut to length only)	17796
39172210	Rigid tubes, pipes and hoses, of polymers of propylene, seamless and of a length > the maximum cross-sectional dimension, whether or not surface-worked, but not otherwise worked	1179
39172290	Rigid tubes, pipes and hoses, of polymers of propylene (excl. seamless and cut to length only)	Data too uncertain*
39172310	Rigid tubes, pipes and hoses, of polymers of vinyl chloride, seamless and of a length > the maximum cross-sectional dimension, whether or not surface-worked, but not otherwise worked	5843
39172390	Rigid tubes, pipes and hoses, of polymers of vinyl chloride (excl. seamless and cut to length only)	7943
39172900	Rigid tubes, pipes and hoses, of plastics (excl. those of polymers of ethylene, propylene and vinyl chloride)	769

Commodity code	Commodity description	Amounts
39173100	Flexible tubes, pipes and hoses, of plastics, burst pressure >= 27,6 MPa	Data too uncertain*
39173200	Flexible tubes, pipes and hoses of plastics, not reinforced or otherwise combined with other materials, without fittings	6573
39173300	Flexible tubes, pipes and hoses of plastics, not reinforced or otherwise combined with other materials, with fittings, seals or connectors	42
39173900	Flexible tubes, pipes and hoses, of plastics, reinforced or otherwise combined with other materials (excl. those with a burst pressure of >= 27,6 MPa)	408
39174000	Fittings, e.g. joints, elbows, flanges, of plastics, for tubes, pipes and hoses	14391
39189000	Floor coverings of plastics, whether or not self-adhesive, in rolls or in the form of tiles, and wall or ceiling coverings in rolls with a width of >= 45 cm, consisting of a layer of plastics fixed permanently on a backing of an...	11
39191012	Plastic strips of polyvinyl chloride or of polyethylene, coated with unvulcanised natural or synthetic rubber, self-adhesive, in rolls <= 20 cm wide	1
39191080	Self-adhesive plates, sheets, film, foil, tape, strip and other flat shapes, of plastics, in rolls <= 20 cm wide (excl. plastic strips coated with unvulcanised natural or synthetic rubber)	1589
39199000	Self-adhesive plates, sheets, film, foil, tape, strip and other flat shapes, of plastics, whether or not in rolls > 20 cm wide (excl. floor, wall and ceiling coverings of heading 3918)	22303
39201023	Non-cellular polyethylene film of a thickness of >= 20 micrometres but <= 40 micrometres, for the production of photoresist film used in the manufacture of semiconductors or printed circuits	1353
39201024	Stretch film of non-cellular polyethylene, not printed, of a thickness of <= 0,125 mm and of a specific gravity of < 0,94	2164
39201025	Plates, sheets, film, foil and strip, of non-cellular polyethylene, printed, not reinforced, laminated, supported or similarly combined with other materials, unworked or not further worked than surface-worked or only cut to squa...	49900
39201040	Plates, sheets, film, foil and strip, of non-cellular polymers of ethylene, not reinforced, laminated, supported or similarly combined with other materials, unworked or not further worked than surface-worked or only cut to squar...	1196
39201089	Plates, sheets, film, foil, tape, strip, of unexpanded polymers of ethylene, not reinforced and non-cellular laminated or supported or similarly combined with other materials, unworked or not further worked than surface-worked o...	Data too uncertain*
39202021	Plates, sheets, film, foil and strip, of non-cellular polymers of propylene, not reinforced, laminated, supported or similarly combined with other materials, not further worked or only surface-worked and not cut to shapes other...	1836
39203000	Plates, sheets, foil, film and strip, of non-cellular polymers of styrene, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into sq...	7159
39204310	Plates, sheets, film, foil and strip, of non-cellular polymers of vinyl chloride, containing by weight >= 6% of plasticisers, of a thickness of <= 1 mm, not reinforced, laminated, supported or similarly combined with other mater...	4993
39204390	Plates, sheets, film, foil and strip, of non-cellular polymers of vinyl chloride, containing by weight >= 6% of plasticisers, of a thickness of > 1 mm, not reinforced, laminated, supported or similarly combined with other materi...	1252
39204990	Plates, sheets, film, foil and strip, of non-cellular polymers of vinyl chloride, containing by weight < 6% of plasticisers, of a thickness of > 1 mm, not reinforced, laminated, supported or similarly combined with other materia...	340
39205990	Plates, sheets, foil, film and strip of non-cellular acrylic polymers, not reinforced, coated, laminated or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into squares o...	52
39206100	Plates, sheets, film, foil and strip, of non-cellular polycarbonates, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into squares...	Data too uncertain*
39206290	Plates, sheets, film, foil and strip, of non-cellular polyethylene terephthalate, not reinforced, laminated, supported or similarly combined with other materials, without support, unworked or not further worked than surface-work...	14827
39206900	Plates, sheets, film, foil and strip, of non-cellular polyesters, not reinforced, laminated, supported or similarly combined with other materials, not worked or only surface-worked, or only cut to rectangular, incl. square, shap...	Data too uncertain*
39209200	Plates, sheets, film, foil and strip, of non-cellular polyamides, not reinforced, laminated, supported or similarly combined with other materials, without backing, unworked or merely surface-worked or merely cut into squares or...	1

Commodity code	Commodity description	Amounts
39209928	Plates, sheets, film, foil and strip, of non-cellular condensation polymerization products and rearrangement polymerization products, n.e.s., not reinforced, laminated, supported or similarly combined with other materials, not w...	171
39211100	Plates, sheets, film, foil and strip, of cellular polymers of styrene, unworked or merely surface-worked or merely cut into squares or rectangles (excl. self-adhesive products, floor, wall and ceiling coverings of heading 3918 a...	10614
39211200	Plates, sheets, film, foil and strip, of cellular polymers of vinyl chloride, unworked or merely surface-worked or merely cut into squares or rectangles (excl. self-adhesive products, floor, wall and ceiling coverings of heading...	8
39211310	Plates, sheets, film, foil and strip, of flexible cellular polyurethane, unworked or not further worked than surface-worked or merely cut into squares or rectangles (excl. such self-adhesive products, and floor, wall and ceiling...	2065
39211390	Plates, sheets, film, foil and strip, of rigid cellular polyurethane, unworked or not further worked than surface-worked or merely cut into squares or rectangles (excl. such self-adhesive products, and floor, wall and ceiling co...	175
39211900	Plates, sheets, film, foil and strip, of cellular plastic, unworked or merely surface-worked or merely cut into squares or rectangles (excl.those of polymers of styrene, vinyl chloride, polyurethanes and regenerated cellulose, s...	440
39219010	Plates, sheets, film, foil and strip, of polyesters, reinforced, laminated, supported or similarly combined with other materials, unworked or merely surface-worked or merely cut into squares or rectangles (excl. of cellular plas...	Data too uncertain*
39219030	Plates, sheets, film, foil and strip, of phenolic resins, reinforced, laminated, supported or similarly combined with other materials, unworked or merely surface-worked or merely cut into squares or rectangles (excl. self-adhesi...	Data too uncertain*
39219041	High-pressure laminates of amino-resins, with a decorative surface on one or both sides but otherwise unworked or merely cut into squares or rectangles	Data too uncertain*
39219055	Plates, sheets, film, foil and strip, of condensation or rearrangement polymerization products, whether or not chemically modified, reinforced, laminated, supported or similarly combined with other materials, unworked or merely...	551
39219060	Plates, sheets, film, foil and strip, of addition polymerization products, reinforced, laminated, supported or similarly combined with other materials, unworked or merely surface-worked or merely cut into squares or rectangles (...	4998
39219090	Plates, sheets, film, foil and strip, of plastics, reinforced, laminated, supported or similarly combined with other materials, unworked or merely surface-worked or merely cut into squares or rectangles (excl. of cellular plasti...	9543
39222000	Lavatory seats and covers, of plastics	Data too uncertain*
39229000	Bidets, lavatory pans, flushing cisterns and similar sanitary ware, of plastics (excl. baths, shower-baths, sinks, washbasins, lavatory seats and covers)	120
39231000	Boxes, cases, crates and similar articles for the conveyance or packaging of goods, of plastics	47390
39232100	Sacks and bags, incl. cones, of polymers of ethylene	22311
39232990	Sacks and bags, incl. cones, of plastics (excl. those of polyvinyl chloride and polymers of ethylene)	275
39233010	Carboys, bottles, flasks and similar articles for the conveyance or packaging of goods, of plastics, with a capacity of <= 2 l	25589
39233090	Carboys, bottles, flasks and similar articles for the conveyance or packaging of goods, of plastics, with a capacity of > 2 l	18813
39234090	Spools, cops, bobbins and similar supports, of plastics (excl. those for photographic and cinematographic film or for tapes, films and the like, for sound or video recordings or the recording of signals, data or programmes)	2349
39235010	Caps and capsules for bottles, of plastics	1252
39235090	Stoppers, lids, caps and other closures, of plastics (excl. caps and capsules for bottles)	9830
39239000	Articles for the conveyance or packaging of goods, of plastics (excl. boxes, cases, crates and similar articles, sacks and bags, incl. cones, carboys, bottles, flasks and similar articles, spools, spindles, bobbins and similar s...	34591
	TOTAL	383412

*Data considered to be too uncertain to be reported by Statistics Denmark.

A.3 Domestic consumption

TABLE A.8 Purchase of plastic packaging and other plastic commodities by manufacturing industry in 2016. Unit: tonnes. The amounts of plastic were estimated from the monetary purchases reported in Table C.3 and the conversion factors calculated in Tables C.4 and C.5.

		Commodity code*									
Industry code	**Industry description**	**392090**	**392391**	**392392**	**392393**	**392394**	**392395**	**392399**	**Other plastic***	**TOTAL (packaging)**	**TOTAL**
CA	Manufacture of food products, beverages and tobacco	4225	844	7551	19716	1446	75	6941	6718	40797	47515
CB	Textiles and leather products	42	0	0	6	40	0	107	22797	195	22992
CC	Wood and paper products and printing	146	2	321	9	548	0	330	11417	1356	12773
CDE	Manufacture of chemicals and oil refineries etc.	134	441	11560	1023	321	263	1195	49117	14937	64054
CF	Pharmaceuticals	68	6	666	141	75	0	504	37269	1461	38730
CH	Basic metals and fabricated metal products	79	7	0	61	29	0	200	20829	376	21205
CI	Manufacture of electronic components	3	0	514	88	11	0	131	12177	747	12925
CJ	Electrical equipment	46	0	0	0	20	22	227	16712	315	17027
CK	Manufacture of machinery	272	4	23	57	723	0	3474	36502	4554	41055
CL	Transport equipment	25	1	1	20	5	0	43	7490	95	7585
CM	Manufacture of furniture and other manufacturing	85	3527	2	34	482	0	172	35954	4301	40255
	TOTAL	5125	4831	20638	21155	3699	360	13325	256982	69134	326116

*Commodity description is provided in Table C4.

TABLE A.9 Purchase of commodities by the construction and building industry in 2016, expressed in monetary terms (1000 DKK) and mass (tonnes). The amounts of plastic were estimated from the monetary purchases reported in the table (SD, 2018) and the average conversion factor calculated in Table C.5.

Industry code	Industry description	Value (1000 DKK)	Tonnes
41000	Construction of buildings	320158	13531
42000	Civil engineering	625096	26418
43001	Construction installation activities	1174809	49650
43002	Building completion and finishing	182575	7716
43009	Bricklaying and other specialized construction activities and site preparation activities	680977	28779
	TOTAL	2983615	126093

A.4 Plastic waste generation, collection and treatment

TABLE A.10. Generation of sorted packaging and non-packaging waste plastic from different sources in 2016 (Miljøstyrelsen, 2018). Unit: tonnes.

Sources of waste plastic	Packaging	Non-packaging
Households	24167	17747
Services	13182	10186
Wholesale and retail trade and repair of motor vehicles and motorcycles	148	421
Wholesale of metal waste and scrap	2882	4695
Non-specialised wholesale trade (excluding the one above)	3431	1287
Retail sale in non-specialised stores	3329	720
Transportation (Passenger and freight)	1496	1312
Accommodation and food and beverage service activities (or Hotels and restaurants)	65	65
Communication, culture, finance and private services	1205	1242
Public administration, education, health and social life (e.g., schools, hospitals)	614	178
Business waste (Unspecified service)	11	268
Industry	8911	21869
Mining and quarrying	94	56
Manufacture of food products	2016	1094
Manufacture of beverages and tobaco products	445	109
Manufacture of textile, wearing apparel, leather and related products	66	339
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	385	78
Manufacture of paper and paper products	209	376
Printing and reproduction of recorded media	174	84
Manufacture of coke and refined petroleum products	0	0
Manufacture of chemicals and chemical products	669	1488
Manufacture of basic pharmaceutical products and pharmaceutical preparations	285	803
Manufacture of rubber and plastic products*	2581	13457
Manufacture of other non-metallic mineral products	135	99
Manufacture of basic metals	19	160
Manufacture of fabricated metal products, except machinery and equipment	330	312
Manufacture of computer, electronic, electrical equipment and optical products	309	627

Manufacture of machinery and equipment n.e.c.	751	1516
Manufacture of motor vehicles, trailers, semi-trailers and other transport equipment	57	298
Manufacture of furniture	300	87
Other manufacturing	70	858
Repair and installation of machinery and equipment	15	25
Building and construction	320	5044
Utilities	165	1861
Agriculture, hunting and forestry	560	4856
Business waste (without industry branch code)	204	187
TOTAL	47508	61749

*The waste from “Manufacture of rubber and plastic products” was assumed to be associated predominantly with plastic industry.

TABLE A.11 Generation of waste plastic from mixed and combustible waste streams in 2016. Unit: tonnes.

Sources of waste (plastic)	Mixed waste	Combustible waste	Plastic in mixed waste*	Plastic in combustible waste**
Households	1341194	409330	191383	36840
Services	60886	527843	8688	47506
Wholesale and retail trade and repair of motor vehicles and motorcycles	703	15256	100	1373
Wholesale of (metal?) waste and scrap	15	8400	2	756
Non-specialised wholesale trade (excluding the one above)	2003	55339	286	4981
Retail sale in non-specialised stores	5004	91851	714	8267
Transportation (Passenger and freight)	9312	101487	1329	9134
Accommodation and food and beverage service activities (or Hotels and restaurants)	5380	47918	768	4313
Communication, culture, finance and private services	8405	106362	1199	9573
Public administration, education, health and social life (e.g., schools, hospitals)	25957	76997	3704	6930
Business waste (Unspecified service)	4107	24098	586	2169
Industry	7065	141638	1008	12747
Mining and quarrying	12	3434	2	309
Manufacture of food products	4936	34410	704	3097
Manufacture of beverages and tobaco products	6	1162	1	105
Manufacture of textile, wearing apparel, leather and related products	33	3829	5	345
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	91	3625	13	326
Manufacture of paper and paper products	166	9736	24	876
Printing and reproduction of recorded media	33	2166	5	195
Manufacture of coke and refined petroleum products	27	330	4	30
Manufacture of chemicals and chemical products	62	10331	9	930
Manufacture of basic pharmaceutical products and pharmaceutical preparations	5	6628	1	597
Manufacture of rubber and plastic products***	321	14200	46	1278
Manufacture of other non-metallic mineral products	33	4316	5	388
Manufacture of basic metals	9	2731	1	246
Manufacture of fabricated metal products, except machinery and equipment	359	8467	51	762
Manufacture of computer, electronic, electrical equipment and optical products	81	5115	12	460

Manufacture of machinery and equipment n.e.c.	509	18768	73	1689
Manufacture of motor vehicles, trailers, semi-trailers and other transport equipment	66	2496	9	225
Manufacture of furniture	174	4799	25	432
Other manufacturing	53	1782	8	160
Repair and installation of machinery and equipment	90	3314	13	298
Building and construction	1766	263086	252	23678
Utilities	2886	34297	412	3087
Agriculture, hunting and forestry	1766	85439	252	7690
Business waste (without industry branch code)	339	15879	48	1429
TOTAL	1415903	1477512	202044	132976

*Share of plastic in mixed waste was based on the data presented in Table C.7; **Share of plastic in combustible waste was based on the data presented in Table C.8; ***The waste from “Manufacture of rubber and plastic products” was assumed to be associated predominantly with plastic industry.

TABLE A.12 Treatment of sorted (packaging and non-packaging) waste plastic in 2016 (Miljøstyrelsen, 2018).

Waste management options	Tonnes	%
Recovery for recycling	107847	98.7
Incineration	536	0.5
Landfilling	594	0.5
Temporary storage	275	0.3
Special treatment	5	0.0
TOTAL	109257	100.0

Appendix B

B.1 Plastic trade

B.1.1 Primary plastic

TABLE B.1 Polymer composition of primary plastic trade in 2016 (based on data in (SD, 2018)). Unit: tonnes. The polymer composition was based on commodity description.

Polymer type	Commodity (group) code	Commodity group description	Imports	Exports
PE	3901	Polymers of ethylene, in primary forms	194433	20473
PP	3902	Polymers of propylene or of other olefins, in primary forms	191083	25257
Other	3903	Polymers of styrene, in primary forms	69299	2841
Other	3904+3905	Polymers of vinyl, vinyl chloride, or other haloginated olefins	60392	7089
Other	3906	Acrylic polymers in primary forms	50991	2600
Other	3907	Polyacetals, polyethers, epoxide resins, polycarbonates, etc. (excluding PET, see below)	87588	14390
PET	39076020 39076080	Poly(ethylene terephthalate)	28439	1085
Other	3908	Polyamides in primary forms	17038	4358
Other	3909	Amino-resins, phenolic resins and polyurethanes, in primary forms	30983	9338
Other	3910	Silicones in primary forms	1938	463
Other	3911	Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones and other products specified in note 3 to this chapter, not elsewhere specified or included, in primary forms	6706	568
Other	3912	Cellulose and its chemical derivatives, not elsewhere specified or included, in primary forms	4338	566
Other	3913	Natural polymers, in primary forms	2701	583
Other	3914	Ion-exchangers based on polymers of heading 3901 to 3913, in primary forms	740	282
		TOTAL	746668	89893

B.1.2 Semi-finished and finished plastic products

TABLE B.2 Polymer composition of semi-finished and finished plastic products imported and exported in 2016 (based on data in (SD, 2018)). Unit: tonnes. The polymer composition was based on commodity description.

Polymer type	Imports	Exports
PET	12313	14457
PE	127662	84314
PP	35837	14739
Other	106043	51181
Not specified	326274	204153
TOTAL	608128	368844

B.1.3 Plastic containing products

TABLE B.3 Polymer composition of the commodities imported in 2016 (based on data in (SD, 2018)). Unit: tonnes. Presence of different polymer types in each of the commodity groups is provided in Table C.2.

Commodity group	Commodity group description	PET	PE	PP	Other	Total plastic
1-5	Live animals; animal products	0	18993	18993	66476	104462
6-14	Vegetable products	0	39693	9923	19847	69463
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	0	0	3211	9634	12845
16-24	Prepared foodstuffs; beverages, spirits and vinegar; tobacco and manufactured tobacco substitutes	0	48124	24062	120310	192496
25-27	Mineral products	0	102597	0	102597	205195
28-38	Products of the chemical or allied industries	0	20522	20522	123133	164178
39-40	Plastics and articles thereof; rubber and articles thereof	-	-	-	-	-
41-43	Raw hides and skins, leather, furskins and articles thereof; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silkworm gut)	0	0	0	14616	14616
44-46	Wood and articles of wood; wood charcoal; cork and articles of cork; manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork	0	0	0	0	0
47-49	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard; paper and paperboard and articles thereof	0	14195	7098	35488	56781
50-63	Textiles and textile articles	881	7050	17625	85482	111038
64-67	Footwear, headgear, umbrellas, sun umbrellas, walking sticks, seat-sticks, whips, riding-crops and parts thereof; prepared feathers and articles made therewith; artificial flowers; articles of human hair	0	438	876	13358	14672
68-70	Articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware	3656	7311	7311	32900	51178
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coin	0	0	0	0	0
72-83	Base metals and articles of base metal	18626	18626	18626	223518	279397
84.85	Machinery and mechanical appliances; electrical equipment; parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	11775	11775	23551	164855	211956
86-89	Vehicles, aircraft, vessels and associated transport equipment	6070	4046	8093	58674	76883
90-92	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof	432	173	690	5783	7077
93	Arms and ammunition; parts and accessories thereof	0	0	0	97	97
94-96	Miscellaneous manufactured articles	0	0	0	58703	58703
97-99	Works of art, collectors' pieces and antiques	0	0	0	13474	13474
	TOTAL	41440	293545	160582	1148944	1644512

TABLE B.4 Polymer composition of the commodities exported in 2016 (based on data in (SD, 2018)). Unit: tonnes. Presence of different polymer types in each of the commodity groups is provided in Table C.2.

Commodity group	Commodity group description	PET	PE	PP	Other	Total plastic
1-5	Live animals; animal products	0	35688	35688	124908	196285
6-14	Vegetable products	0	61748	15437	30874	108058
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	0	0	2669	8008	10678
16-24	Prepared foodstuffs; beverages, spirits and vinegar; tobacco and manufactured tobacco substitutes	0	30435	15217	76087	121740
25-27	Mineral products	0	69611	0	69611	139222
28-38	Products of the chemical or allied industries	0	6711	6711	40267	53689
39-40	Plastics and articles thereof; rubber and articles thereof	-	-	-	-	-
41-43	Raw hides and skins, leather, furskins and articles thereof; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silkworm gut)	0	0	0	15511	15511
44-46	Wood and articles of wood; wood charcoal; cork and articles of cork; manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork	0	0	0	0	0
47-49	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard; paper and paperboard and articles thereof	0	10892	5446	27229	43566
50-63	Textiles and textile articles	855	6837	17092	82898	107682
64-67	Footwear, headgear, umbrellas, sun umbrellas, walking sticks, seat-sticks, whips, riding-crops and parts thereof; prepared feathers and articles made therewith; artificial flowers; articles of human hair	0	169	339	5167	5675
68-70	Articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware	2664	5328	5328	23974	37294
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coin	0	0	0	0	0
72-83	Base metals and articles of base metal	16555	16555	16555	198661	248326
84.85	Machinery and mechanical appliances; electrical equipment; parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	12665	12665	25331	177316	227977
86-89	Vehicles, aircraft, vessels and associated transport equipment	2956	1971	3941	28575	37442
90-92	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof	379	152	607	5083	6221
93	Arms and ammunition; parts and accessories thereof	0	0	0	55	55
94-96	Miscellaneous manufactured articles	0	0	0	73439	73439
97-99	Works of art, collectors' pieces and antiques	0	0	0	160769	160769
	TOTAL	36074	258761	150362	1148432	1593629

B.1.4 Waste plastic

TABLE B.5 Polymer composition of sorted waste plastic trade in 2016. Unit: tonnes. Details of the polymer composition are provided in Table C.9.

Polymer type	Commodity code	Commodity description	Imports	Exports
PE	39151000	Waste, parings and scrap, of polymers of ethylene	12020	28183
Other	39152000	Waste, parings and scrap, of polymers of styrene	3242	3915
Other	39153000	Waste, parings and scrap, of polymers of vinyl chloride	0	868
PP	39159011	Waste, parings and scrap, of polymers of propylene	4591	2601
Other	39159018	Waste, parings and scrap, of addition polymerization products (excl. that of polymers of ethylene, styrene and vinyl chloride and propylene)	0	0
PET	-	Waste poly(ethylene terephthalate)	15181	19446
Other	-	Waste, parings and scrap, of plastics (excl. that of polymers of ethylene, styrene, vinyl chloride, propylene, and ethylene terephthalate)	3458	4430
Other	39159090	Waste, parings and scrap, of plastics (excl. that of addition polymerization products)	0	0
		TOTAL	38491	59442

B.2 Domestic production

B.2.1 Primary plastic

TABLE B.6 Polymer composition of primary plastic produced in Denmark in 2016 (based on data in (SD, 2018)). Unit: tonnes. The polymer composition was based on commodity description.

Polymer type	Commodity (group) code	Commodity group description	Tonnes
PE	3901	Polymers of ethylene, in primary forms	5361
PP	3902	Polymers of propylene or of other olefins, in primary forms	7152
Other	3903	Polymers of styrene, in primary forms	1014
Other	3904+3905	Polymers of vinyl, vinyl chloride, or other haloginated olefins	187
Other	3906	Acrylic polymers in primary forms	108
Other	3907	Polyacetals, polyethers, epoxide resins, polycarbonates, etc. (excluding PET, see below)	1305
PET	39076020 39076080	Poly(ethylene terephthalate)	0
Other	3908	Polyamides in primary forms	56
Other	3909	Amino-resins, phenolic resins and polyurethanes, in primary forms	41478
Other	3910	Silicones in primary forms	355
Other	3911	Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones and other products specified in note 3 to this chapter, not elsewhere specified or included, in primary forms	0
Other	3912	Cellulose and its chemical derivatives, not elsewhere specified or included, in primary forms	345
Other	3913	Natural polymers, in primary forms	202
Other	3914	Ion-exchangers based on polymers of heading 3901 to 3913, in primary forms	0
		TOTAL	57563

B.2.2 Semi-finished and finished plastic products

TABLE B.7 Polymer composition of semi-finished and finished plastic products produced in Denmark in 2016 (based on data in (SD, 2018)). Unit: tonnes. The polymer composition was based on commodity description.

Polymer type	Tonnes
PET	14827
PE	118190
PP	3015
Other	55978
Not specified	191403
TOTAL	383412

B.3 Waste plastic generation

TABLE B.8 Polymer composition of mixed waste generated in Denmark in 2016. Unit: tonnes. The polymer composition of plastic in the mixed waste was based on data provided in Table C.7.

Sources of waste plastic	PET	PE	PP	Other	TOTAL
Households	12524	130131	16105	32624	191383
Services	569	5908	731	1481	8688
Wholesale and retail trade and repair of motor vehicles and motorcycles	7	68	8	17	100
Wholesale of metal waste and scrap	0	1	0	0	2
Non-specialised wholesale trade (excluding the one above)	19	194	24	49	286
Retail sale in non-specialised stores	47	485	60	122	714
Transportation (Passenger and freight)	87	904	112	227	1329
Accommodation and food and beverage service activities (or Hotels and restaurants)	50	522	65	131	768
Communication, culture, finance and private services	78	815	101	204	1199
Public administration, education, health and social life (e.g., schools, hospitals)	242	2519	312	631	3704
Business waste (Unspecified service)	38	398	49	100	586
Industry	66	686	85	172	1008
Mining and quarrying	0	1	0	0	2
Manufacture of food products	46	479	59	120	704
Manufacture of beverages and tobaco products	0	1	0	0	1
Manufacture of textile, wearing apparel, leather and related products	0	3	0	1	5
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	1	9	1	2	13
Manufacture of paper and paper products	2	16	2	4	24
Printing and reproduction of recorded media	0	3	0	1	5
Manufacture of coke and refined petroleum products	0	3	0	1	4
Manufacture of chemicals and chemical products	1	6	1	2	9
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0	0	0	0	1
Manufacture of rubber and plastic products	3	31	4	8	46
Manufacture of other non-metallic mineral products	0	3	0	1	5
Manufacture of basic metals	0	1	0	0	1
Manufacture of fabricated metal products, except machinery and equipment	3	35	4	9	51

Manufacture of computer, electronic, electrical equipment and optical products	1	8	1	2	12
Manufacture of machinery and equipment n.e.c.	5	49	6	12	73
Manufacture of motor vehicles, trailers, semi-trailers and other transport equipment	1	6	1	2	9
Manufacture of furniture	2	17	2	4	25
Other manufacturing	0	5	1	1	8
Repair and installation of machinery and equipment	1	9	1	2	13
Building and construction	16	171	21	43	252
Utilities	27	280	35	70	412
Agriculture, hunting and forestry	16	171	21	43	252
Business waste (without industry branch code)	3	33	4	8	48
TOTAL	13221	137379	17002	34441	202044

TABLE B.9 Polymer composition of combustible waste generated in Denmark in 2016. Unit: tonnes. The polymer composition of plastic in combustible waste was based on data provided in Table C.8.

Sources of waste plastic	PET	PE	PP	Other	TOTAL
Households	15425	1267	11217	8930	36840
Services	19891	1634	14465	11516	47506
Wholesale and retail trade and repair of motor vehicles and motorcycles	575	47	418	333	1373
Wholesale of metal waste and scrap	317	26	230	183	756
Non-specialised wholesale trade (excluding the one above)	2085	171	1517	1207	4981
Retail sale in non-specialised stores	3461	284	2517	2004	8267
Transportation (Passenger and freight)	3824	314	2781	2214	9134
Accommodation and food and beverage service activities (or Hotels and restaurants)	1806	148	1313	1045	4313
Communication, culture, finance and private services	4008	329	2915	2320	9573
Public administration, education, health and social life (e.g., schools, hospitals)	2902	238	2110	1680	6930
Business waste (Unspecified service)	908	75	660	526	2169
Industry	5338	438	3881	3090	12747
Mining and quarrying	129	11	94	75	309
Manufacture of food products	1297	106	943	751	3097
Manufacture of beverages and tobaco products	44	4	32	25	105
Manufacture of textile, wearing apparel, leather and related products	144	12	105	84	345
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	137	11	99	79	326
Manufacture of paper and paper products	367	30	267	212	876
Printing and reproduction of recorded media	82	7	59	47	195
Manufacture of coke and refined petroleum products	12	1	9	7	30
Manufacture of chemicals and chemical products	389	32	283	225	930
Manufacture of basic pharmaceutical products and pharmaceutical preparations	250	21	182	145	597
Manufacture of rubber and plastic products	535	44	389	310	1278
Manufacture of other non-metallic mineral products	163	13	118	94	388
Manufacture of basic metals	103	8	75	60	246
Manufacture of fabricated metal products, except machinery and equipment	319	26	232	185	762
Manufacture of computer, electronic, electrical equipment and optical products	193	16	140	112	460

Manufacture of machinery and equipment n.e.c.	707	58	514	409	1689
Manufacture of motor vehicles, trailers, semi-trailers and other transport equipment	94	8	68	54	225
Manufacture of furniture	181	15	132	105	432
Other manufacturing	67	6	49	39	160
Repair and installation of machinery and equipment	125	10	91	72	298
Building and construction	9914	814	7210	5740	23678
Utilities	1292	106	940	748	3087
Agriculture, hunting and forestry	3220	264	2341	1864	7690
Business waste (without industry branch code)	598	49	435	346	1429
TOTAL	55679	4573	40490	32234	132976

Appendix C

TABLE C.1 Distribution of broad economic categories (BEC) for Danish external trade in 2016 (SD, 2018). Unit: 1,000,000 DKK.

Commodity group	Commodity group description	Imports	Exports
01-04	Intermediate goods for agriculture, total	15842	15818
05-10	Intermediate goods for the construction industry, total	40790	37809
11-30	Intermediate goods for other industries, total	168804	183282
32-36	Fuels, lubricants and electric current, total	29953	25722
37-42	Machinery and other capital equipment, total	72638	96439
43-46	Transport equipment, total	48454	13045
47-53	Goods for household consumption, total	189881	259236
54	Goods not elsewhere specified	7556	9169
	TOTAL	573918	640520
	TOTAL (Intermediate goods)	225436	236909
	Intermediate goods/TOTAL	39%	37%

TABLE C.2 Polymer composition of commodities traded as part of the external Danish economy (based on data provided in (Miljøstyrelsen, 1995)).

Commodity group	Commodity group description	PET* [%]	PE [%]	PP [%]	Other [%]	Total plastic [%]
1-5	Live animals; animal products	0	1	1	3.5	5.5
6-14	Vegetable products	0	2	0.5	1	3.5
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	0	0	0.5	1.5	2
16-24	Prepared foodstuffs; beverages, spirits and vinegar; tobacco and manufactured tobacco substitutes	0	1	0.5	2.5	4
25-27	Mineral products	0	0.5	0	0.5	1
28-38	Products of the chemical or allied industries	0	0.5	0.5	3	4
39-40	Plastics and articles thereof; rubber and articles thereof					
41-43	Raw hides and skins, leather, furskins and articles thereof; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silkworm gut)	0	0	0	32	32
44-46	Wood and articles of wood; wood charcoal; cork and articles of cork; manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork	0	0	0	0	0
47-49	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard; paper and paperboard and articles thereof	0	1	0.5	2.5	4
50-63	Textiles and textile articles	0.25	2	5	24.25	31.5
64-67	Footwear, headgear, umbrellas, sun umbrellas, walking sticks, seat-sticks, whips, riding-crops and parts thereof; prepared feathers and articles made therewith; artificial flowers; articles of human hair	0	1	2	30.5	33.5
68-70	Articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware	0.25	0.5	0.5	2.25	3.5
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coin	0	0	0	0	0
72-83	Base metals and articles of base metal	0.5	0.5	0.5	6	7.5

Commodity group	Commodity group description	PET* [%]	PE [%]	PP [%]	Other [%]	Total plastic [%]
84.85	Machinery and mechanical appliances; electrical equipment; parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	1	1	2	14	18
86-89	Vehicles, aircraft, vessels and associated transport equipment	0.75	0.5	1	7.25	9.5
90-92	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof	1.25	0.5	2	16.75	20.5
93	Arms and ammunition; parts and accessories thereof	0	0	0	3	3
94-96	Miscellaneous manufactured articles	0	0	0	10.8	10.8
97-99	Works of art, collectors' pieces and antiques	0	0	0	10.8	10.8

*PET was assumed to be 50% of the non-specified (excluding ABS, PVC, PS, PMMA, PC, etc.) plastic.

TABLE C.3 Purchase of plastic packaging and other plastic commodities by manufacturing industry in 2016 (SD, 2018). Unit: 1000 DKK.

		Commodity code*									
Industry code	Industry description	392090	392391	392392	392393	392394	392395	392399	Other plastic	TOTAL (packaging)	TOTAL
CA	Manufacture of food products, beverages and tobacco	788498	37037	142157	727627	91776	3277	304595	158965	2094967	2253932
CB	Textiles and leather products	7847	0	0	232	2537	0	4693	539421	15309	554730
CC	Wood and paper products and printing	27186	89	6048	314	34813	0	14479	270154	82929	353083
CDE	Manufacture of chemicals and oil refineries etc.	25055	19345	217630	37740	20358	11549	52463	1162209	384140	1546349
CF	Pharmaceuticals	12739	283	12533	5212	4784	0	22114	881862	57665	939527
CH	Basic metals and fabricated metal products	14704	302	6	2233	1827	0	8798	492859	27870	520729
CI	Manufacture of electronic components	593	0	9675	3255	716	0	5745	288141	19984	308125
CJ	Electrical equipment	8643	0	0	0	1247	968	9957	395432	20815	416247
CK	Manufacture of machinery	50761	178	438	2102	45906	2	152473	863697	251860	1115557
CL	Transport equipment	4700	30	12	755	305	0	1904	177221	7706	184927
CM	Manufacture of furniture and other manufacturing	15848	154758	46	1249	30580	0	7532	850731	210013	1060744
	TOTAL	956574	212022	388545	780719	234849	15796	584753	6080692	3173258	9253950

*Commodity description is provided in Table C4.

TABLE C.4 Plastic packaging commodities purchased by the manufacturing industry in 2016.

Commodity code	Commodity description	Value (1000 DKK)	Tonnes	1000 DKK/Tonnes	1000 DKK/Tonnes [adjusted]*
392090	Foil of plastics	45637	172	142	187
392392	Carboys, bottles, flasks and similar articles of plastics**	689956	44402	14	19
392393	Boxes, cases, crates and similar articles of plastics	1329568	47390	28	37
392394	Sacks and bags (including cones) of plastics	327193	22586	48	63
392391 392395 392399	Other plastic packaging (Tubs and buckets of plastics, Tubes of plastics, Other articles for the conveyance or packing of goods, of plastics)	1478832	48022	33	44

*Takes into account the difference between wholesale prices for sales and purchases; **The amounts of the material were calculated based on the assumption that a 500 ml PET bottle container and a 10 l HDPE plastic drum for liquids weigh 30 and 500 gr, respectively (Valipac, 2018; WRAP, 2007).

TABLE C.5 Total import of plastic (primary, semi-finished and finished products) in 2016 (based on data in (SD, 2018)).

Commodity code*	Tonnes	1000 DKK	1000 DKK/Tonne	% share of total import (39)	1000 DKK/Tonne [weighted]	1000 DKK/Tonne [weighted-adjusted]**
39011010	18783	223389	12	1%	0.16	0.21
39011090	37295	404695	11	3%	0.29	0.38
39012010	14987	140513	9	1%	0.10	0.13
39012090	77083	727029	9	6%	0.52	0.69
39013000	15105	187694	12	1%	0.13	0.18
39019030	4665	62431	13	0%	0.04	0.06
39019090	26514	314110	12	2%	0.23	0.30
39021000	159987	1301743	8	11%	0.93	1.23
39022000	887	21905	25	0%	0.02	0.02
39023000	27797	252963	9	2%	0.18	0.24
39029010	1397	14837	11	0%	0.01	0.01
39029020	557	5094	9	0%	0.00	0.00
39029090	458	13731	30	0%	0.01	0.01
39031100	29420	307098	10	2%	0.22	0.29
39031900	8173	91061	11	1%	0.07	0.09
39032000	934	15220	16	0%	0.01	0.01
39033000	24171	279393	12	2%	0.20	0.26
39039010	201	2219	11	0%	0.00	0.00
39039090	6400	66057	10	0%	0.05	0.06
39041000	24795	153700	6	2%	0.11	0.15
39042100	5087	53116	10	0%	0.04	0.05
39042200	6615	54039	8	0%	0.04	0.05
39043000	12	328	28	0%	0.00	0.00
39044000	4078	9832	2	0%	0.01	0.01
39045090	563	14482	26	0%	0.01	0.01
39046100	881	57850	66	0%	0.04	0.05
39046910	3	756	257	0%	0.00	0.00
39046920	60	9446	157	0%	0.01	0.01

Commodity code*	Tonnes	1000 DKK	1000 DKK/Tonne	% share of total import (39)	1000 DKK/Tonne [weighted]	1000 DKK/Tonne [weighted-adjusted]**
39046980	862	105587	122	0%	0.08	0.10
39049000	302	3431	11	0%	0.00	0.00
39051200	2721	21127	8	0%	0.02	0.02
39051900	2192	31239	14	0%	0.02	0.03
39052100	3804	29746	8	0%	0.02	0.03
39052900	5894	59277	10	0%	0.04	0.06
39053000	1981	14236	7	0%	0.01	0.01
39059100	188	11237	60	0%	0.01	0.01
39059910	0	3	112	0%	0.00	0.00
39059990	351	14872	42	0%	0.01	0.01
39061000	903	28512	32	0%	0.02	0.03
39069010	15	1252	86	0%	0.00	0.00
39069020	0	8	820	0%	0.00	0.00
39069030	1	118	119	0%	0.00	0.00
39069040	0	1	56	0%	0.00	0.00
39069050	3	133	51	0%	0.00	0.00
39069060	34	506	15	0%	0.00	0.00
39069090	50035	620850	12	4%	0.45	0.59
39071000	4606	66018	14	0%	0.05	0.06
39072011	1813	22214	12	0%	0.02	0.02
39072020	26874	338803	13	2%	0.24	0.32
39072091	171	1616	9	0%	0.00	0.00
39072099	798	27489	34	0%	0.02	0.03
39073000	18562	417148	22	1%	0.30	0.39
39074000	11160	205673	18	1%	0.15	0.19
39075000	6848	98341	14	0%	0.07	0.09
39076020	6188	44381	7	0%	0.03	0.04
39076080	22251	135827	6	2%	0.10	0.13
39077000	10	436	42	0%	0.00	0.00
39079110	12244	174471	14	1%	0.13	0.16
39079190	839	22201	26	0%	0.02	0.02
39079910	33	1916	57	0%	0.00	0.00
39079990	3627	92745	26	0%	0.07	0.09
39081000	11263	248545	22	1%	0.18	0.23
39089000	5775	79545	14	0%	0.06	0.08
39091000	4450	43948	10	0%	0.03	0.04
39092000	244	2161	9	0%	0.00	0.00
39093000	10033	115216	11	1%	0.08	0.11
39094000	8004	64895	8	1%	0.05	0.06
39095010	160	3819	24	0%	0.00	0.00
39095090	8092	238112	29	1%	0.17	0.22
39100000	1938	97431	50	0%	0.07	0.09
39111000	2139	40423	19	0%	0.03	0.04
39119011	109	8671	80	0%	0.01	0.01
39119013	114	7497	66	0%	0.01	0.01

Commodity code*	Tonnes	1000 DKK	1000 DKK/Tonne	% share of total import (39)	1000 DKK/Tonne [weighted]	1000 DKK/Tonne [weighted-adjusted]**
39119019	2087	52743	25	0%	0.04	0.05
39119099	2258	59205	26	0%	0.04	0.06
39121100	0	160	1841	0%	0.00	0.00
39121200	20	358	18	0%	0.00	0.00
39122011	1	101	166	0%	0.00	0.00
39122019	29	783	27	0%	0.00	0.00
39122090	0	2	792	0%	0.00	0.00
39123100	2513	57567	23	0%	0.04	0.05
39123920	51	7011	136	0%	0.01	0.01
39123985	534	26752	50	0%	0.02	0.03
39129010	15	1279	86	0%	0.00	0.00
39129090	1174	46237	39	0%	0.03	0.04
39131000	955	74879	78	0%	0.05	0.07
39139000	1746	140000	80	0%	0.10	0.13
39140000	740	74663	101	0%	0.05	0.07
39151000	12020	50958	4	1%	0.04	0.05
39152000	3242	23020	7	0%	0.02	0.02
39153000	0	11	295	0%	0.00	0.00
39159011	4591	866	0	0%	0.00	0.00
39159080	18638	59592	3	1%	0.04	0.06
39161000	669	31535	47	0%	0.02	0.03
39162000	4233	62818	15	0%	0.05	0.06
39169010	986	39101	40	0%	0.03	0.04
39169050	681	17243	25	0%	0.01	0.02
39169090	2148	41078	19	0%	0.03	0.04
39171010	45	13034	290	0%	0.01	0.01
39171090	462	43753	95	0%	0.03	0.04
39172110	7905	167396	21	1%	0.12	0.16
39172190	2960	59828	20	0%	0.04	0.06
39172210	9721	133325	14	1%	0.10	0.13
39172290	1329	31586	24	0%	0.02	0.03
39172310	4104	42110	10	0%	0.03	0.04
39172390	2884	34099	12	0%	0.02	0.03
39172900	1580	89027	56	0%	0.06	0.08
39173100	1171	57684	49	0%	0.04	0.05
39173200	5938	209968	35	0%	0.15	0.20
39173300	639	34714	54	0%	0.02	0.03
39173900	3868	176361	46	0%	0.13	0.17
39174000	11244	484891	43	1%	0.35	0.46
39181010	8394	187515	22	1%	0.13	0.18
39181090	2508	92608	37	0%	0.07	0.09
39189000	5360	75064	14	0%	0.05	0.07
39191012	1429	65882	46	0%	0.05	0.06
39191015	2180	63432	29	0%	0.05	0.06
39191019	612	44134	72	0%	0.03	0.04

Commodity code*	Tonnes	1000 DKK	1000 DKK/Tonne	% share of total import (39)	1000 DKK/Tonne [weighted]	1000 DKK/Tonne [weighted-adjusted]**
39191080	3128	161147	52	0%	0.12	0.15
39199000	17248	549327	32	1%	0.39	0.52
39201023	10026	144064	14	1%	0.10	0.14
39201024	21960	316393	14	2%	0.23	0.30
39201025	16831	286916	17	1%	0.21	0.27
39201028	6371	162950	26	0%	0.12	0.15
39201040	4740	77523	16	0%	0.06	0.07
39201081	174	4904	28	0%	0.00	0.00
39201089	12183	201748	17	1%	0.14	0.19
39202021	8410	172459	21	1%	0.12	0.16
39202029	5296	116554	22	0%	0.08	0.11
39202080	8903	161057	18	1%	0.12	0.15
39203000	7714	140036	18	1%	0.10	0.13
39204310	466	16762	36	0%	0.01	0.02
39204390	380	9334	25	0%	0.01	0.01
39204910	4120	75537	18	0%	0.05	0.07
39204990	1971	30852	16	0%	0.02	0.03
39205100	2985	81724	27	0%	0.06	0.08
39205910	306	30417	99	0%	0.02	0.03
39205990	151	8567	57	0%	0.01	0.01
39206100	3255	96796	30	0%	0.07	0.09
39206212	35	1858	53	0%	0.00	0.00
39206219	7099	147621	21	1%	0.11	0.14
39206290	5179	71575	14	0%	0.05	0.07
39206300	254	10888	43	0%	0.01	0.01
39206900	4012	60775	15	0%	0.04	0.06
39207100	83	4675	56	0%	0.00	0.00
39207310	0	2	726	0%	0.00	0.00
39207380	14	8570	614	0%	0.01	0.01
39207910	1	150	144	0%	0.00	0.00
39207990	0	240	719	0%	0.00	0.00
39209100	526	14128	27	0%	0.01	0.01
39209200	2660	58150	22	0%	0.04	0.05
39209300	1	30	45	0%	0.00	0.00
39209400	323	6676	21	0%	0.00	0.01
39209921	62	2559	41	0%	0.00	0.00
39209928	279	23005	83	0%	0.02	0.02
39209952	1	485	326	0%	0.00	0.00
39209953	1	950	1213	0%	0.00	0.00
39209959	214	12683	59	0%	0.01	0.01
39209990	2923	94249	32	0%	0.07	0.09
39211100	4013	100723	25	0%	0.07	0.10
39211200	1651	43486	26	0%	0.03	0.04
39211310	1609	79651	50	0%	0.06	0.08
39211390	1158	60830	53	0%	0.04	0.06

Commodity code*	Tonnes	1000 DKK	1000 DKK/Tonne	% share of total import (39)	1000 DKK/Tonne [weighted]	1000 DKK/Tonne [weighted-adjusted]**
39211400	127	2218	18	0%	0.00	0.00
39211900	3104	121561	39	0%	0.09	0.11
39219010	1374	49746	36	0%	0.04	0.05
39219030	136	5232	38	0%	0.00	0.00
39219041	14924	309635	21	1%	0.22	0.29
39219043	1484	40265	27	0%	0.03	0.04
39219049	380	9246	24	0%	0.01	0.01
39219055	506	43695	86	0%	0.03	0.04
39219060	2199	90610	41	0%	0.07	0.09
39219090	17086	403578	24	1%	0.29	0.38
39221000	2886	98313	34	0%	0.07	0.09
39222000	869	42911	49	0%	0.03	0.04
39229000	2062	118026	57	0%	0.08	0.11
39231000	44787	1048301	23	3%	0.75	0.99
39232100	43129	711200	16	3%	0.51	0.67
39232910	1032	24862	24	0%	0.02	0.02
39232990	12351	331587	27	1%	0.24	0.31
39233010	18667	392373	21	1%	0.28	0.37
39233090	8800	230553	26	1%	0.17	0.22
39234010	0	25	555	0%	0.00	0.00
39234090	469	10905	23	0%	0.01	0.01
39235010	4175	108275	26	0%	0.08	0.10
39235090	8408	277885	33	1%	0.20	0.26
39239000	21047	411356	20	2%	0.30	0.39
39241000	26757	818708	31	2%	0.59	0.77
39249000	10589	330018	31	1%	0.24	0.31
39251000	2444	73583	30	0%	0.05	0.07
39252000	5206	155880	30	0%	0.11	0.15
39253000	1223	80943	66	0%	0.06	0.08
39259010	3721	125843	34	0%	0.09	0.12
39259020	1379	48676	35	0%	0.03	0.05
39259080	15406	293187	19	1%	0.21	0.28
39261000	5458	165238	30	0%	0.12	0.16
39262000	2818	117219	42	0%	0.08	0.11
39263000	2017	128265	64	0%	0.09	0.12
39264000	1601	59247	37	0%	0.04	0.06
39269050	1439	26659	19	0%	0.02	0.03
39269092	11943	322930	27	1%	0.23	0.30
39269097	54362	2484529	46	4%	1.78	2.35
TOTAL	1393288	25063085		100%	18	24

*For convenience, only commodity codes are reported. Details of the commodity description can be found in Tables A.1 and A.2
**Takes into account the difference between wholesale prices for sales and purchases.

TABLE C.6 Polymer composition of sorted packaging and non-packaging waste plastic from households in Denmark (based on the data in (Eriksen and Astrup, 2019)).

Polymer type	Packaging [%]	Non-packaging [%]
PET	32	0
PE	39	11
PP	26	61
Other	4	28
TOTAL	100	100

TABLE C.7 Polymer composition of mixed waste in Denmark (based on the data in (Edjabou et al., 2015)). Distribution between population living in one-family households and multi-family households was based on the data reported by Statistics Denmark (SD, 2018).

	Share [%] of plastic in mixed waste		
Polymer type	**One-family households**	**Multi-family households**	**Average (weighted)**
PET	1.1	0.6	0.9
PE	10.7	7.7	9.7
PP	1.5	0.6	1.2
Other	2.1	3.1	2.4
TOTAL	15.4	12	14.3

TABLE C.8 Polymer composition of combustible waste in Denmark (based on the data reported in (Edjabou et al., 2017; Faraca et al., 2019; Faraca and Astrup, 2019; Petersen, 2018)).

	Share [%] of plastic in combustible waste		
Polymer type	**"Small" combustibles**	**"Large" combustibles/Bulky waste**	**Average (weighted)**
PET	5.7	2.1	3.8
PE	0.4	0.2	0.3
PP	2.1	2.9	2.7
Other	3.1	1.4	2.2
TOTAL	11.3	6.6	9.0

TABLE C.9. Polymer composition of sorted waste plastic traded in 2016. The polymer composition was based on the amounts of waste plastic traded and the commodity description (SD, 2018).

Polymer type	**Commodity code**	**Commodity description**	**Imports**	**Exports**
PE	39151000	Waste, parings and scrap, of polymers of ethylene	31%	47%
Other	39152000	Waste, parings and scrap, of polymers of styrene	8%	7%
Other	39153000	Waste, parings and scrap, of polymers of vinyl chloride	0%	1%
PP	39159011	Waste, parings and scrap, of polymers of propylene	12%	4%
Other	39159018	Waste, parings and scrap, of addition polymerization products (excl. that of polymers of ethylene, styrene and vinyl chloride and propylene)	0%	0%
PET*	-	Waste poly(ethylene terephthalate)	39%	33%
Other	-	Waste, parings and scrap, of plastics (excl. that of polymers of ethylene, styrene, vinyl chloride, propylene, and ethylene terephthalate)	9%	7%
Other	39159090	Waste, parings and scrap, of plastics (excl. that of addition polymerization products)	0%	0%
		TOTAL	100%	100%

*According to the information from the Danish packaging deposit-return system, in 2017 approximately 50000 tonnes of materials were sent for recycling (Dansk Retursystem, 2017). The composition of this material was 51% glass, 17% metal and 32% plastic, by mass. Assuming the predominant share of the plastic collected by the Danish deposit-return system is PET, and all of the collected plastic material is being exported (Dansk Retursystem, 2017), it is safe to assume that PET exported from Denmark in 2017 was at least 16 000 tonnes. Considering that in 2017, 19 600 tonnes of waste plastic were exported within the commodity group 39159080, PET represents more than 80% of the export amounts within the commodity. This share of PET in the export in 2017 was assumed to be the same for 2016. In addition, the distribution of commodity 39159080 in plastic import was assumed the same as in plastic export.

Preliminary assessment of plastic material flows in Denmark
Technical Report

This report is an initial attempt to provide a quantitative overview of plastic flows in Denmark. This technical report represents an initial data screening that was intended to serve as a basis for future updates as more reliable and up-to-date information becomes available.

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